AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

105th Congress, 1st Session – – – – – – – – – – – – – House Document 105–152

KAWEAH RIVER BASIN PROJECT, CALIFORNIA

COMMUNICATION

FROM

THE ACTING ASSISTANT SECRETARY (CIVIL WORKS), THE DEPARTMENT OF THE ARMY

TRANSMITTING

A REPORT ON A FLOOD DAMAGE REDUCTION AND AGRICULTURAL WATER SUPPLY PROJECT AT THE TERMINUS DAM, KAWEAH RIVER BASIN, CALIFORNIA, PURSUANT TO PUB. L. 104–303, SEC. 101(b)(5)

OCTOBER 21, 1997.—Referred to the Committee on Transportation and Infrastructure and ordered to be printed

U.S. GOVERNMENT PRINTING OFFICE
44–464 WASHINGTON : 1997

CONTENTS

	Page
Letter of Transmittal	vii
Comments of the Office of Management and Budget	ix
Comments of the State of California	x
Comments of the Department of the Interior	xi
Comments of the Federal Emergency Management Agency	xii
Comments of the Federal Energy Regulatory Commission	xiii
Comments of the Department of Transportation	xiv
Comments of the Environmental Protection Agency	xv
Letter to the Environmental Protection Agency	xvii
Report of the Chief of Engineers, Department of the Army	1
Addendum	
Attachment 1. Sponsor Letters of Intent	12
Appendix 1. Revised Detailed Cost Allocation—Ned Plan	14
Report of the District Engineer	18
Executive Summary	18
Chapter 1. Introduction	21
Purpose and Scope	22
Study Authority	22
Study Partners and Coordination	22
Prior Studies and Reports	24
Chapter 2. Study Area and Description	28
Setting	29
Terminus Dam and Kaweah River Basin	29
Downstream Area	29
Tulare Lakebed	32
Existing Condition	35
Climate	35
Geology and Soils	35
Seismicity and Faulting	36
Precipitation	38
Runoff	39
Mining	40
Population	40
Land Use	40
Socioeconomic Conditions	40
Air Quality	41
Noise	41
Water Supply	42
Water Quality	42
Vegetation and Wildlife	44
Fisheries	45
Potentially Affected Species	46
Cultural Resources	46
Recreation	47
Hazardous, Toxic, and Radioactive Wastes (HTRW)	47
Existing Water Resource Projects	48
Terminus Dam and Lake Kaweah Basin	48
Southern California Edison Company Hydroelectric Plants	51
Central Valley Project—Friant-Kern Canal	51
State Water Project—California Aqueduct	51
Mckays Point Weir	52
Channels	52
Spreading Basins	53
Levees	53

Page

Report of the District Engineer—Continued
Chapter 2. Study Area and Description—Continued
Existing Water Resource Projects—Continued
Tulare Lakebed 53
Future Condition Without—Project 55
Land Use 55
Terminus Dam and Lake Kaweah 55
Chapter 3. Problems, Needs, and Opportunities 57
Flooding 58
General 58
Flood Plains 58
Historic Flood Damages—Downstream Area 60
Historic Flood Damages—Tulare Lakebed 61
Future Flooding 63
Lake Kaweah Sediment Storage 64
Water Supply 65
Recreation 65
Hydropower 66
Chapter 4. Technical Studies 68
Hydrology 68
Channel Capacities 68
Unimpaired Rain Flow Frequency Curves—Kaweah River 68
Unimpaired Snowmelt Flow Frequency Curves 71
Unit Hydrograph, Loss Rates, and Base Flow 71
Standard Project Flood 71
Regulated Peak Flow and Volume Flow Frequency Curves 71
Flor to Tulare Lakebed from the Kings, Kaweah Tule, Kern, and Local Streams 75
Variation of Reservoir Storage 75
Sedimentation 75
Reservioir Routings 75
Reservoir Operation 78
Wave Runup 78
Geotechnical Explorations 79
Seismic Stability 79
Flood Plain Delineation 80
Alluvial Fan 80
Tulare Lakebed 80
Economics Analysis 86
Land Use in the Flood Plain 86
Damageable Structures 88
Value of Property 88
Future Growth and Development 88
Types of Damages 89
Depth-Damage Relationships 89
Tulare Lakebed Damages 89
Average Annual Damages 91
Real Estate 92
Environmental Studies 93
Enviornmental Impact Statement/Environmental Impact Report . 93
Hazardous, Toxic, and Radioactive Waste 93
Chapter 5. Plan Formulation 94
Planning Objectives 95
Planning Criteria 95
Planning Constraints 96
Measures Considered 97
Measures 97
Nonstructural 97
Ground-Water Recharge/Increased Spreading Basins 99
Levee and Channel Construction 100
Detention Basin Near Highway 99 100
Detention Basin on Kaweah River Above Visalia 101
Pumping Into Friant-Kern Canal 101
Storage Upstream from Terminus Dam 101
Removing Sediment from Lake Kaweah 101
Increased Storage at Lake Kaweah 102
Flood Detention Dam on Dry Creek 102
Dry Creek Reservoir 103

Page

Report of the District Engineer—Continued
Chapter 5. Plan Formulation—Continued
Measures—Continued
Limekiln Reservoir 103
Limekiln Flood Detention Dam 103
Preliminary Alternatives 103
No Action 104
Increase Storage at Lake Kaweah (21-foot Spillway Raise) 106
Flood Detention Dam on Dry Creek (27,000 acre-feet) and Increase Storage at Lake Kaweah (42,600 acre-feet) 107
Dry Creek Reservoir with (70,000 acre-feet Dry Creek Dam) Increase Storage at Lake Kaweah and Tunnel Connection to Lake Kaweah 108
Reformulation of Preliminary Alternatives 110
Completeness 110
Effectiveness 110
Efficiency 111
Spillway Options 111
NED Optimization-Benefits 114
NED Optimization 124
Acceptability 128
Additional Alternative Formulation 128
Raise Spillway at Terminus Dam by 21 Feet and Change Precipitation Parameter (Locally Preferred Plan) 128
Final Alternatives 128
Alternative 1—No Action 128
Alternative 2—21-Foot NED Spillway Raise 129
Alternative 3—21-Foot LPP Spillway Raise 130
Comparison of Flood Damage Reduction Benefits 131
Comparison of Costs and Benefits 131
Comparison of Environmental Impacts and Mitigation 131
Chapter 6. The Selected Plan 137
Plan Description 138
Flood Control Features 138
Accomplishments 138
Hydrology 139
Flood Plain Effects 139
Flood Control Storage 139
Reservoir Operation 142
Conservation Storage 143
Recreation 143
Hydropower 144
Other Project Features 146
Relocations 146
Real Estate 146
Environmental Impacts 147
HEP Analysis 147
Potentially Affected Species 147
Cultural Resources 149
Mitigation Costs 149
Project Cost 150
Economic Analysis 150
Bridge Replacement Benefits 152
Hydropower 152
Recreation 152
Employment Benefits 155
Benefit-To-Cost 155
Risk and Uncertainty 156
Hydrology 156
Sedimentation Rate 157
Seismic Stability 157
Environmental Mitigation 157
Project Cost 158
Benefits 158
PED and Construction 158
Operation and Maintenance 159
Selected Plan (NED Plan) 159
Chapter 7. Plan Implementation 160

Page

Report of the District Engineer—Continued
Chapter 7. Plan Implementation—Continued
Preliminary Cost Allocation 161
General 161
Alternative Single-Purpose Project Costs 162
Separable Costs 163
Joint Use Costs 164
Allocated Costs—NED Plan 164
Cost Apportionment—NED Plan 166
General 166
Allocated Costs—LPP 167
Cost Apportionment—LPP 169
Selected Plan Cost Allocation 171
Federal Responsibilities 172
Non-Federal Responsibilities 172
Procedures for Implementation 174
Non-Federal Financial Capabilities 174
Views of Non-Federal Interests 175
Chapter 8. Public Involvement 176
Chapter 9. Conclusions 179
Chapter 10. Recommendations 181
RECOMMENDATION OF THE DIVISION ENGINEER 182
Plates
1. Spillway, Profile and Sections 186
2. Lake Kaweah, Plan of Improvements Details and Curves 187
FINAL ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT 188

APPENDICES ACCOMPANYING THE REPORT OF THE DISTRICT ENGINEER

(Appendices Not Printed)

Appendices:
A. Basis of Design and Cost Estimates.
B. Hydrology.
C. Economics.
D. Water Supply.
E. Flood Plain Determination.
F. Real Estate Appraisal.
G. Hazardous, Toxic, and Radioactive Waste.
H. Financial Capability.

LETTER OF TRANSMITTAL

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

REPLY TO
ATTENTION OF

6 OCT 1997

Honorable Newt Gingrich
Speaker of the House
of Representatives
Washington, D.C. 20515

Dear Mr. Speaker:

Section 101(b)(5) of the Water Resources Development Act (WRDA) of 1996 authorized a flood damage reduction and agricultural water supply project at the Terminus Dam, Kaweah River Basin, California. The Secretary of the Army supports the authorization and plans to implement the project through the normal budgetary process.

The authorized project is described in the report of the Chief of Engineers dated December 23, 1996, which includes other pertinent reports and comments. The report is in partial response to a resolution adopted by the House Committee on Public Works on May 8, 1964.

The views of the State of California; the Departments of the Interior, Transportation, and Energy; the Federal Emergency Management Agency; and the Environmental Protection Agency are set forth in the enclosed report.

The authorized project consists of modifying the Terminus Dam by constructing a 21-foot-high concrete ogee weir across the spillway sill and widening the spillway from 307 feet to 455 feet. This would raise the gross pool by about 21 feet, adding about 42,600 acre-feet of storage to Lake Kaweah. The gross pool would be operated jointly for flood control and agricultural water supply purposes. Over the project life, flood control storage space is expected to diminish as sediment accumulates in the reservoir. The project includes the relocation of the State Highway 198 bridge and its approaches. In addition, the project includes the purchase of about 827 acres of mitigation lands (about 461 acres for the loss or terrestrial habitats and about 366 acres for the loss of wetland habitats). The authorized project is the national economic development plan.

Based on October 1995 price levels, the total first cost of the authorized project is about $35,645,000, with a Federal cost of about $21,465,000, and a non-Federal cost of about $14,180,000. The cost sharing for the project is in accordance with the flood damage reduction and agricultural water supply cost sharing specified in WRDA 1986. In addition, in accordance with WRDA 1996 non-Federal interest would be required to implement a flood plain management plan for the project area.

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,

John H. Zirschky
Acting 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

JUL 30 1997

The Honorable John H. Zirschky
Acting Assistant Secretary of the Army
for Civil Works
Pentagon - Room 2E570
Washington, DC 20310-0108

Dear Dr. Zirschky:

As required by Executive Order 12322, the Office of Management and Budget has completed its review of former Assistant Secretary Lancaster's recommendation for the Kaweah River Basin Feasibility Report, Modifying the Spillway at Terminus Dam.

The recommendation for this project in his letter of March 4, 1997, is consistent with the policies and program of the President. The Office of Management and Budget does not object to submission of this report to Congress.

Sincerely,

Kathleen Peroff
Deputy Associate Director
Energy and Science Division

COMMENTS OF THE STATE OF CALIFORNIA

PETE WILSON
GOVERNOR

State of California
GOVERNOR'S OFFICE OF PLANNING AND RESEARCH
1400 TENTH STREET
SACRAMENTO 95814

LEE GRISSOM
DIRECTOR

November 22, 1996

DAVID B. SANFORD JR.
U.S. ARMY CORPS OF ENGINEERS
CECW-AR
7701 TELEGRAPH ROAD
ALEXANDRIA, CA 22315-3861

Subject: KAWEAH RIVER BASIN INVESTIGATION FEASIBILITY STUDY SCH #: 96104001

Dear DAVID B. SANFORD JR.:

The State Clearinghouse submitted the above named environmental document to selected state agencies for review. The review period is closed and none of the state agencies have comments. This letter acknowledges that you have complied with the State Clearinghouse review requirements for draft environmental documents, pursuant to the California Environmental Quality Act.

Please call at (916) 445-0613 if you have any questions regarding the environmental review process. When contacting the Clearinghouse in this matter, please use the eight-digit State Clearinghouse number so that we may respond promptly.

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 96/645

DEC 17 1996

Mr. David B. Sanford, Jr.
Chief, Policy Division
Policy Review Branch
ATTN: CECW-AR (SA)
7701 Telegraph Road
Alexandria, Virginia 22315-3861

Dear Mr. Sanford:

The Department of the Interior (Department) has reviewed the Chief of Engineers Proposed Report (Chief's Report), Final Environmental Impact Statement/Environmental Impact Report (FEIS/EIR) and Final Feasibility Report for the Kaweah River Investigation Feasibility Study (Final Study), Tulare and Kings Counties, California. The Department does not have any comments to either the Chief's Report, FEIS/EIR, or Final Study, and does not object to the proposed project.

Thank you for the opportunity to comment.

Sincerely,

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

cc: District Engineer
ATTN: Jane Rinck
U.S. Army Corps of Engineers
Sacramento District Office
1325 J Street
Sacramento, California 95814-2922

COMMENTS OF THE FEDERAL EMERGENCY MANAGEMENT AGENCY

Federal Emergency Management Agency
Region IX
Building 105
Presidio of San Francisco
San Francisco, California 94129

DEC 26 1996

Mr. Douglas W. Lamont, Chief
Policy Review Branch (CECW-AR)
U.S. Army Corps of Engineers
Kingman Building, Rm. 2D18
7701 Telegraph Road
Alexandria, VA 22315-3861

RE: Kaweah River Basin Investigation, California
Draft Environmental Impact Statement

Dear Mr. Lamont:

This letter is in response to the October 25, 1996 transmittal from Mr. Raleigh H. Leef, Acting Chief, Policy Division, Directorate of Civil Works, regarding the subject project.

Our comments address the treatment of Executive Order 11988, Floodplain Management. We have reviewed the draft environmental impact statement and have concluded that Executive Order 11988 has been adequately addressed.

Our agency continues to be concerned about the effects of such flood control projects and the potential for increasing or altering the 100-year floodplain. Should there be the potential for the latter, the Federal Emergency Management Agency (FEMA) should be alerted, because this will have consequences on public and private lands as well as the FEMA flood insurance program.

Thank you for the opportunity to comment on the draft environmental impact statement. If you have any questions, please contact me directly at (415) 923-7100, or your staff may contact Mr. Sandro Amaglio, Regional Environmental Officer, at (415) 923-7284.

Sincerely,

S Mattingly

Shirley Mattingly
Regional Director

COMMENTS OF THE FEDERAL ENERGY REGULATORY COMMISSION

FEDERAL ENERGY REGULATORY COMMISSION
WASHINGTON, D. C. 20426

OCT 0 4 1996

Mr. Henri Langlois
Policy Review Manager
Policy Division
ATTN: CECW - AR (SA)
7701 Telegraph Road
Alexandria, VA 22315-3861

Dear Mr. Langlois:

Thank you for providing the Commission with a copy of your final feasibility report and related FEIS.

Based on staff review, the following document qualifies as a comprehensive plan under section 10(a)(2)(A) of the Federal Power Act (FPA).

Sacramento District Corps of Engineers. 1996. Kaweah River Basin investigation: final feasibility report and final environmental impact statement. Department of the Army, Sacramento, California. September 1996. Three volumes.

Any future river-related plans prepared by the Sacramento District Corps of Engineers should be filed with the Commission in order to be considered in the Commission's FPA section 10(a)(2)(A) analysis of hydropower projects in California.

Sincerely,

J. Mark Robinson
Director, Division of
Licensing and Compliance

COMMENTS OF THE DEPARTMENT OF TRANSPORTATION

U.S. Department of Transportation
United States Coast Guard

Commandant
United States Coast Guard

2100 Second Street, S.W.
Washington, DC 20593-0001
Staff Symbol: G-MOR
Phone: (202) 267-0518
FAX: (202) 267-4085

16450
November 25, 1996

Policy Division, Policy Review Branch
Department of the Army
U.S. Army Corps of Engineers
Washington, DC 20314-1000

Dear Sir:

Recently you sent copies of the proposed report for the Chief of Engineers and report of the district engineer on the listed projects. In addition, you sent a letter dated October 25, 1996 requesting an expedited review of these documents. We have reviewed the proposed reports and have no comments to offer.

Chesapeake and Delaware Canal, Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland, sent September 12, 1996, 90 Days ending December 11, 1996.

Saint Paul, Alaska, sent September 17, 1996, 90 days ending December 16, 1996.

New Jersey Shore Protection Study, Brigantine Inlet to Great Egg Harbor Inlet, Absecon Island Interim, sent September 19, 1996, 90 days ending December 18, 1996.

Kaweah River Basin, California, sent September 25, 1996, 90 days ending December 24, 1996.

Thank you for providing the Coast Guard the opportunity to review the proposed reports. We look forward to receiving the final reports when issued.

Sincerely,

R. E. BENNIS
Captain, U.S. Coast Guard
Chief, Office of Response
By direction

COMMENTS OF THE ENVIRONMENTAL PROTECTION AGENCY

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

November 7, 1996

David B. Sanford, Jr.
Policy Review Branch
Policy Division
US Army Corps of Engineers
ATTN: Mr. Henri Langlois
CECW-AR (SA)
7701 Telegraph Road
Alexandria, Virginia 22315-3861

Dear Mr. Sanford:

The Environmental Protection Agency (EPA) has reviewed the Final Environmental Impact Statement (FEIS) for the project entitled **Kaweah River Basin Investigation, Tulare County, CA.** Our review is pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

The US Army Corps of Engineers (Corps) and the non-Federal sponsors propose to increase flood protection downstream of Terminus Dam and increase the storage space in Lake Kaweah for irrigation water supply by making modifications to the dam and the operation of the reservoir. The proposed action would raise the spillway 21 feet. The gross pool would be raised from 694 feet, mean sea level (m.s.l.), to 715 feet, m.s.l., inundating an additional 243 acres in the reservoir area. Alternatives evaluated in detail include no action (Alternative 1), the National Economic Development (NED) Plan (Alternative 2), and the Locally Preferred Plan (LPP)(Alternative 3). The structural features of the LPP alternative would be the same as the NED Plan. However, the water control diagram and basin wetness parameter for Lake Kaweah would be modified to allow storage of conditional carryover water of up to 12,000 acre-feet (versus 7,000 acre-feet under the NED plan) during the rainflood season (fall/winter). The selected plan is the NED plan.

EPA is gravely concerned with the Corps' decision to pursue the NED plan despite the strong, broad support for the Locally Preferred Plan (LPP) by the non-Federal sponsor, local community, local Congressmen, and the recreational, environmental and resource management communities. We strongly urge the Corps to reconsider their decision. We believe the LPP alternative would best address the adverse impacts to recreation and fisheries while meeting the flood protection and water supply project purposes. We note that the structural features of the LPP are the same as the NED plan and that the benefit/cost ratio for the LPP alternative is 1.18, only a 0.03 difference to the NED b/c ratio of 1.21.

Dam siltation is a growing, broad-scale, national problem. A precedent should not be made dictating that dam raising is the appropriate or recommended solution. We urge the Corps to address the long-term sedimentation issue, the underlying cause of the lost storage space, instead of focusing only on a short-term fix to the problem. We note that the current proposed action would provide only a small incremental improvement to the existing flood protection and water supply problems. In addition, the proposed action does not help address the critical regional issues of groundwater overdraft, water supply, and cumulative impacts from multiple water supply and flood protection projects. We recommend the Corps consider maximum utilization of existing facilities, such as the percolation ponds; sluicing or dredging sediment in Lake Kaweah; water conservation and/or demand-side management measures; new storage areas in the Tulare Lakebed; and a basin-wide water management plan, or a combination of these features as potential long-term solutions to regional flood protection and water supply needs.

We appreciate the opportunity to review this FEIS. Please send two copies of the Record of Decision and Chief's Report to this office at the same time it is officially released to the public. If you have questions, please call me at (415) 744-1584, or invite your staff to call Ms. Laura Fujii at (415) 744-1579.

Sincerely,

David J. Farrel, Chief
Federal Activities Office

Filename: kaweah.fei
MI001306

cc: USFWS, Mike Fris, Sacramento
CDFG, Sacramento
DWR, Sacramento
Kaweah Lake Preservation Group
Environmental Defense Fund
American Whitewater Affiliation

LETTER TO THE ENVIRONMENTAL PROTECTION AGENCY

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

REPLY TO
ATTENTION OF:

Planning Division
East-West Planning Program Management Branch

23 DEC 1996

Mr. David J. Farrel
Chief, Federal Activities Office
U.S. Environmental Protection Agency
76 Hawthorne street
San Francisco, California 94105

Dear Mr. Farrel:

Thank you for your letter of November 7, 1996, providing comments on the Kaweah River Basin Investigation, California, feasibility study. In that letter, you expressed concern that the U.S. Army Corps of Engineers is pursuing the National Economic Development (NED) plan rather than the Locally Preferred Plan (LPP). You cited strong support for the LPP and your belief that the LPP would best address the adverse impacts to recreation and fisheries while meeting the flood protection and water supply project purposes.

As you may be aware, the Kaweah River project was conditionally authorized by Section 101(b)(5) of the Water Resources Development Act of 1996 (WRDA 1996), Public Law 104-303. The authorization was subject to completion of a report of the Corps by December 31, 1996. Concerns related to the LPP arose during the Washington level review of the report. These concerns, which include potential cost sharing issues related to both recreation and water supply, cannot be resolved within the time frame allowed in WRDA 1996. Because the NED plan and the LPP are physically identical with regard to construction needed for implementation, proceeding with the design and construction, if funded, or the NED plan will not preclude the LPP.

We appreciate your views and comments on the Kaweah River report and will make your views a part of the record for this project. If you have further questions on this report, please contact Mr. David Fountain of my Civil Works planning staff, at 202-761-1979.

Sincerely,

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

KAWEAH 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:

23 DEC 1996

CECW-PE (10-1-7a)

SUBJECT: Kaweah River Basin Investigation, Feasibility Study, California

THE SECRETARY OF THE ARMY

1. I submit for transmission to Congress my report on the study of flood control and agricultural water supply improvements for the Kaweah River Basin, California. It is accompanied by the report of the district and division engineers. These reports are in partial response to a resolution passed by the Committee on Public Works of the U.S. House of Representatives on 8 May 1964. This resolution requested review of the previous report on the Sacramento-San Joaquin Basin Streams, California, with a view towards determining whether any modification of the recommendations would be advisable, with particular reference to further coordinated development of the water resources of the San Joaquin River Basin, California.

2. Section 101(b)(5) of the Water Resources Development Act of 1996 (WRDA 1996), Public Law 104-303, authorized construction of the Terminus Dam, Kaweah River, California, project for flood control and water supply subject to completion of a final report of the Chief of Engineers on or before December 31, 1996 and subject to the conditions recommended in that final report. This report constitutes the final report of the Corps of Engineers in response to this legislation. The authorizing language for the Terminus Dam/Kaweah River project reflects an earlier project cost estimate of $34,500,000. The cost estimate for the authorized project has been refined to reflect current information on the project authorized by Section 101(b)(5) of WRDA 1996.

3. The plan developed by the district engineer consists of raising the existing Terminus Dam spillway by 21 feet. Spillway modifications include placing a 21-foot high concrete ogee weir across the spillway sill and widening the spillway from 307 to 455 feet. The project would provide both flood damage reduction and agricultural water supply benefits. In addition, plans are

included for purchase of about 827 acres of mitigation lands (terrestrial 461 acres and wetlands 366 acres).

4. As reported by the district engineer, based on October 1995 price levels, the total first cost of the plan is estimated at $35,644,000, of which about $21,465,000 would be Federal and about $14,179,000 would be non-Federal. The non-Federal cash contribution is estimated at $2,290,000, with the balance consisting of $11,889,000, for the estimated creditable cost for lands, easements, rights-of-way, relocations, and suitable borrow and dredged or excavated material disposal areas (LERRD). Average annual benefits are estimated at $3,748,000, and average annual costs are estimated at $3,092,000. The resulting benefit-to-cost ratio is 1.2, based on a discount rate of 7.625 percent and a 100-year period of economic analysis. The plan developed by the district engineer is the National Economic Development (NED) plan.

5. Washington level review indicates that the proposed plan is technically sound, economically justified, and environmentally and socially acceptable. The proposed project complies with applicable U.S. Army Corps of Engineers planning procedures and regulations. Also, the views of interested parties, including Federal, State, and local agencies have been considered.

6. I generally concur in the findings, conclusions, and recommendations of the reporting officers. Accordingly, I recommend implementation of the authorized project in accordance with the reporting officers' plan with such modifications as in the discretion of the Chief of Engineers may be advisable. Additional analysis is needed to determine a final allocation of flood control and water supply storage costs and how the project should be operated. In addition, the non-Federal sponsor has requested that the project be operated in a manner that would increase agricultural water supply dependability. Their concerns will be further addressed during the preconstruction engineering and design phase of the project and may result in modifications under the Chief's discretionary authority.

7. Federal implementation of the authorized project would be subject to the non-Federal sponsor agreeing with applicable

Federal laws and policies. The non-Federal sponsor would be responsible for the following items of local cooperation:

a. Provide a minimum of 25 percent, but not to exceed 50 percent, of total project costs assigned to structural flood control, including the provision, during construction, of a cash contribution equal to 5 percent of total project costs assigned to flood control.

b. Provide 35 percent of the total project costs assigned to agricultural water supply.

c. 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, or maintenance of the project.

d. Provide all improvements required on lands, easements, and rights-of-way to enable the proper disposal of dredged or excavated material associated with the construction, operation, and maintenance of the project. Such improvements may include, but are not necessarily limited to, retaining dikes, waste weirs, bulkheads, embankments, monitoring features, stilling basins, and dewatering pumps and pipes.

e. Provide, during construction, any additional amounts as are necessary to make its total contribution equal to 25 percent of total project costs assigned to structural flood control and 35 percent of total project costs assigned to agricultural water supply.

f. For so long as the project remains authorized, pay 100 percent of the costs to operate, maintain, repair, replace, and rehabilitate the completed project, or functional portion of the project, authorized by WRDA 96.

g. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor, now or hereafter, owns or

controls for access to the project for the purpose of inspection, and, if necessary after failure to perform by the non-Federal sponsor, for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project. No completion, operation, maintenance, repair, replacement, or rehabilitation by the Federal Government shall operate to relieve the non-Federal sponsor of responsibility to meet the non-Federal sponsor's obligations, or to preclude the Federal Government from pursuing any other remedy at law or equity to ensure faithful performance.

h. Hold and save the United States free from all damages arising from 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 United States or its contractors.

I. 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.

j. 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 USC 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 construction, operation, and maintenance 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.

k. 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 construction, operation, or maintenance of the project.

l. 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.

m. 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.

n. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), 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".

o. Provide 25 percent of that portion of total historic 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.

p. Participate in and comply with applicable Federal floodplain management and flood insurance programs in accordance with Section 402 of Public Law 99-662, as amended.

q. Within 1 year after the date of signing a project cooperation agreement, prepare a floodplain management plan designed to reduce the impact of future flood events in the project area. The plan shall be prepared in accordance with guidelines developed by the Secretary of the Army and must be implemented not later than 1 year after completion of construction of the project.

r. Prescribe and enforce regulations to prevent obstruction of or encroachment on the project that would reduce the level of protection it affords or that would hinder operation and maintenance of the project.

s. Not less than once each year, inform affected interests of the extent of the protection afforded by the project.

t. 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.

u. Acquire all necessary water rights, and hold and save the United States free from all damages arising from any water rights claims.

JOE N. BALLARD
Lieutenant General, USA
Chief of Engineers

19 November 1996
(Revised 25 Feb 1997)

ADDENDUM TO THE KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA FINAL FEASIBILITY REPORT AND FINAL ENVIRONMENTAL IMPACT STATEMENT/ENVIRONMENTAL IMPACT REPORT

1. Reference CECW-AR memorandum dated 28 October 1996, subject: Kaweah Fiver Basin Investigation - HQUSACE Policy Compliance Assessment.

2. This addendum has been prepared in response to reference I above which was also discussed in a teleconference on 6 November 1996, subject as above. The intent of this addendum is to clarify and provide additional information for the final feasibility report. Specific items are addressed in the following paragraphs.

a. Local Sponsor Support. Enclosure 1 is a letter of intent from the Kaweah Delta Water Conservation District (KDWCD) indicating their support for the National Economic Development (NED) Plan. They have also provided another letter which states their awareness and acceptance of the items of local cooperation contained in the model PCA and the LERRD responsibilities and of requirements of Section 202(c) of WRDA 1996. The letter also states that the sponsor is aware that the NED Plan would be operated for flood control and water supply purposes only.

The KDWCD has been the lead sponsor in this study process. Each of the sponsoring entities, including the KDWCD, could demonstrate the capability to provide the financing of the project as the sole sponsor of the project. The KDWCD has authority under the Water Conservation Act of 1927 and the Revenue Bond Law of 1941 to issue revenue bonds as one mechanism of financing this project. The present assessed value within KDWCD is $6,059,615,220. If the voters of the KDWCD approved a revenue bond issue to pay for the non-Federal share of the project, the resulting tax would be about $0.02 per $100 of assessed value. While the annual payment of $1,350,000 could be made solely by the KDWCD, it is likely that all local sponsors would contribute an equitable share of the payment. The low rate demonstrates the ability of the KDWCD, or any one of the separate subsponsors, to financially carry the burden of the local cost share.

b. Locallv Preferred Plan (LPP). Tables 7-7 through 7-1 0 in the final feasibility report provide a cost allocation and cost apportionment associated with implementation of a LPP. Since the construction requirements for the NED Plan and LPP are identical, it may not be clear that the operational changes could alter the cost sharing provisions of Tables 7-7 through 7-10. An additional benefit analysis must be undertaken prior to implementation of the LPP and the results of this analysis could modify the cost allocation and subsequently the cost apportionment. The local sponsor is aware and fully concurs that implementation of the LPP is subject to additional studies which may alter the cost sharing requirements shown in the tables.

Also, the flood control benefits changed between the draft and final reports based upon

responses to technical comments received between the draft and final reports on the operational modeling of the NED Plan and LPP. The area of concern which most influenced the change in benefits focused on the location of the operational transition zone that identifies the storage at which supplemental rainflood releases are required (primary operational line differentiating Schedule 1 Space and Schedule 2 Space). Adjustments to the operations modeling were carried out to address these comments. Other technical reservoir operation modeling comments which arose between the draft and final versions of the report related to the affect of sediment deposition on the conditional storage space over the life of the project in the two plans. Adjustment of the operations modeling to address these comments resulted in minor differences in the flood control outputs.

c. Allocation of Increased Maintenance Costs of Existing Recreation Facilities. The NED Plan does not provide direct recreation outputs; therefore, the increased operation and maintenance costs (estimated at $5,000/year) of the existing recreation facilities must be allocated to the project purposes of flood control and water supply. Because the OMRR&R costs of both the flood control and irrigation purposes are cost shared at 100 percent non-Federal, all of these additional costs are a non-Federal responsibility. Enclosure 2 is a revised cost allocation.

d. Project Mitigation.

Concerns have been raised that the mitigation proposal in the project for the oak savannah habitat exceeds the projected losses by more than 25 percent. Corps guidance requires that mitigation plans use established techniques to address management objectives. On page A-4, Appendix A (Habitat Evaluation Procedures) of Appendix A (Coordination Act Report) of the Final Environmental Impact Statement, the methodology for the mitigation planning is cited as the U.S. Department of Interior, Division of Ecological Services, Fish and Wildlife Service 1980, Ecological Services Manual Habitat Evaluation Procedures. The procedures for determining compensation analysis are provided in the cited manual, starting on page 102-ESM-7-1. Additionally, the habitat benefits and the implementation costs of fencing all or part of the reservoir should be addressed further to demonstrate compliance with ER 1105-2-100, paragraph 7-35.e. These issues can be clarified by discussions in two areas.

While evaluating the habitats and evaluation species for the HEP analysis, the HEP team considered the scarcity and diversity of the habitats in the study area, as well as the significance of the habitats on a state and regional level, and the overall ecosystem of the reservoir. The oak woodland communities of the western Sierra Nevada foothills are vulnerable to habitat degradation as a result of greater access by humans and of the continuing potential for urban development. Much of the original extent of these communities has been reduced or altered due

to intensive grazing, urbanization, woodcutting, agriculture, mining, conversion to annual grassland, and land development. Severe damage to the foothill riparian zones has greatly diminished the overall viability of the foothill woodland communities.

Over the last 40 years, about 1.2 million acres of oak woodland have been lost in California, mostly to rangeland clearing. Hardwoods are still cleared for firewood and development, which has spread into the foothills throughout California. Additionally, there are local ordinances protecting oak and oak habitats in the study area. The oak habitats around the reservoir support ecologically important and diverse species, provide a transitory riparian/oak upland habitat, and play a valuable role in the ecosystem of the reservoir. Animal diversity is higher in the foothill woodland than in adjacent grassland and conifer forest. More than 100 species of birds live in woodlands during breeding season, and 60 species of mammals use oaks in some way for feeding, nesting, or perching. Vegetation such as oak woodland tends to be structurally complex and create a variety of habitats that can be occupied by different animals. The habitat evaluation team selected an in-kind replacement (resource category 2) approach to the habitat replacement. Although the sum of squares technique would optimize the in-kind goal, it reduces the mitigation size by 80 acres. The proposed mitigation of 327 acres fully mitigates for two of the three indicator species. Therefore, the goal of no net loss of in-kind habitat value is realized with the higher acreage. This revises the mitigation total, for mitigation information contained in the report. The total revised mitigation is 21 acres riparian scrub, 14 acres riparian forest, 327 acres oak savannah, 99 acres of oak woodlands and 366 acres of wetlands habitat, for a total of 827 acres.

Use of Project Lands for Mitigation of Oak Savannah Habitat.

The possibility of fencing reservoir lands was considered during preliminary mitigation planning, but was not included in the final analysis due to uncertainty of the long-term sustainability of the habitat on the available acreage. Only the north side of the reservoir could be fenced as the recreation facilities and highway 198 on the south side of the reservoir are limiting factors.

Exclusion of cattle grazing on the north side of the reservoir could improve oak tree recruitment in the area, but such measures would not provide sufficient benefits to offset all adverse effects to oak habitats in the area due to the project. Tree plantings would also be needed, and on the steeper and drier south-facing slopes, would require very expensive watering for many years. We also have concerns regarding the persistence of any replantings on the south-facing slopes; it may be possible to plant more trees in the area, but future natural recruitment rates would continue to be low, because of the lack of water in the soils. Thus, replantings would increase tree densities for a period of time, but the site would eventually "thin out" due to moisture stress. We believe that the increment of habitat replacement which can be derived from enhancement of existing oak woodlands is relatively low. However, because this measure may

provide an economical increment to partially compensate for project effects, fencing on a part of the north side of the reservoir will be further evaluated during PED.

e. Project Benefits and Benefit-to-Cost Ratio (BCR). The BCR should include losses from hydropower production resulting from raising of the spillway. The appropriate annual amounts and benefit categories should include the following: $3,558,000 for flood control; $271,100 for irrigation; $207,000 for employment; ($288,000) for recreation losses; and ($287,000) for hydropower losses. Revised Detailed Cost Allocation Tables 7-1 through 7-6 reflecting the above changes are included herein as Enclosure 2. Using these benefits and costs, the appropriate BCR is the total annual benefits of $3,461,000 divided by the total annual costs of $3,097,000 yielding a BCR of 1.12.

f. Items of Local Cooperation. The items of local cooperation shown under "Non-Federal Responsibilities" on page 7-12 and under "Recommendations" beginning on page 10-1 are inconsistent. The correct items should include the following:

(1) The non-Federal sponsor has a requirement to provide all LERRDs (LERRD values will be applied toward both flood control costs and irrigation costs); provide a cash contribution equal to 5 percent of the costs allocated to flood control; provide an additional cash contribution if needed to bring its share of costs allocated to flood control to 25 percent; and contribute 35 percent of the costs allocated to irrigation water supply, such contribution being the value of LERRD's allocated to irrigation water supply and cash. While correcting this changes the Federal/non-Federal apportionment for the project as a whole, it does not relieve the sponsor of the requirement to provide all LERRDs.

(2) Section 202(c) of WRDA 1996 requires sponsors of flood control projects to comply with the flood plain management and insurance programs and to prepare flood plain management plans.

g. Real Estate. As part of PED, and prior to execution of the PCA, further analysis will be performed regarding what lands, easements and rights-of-way will be required to support the construction, operation and maintenance of the project. Since the analysis will include reconsideration of the acreage and estate requirements above elevation 715 feet (M.S.L.), the acreage and estate conclusions cited in appendix F of the report are subject to change. The sponsor is aware that they are responsible for payment and implementation of all operation and maintenance responsibilities associated with this project. A detailed breakdown of all anticipated and maintenance costs will be prepared prior to execution of the Project Construction Agreement. Operation and maintenance costs identified in the final feasibility report are estimates only and ultimate responsibilities will be based upon actual costs associated with the

project.

2. The citation to "Federal law" in Subparagraph 3 of paragraph 9 of appendix F is hereby changed to read "applicable law."

h. Operation, Maintenance, Replacement, Repair and Rehabilitation. The following table provides a breakdown of the estimated increased O&M costs associated with the project. No increased operation and maintenance costs for the spillway facilities is expected as a result of this project. All increases in the operation and maintenance costs coming as a result of this project are associated with the mitigation features for affects to fish and wildlife and recreation.

OMRR&R ACTIVITY	ESTIMATED ANNUAL COST
Fish and Wildlife Facilities	$60,000
Mitigation for Impacts to Existing Recreation	$5,000
TOTAL	$65,000

i. Period of Analysis. The final report uses a 100-year period of analysis in all of its evaluations of the proposed project. Some interest has been expressed on the sensitivity of the analysis if a 50-year period of analysis were to be used. In this case, the total average annual cost would be $3,174,000 and the BCR would be 1.09:1.

j. Parking Safety. A potential safety hazard has been identified as a result of the inundation of the existing parking facilities. Further assessment of these safety issues may lead to a conclusion that development of limited additional parking facilities may be required as hazard mitigation. Construction of these facilities and operation and maintenance would be cost shared by the non-Federal sponsor. The estimated operation and maintenance cost identified in the final report is an estimate only and may be increased prior to signing of the Project Construction Agreement. The sponsor is aware of these potential cost increases.

Attachment 1 - Sponsor Letters of Intent

KAWEAH DELTA WATER CONSERVATION DISTRICT
2975 N. Farmersville, California 93223
P.O. Box 1247, Visalia, California 93279
Telephone: (209) 747-5601
Fax (209) 747-1989

November 21, 1996

Colonel Dorothy Klasse
Sacramento District Engineer
U.S. Army Corps of Engineers, Sacramento District
1325 J Street
Sacramento, California 95814-2922

Dear Colonel Klasse:

As stated in our October 24, 1996 letter (copy attached), the Kaweah Delta Water Conservation District intends to act as the non-Federal sponsor for the construction of the recommended NED Plan as identified in the September 1996, feasibility report.

In this sponsorship, we will accept the items of local cooperation contained in the model PCA. In addition, we recognize that the operation of the project under the NED Plan would be only for flood control and agricultural water supply. Also, as the non-Federal sponsor, we will be responsible for obtaining all required projects lands, easements, relocations, rights-of-way, and disposal areas (LERRD). We are also aware and accept the requirements of Section 202 of the Water Resources Development Act of 1996 requiring sponsors of flood control projects to comply with flood plain management and insurance programs and to prepare flood plain management plans.

We believe this project will provide the community with flood protection while contributing additional water supply benefits.

Sincerely,

Bruce George, Manager
Kaweah Delta Water Conservation District

Attachment

KAWEAH DELTA WATER CONSERVATION DISTRICT
2975 N. Farmersville Blvd., Farmersville, CA 93223
P.O. 1247 Visalia, California 93279
Telephone: (209) 747-5601
Fax: (209) 747-1989

October 24, 1996

Colonel Dorothy Klasse, District Engineer
U.S. Army Corps of Engineers
Sacramento District
1325 J Street
Sacramento, California 95814

Subject: Kaweah River Basin Feasibility Study Letter of Intent To Cost Share in the Construction of the Proposed Spillway Raise at Terminus Dam

Dear Colonel Klasse:

The Kaweah Delta Water Conservation District (KDWCD) intends to act as the non-Federal sponsor for the construction of a project at Terminus Dam to increase flood control and water supply for the region. KDWCD fully supports, and will act as the non-Federal cost sharing sponsor for the recommended NED Plan identified in the Final Feasibility Report dated September 1996.

As you know, both the NED Plan and the Locally Preferred Plan are structurally the same. Recognizing this fact, we want to affirm our commitment to the NED Plan as described in the Final Feasibility Report.

We look forward to continue working with the Sacramento District as we enter the preconstruction, engineering and design (PED) phase of the project.

Sincerely,

Bruce George, Manager
Kaweah Delta Water
Conservation District

cc:
Mr. Henri Langlois, Policy Review Manager, Policy Division, ATTN: CECW-AR(SA), 7701 Telegraph Road, Alexandria, VA 22315-3861

Mr. Dave Fountain, Room 7111 Pulaski Building, ATTN: CECW-PW, 20 Massachusetts Ave. NW, Washington, DC 20314-1000

Appendix 1 - Revised Detailed Cost Allocation - NED Plan

Table 7-1
Single-Purpose and Multipurpose Costs
NED Plan and LPP

Item	Flood Control Only	Water Supply Only	Multipurpose
First Cost	$35,644,000	$35,644,000	$35,644,000
IDC	$4,088,000	$4,088,000	$4,088,000
Total Investment Cost	$39,732,000	$39,732,000	$39,732,000
Annual Cost	$3,032,000	$3,032,000	$3,032,000
O&M	$65,000	$65,000	$65,000
Total	$3,097,000	$3,097,000	$3,097,000

Table 7-2
Separable and Joint Use Costs

Item	Separable Cost			Joint-Use	Multipurpose
	Flood Control	Water Supply	Total		
First Cost	0	$0	$0	$35,644,000	$35,644,000
IDC	0	$0	$0	$4,088,000	$4,088,000
Total Investment Cost	0	$0	$0	$39,732,000	$39,732,000
Annual Cost	0	$0	$0	$3,032,000	$3,032,000
O&M	0	$0	$0	$65,000	$65,000
Total	0	$0	$0	$3,097,000	$3,097,000

Table 7-3
Detailed Cost Allocation [1] - NED Plan
(Separable Costs-Remaining Benefits Method)

Item	Flood Control ($)	Water Supply ($)	Total ($)
1. Allocation of Annual Costs			
a. Annual Benefits	3,558,000	271,000	3,829,000
b. Alternative Annual Costs	3,097,000	3,097,000	0
c. Annual Benefits limited by Annual Costs	3,097,000	271,000	3,368,000
d. Separable Annual Costs	0	0	0
e. Remaining Annual Benefits	3,097,000	271,000	3,368,000
f. Distribution Percentage	91.95	8.05	100
g. Allocated Joint Annual Costs	2,847,700	249,300	3,097,000
h. Total Allocated Annual Costs	2,847,700	249,300	3,097,000
2. Allocation of O&M			
a. Separable Annual Costs	0	0	0
b. Allocated Joint Costs	59,800	5,200	65,000
c. Total Allocation of O&M	59,800	5,200	65,000
d. Specific Costs	0	0	0
e. Allocated Joint Use Costs	59,800	5,200	65,000
f. Percent (%) of Joint Use Costs	91.95	8.05	100
3. Total Allocated OM&R			
a. Allocated Joint Use Costs	59,800	5,200	65,000
b. Percent (%) of Joint Use Costs	91.95	8.05	100
4. Allocation of Investment			
a. Annual Investment Cost (Interest & Amortization)	2,847,700	249,300	3,097,000
b. Allocated Investment	91.95	8.05	100
c. Allocated Investment	36,533,600	3,198,400	39,732,000
5. Allocation of First Costs			
a. Specific Investment	0	0	0
b. Investment in Joint-Use Facilities	36,533,600	3,198,400	39,732,000
c. Interest During Construction on Joint-Use Facilities	3,758,900	329,100	4,088,000
d. First Cost of Joint-Use Facilities	32,774,700	2,869,300	35,644,000
e. Percent of First Cost in Joint-Use Facilities	91.95	8.05	100
f. First Cost of Specific Facilities	0	0	0

[1] Preliminary.

Table 7-4
Allocation of First Costs [1] - NED Plan

Function	Flood Control	Water Supply	Total Cost
Separable Costs	$0	$0	$0
Joint-Use Costs	$32,774,700	$2,869,300	$35,644,000
Total Costs	$32,774,700	$2,869,300	$35,644,000

[1] Preliminary.

Table 7-5
Allocation of Maintenance and Operation Costs [1] - NED Plan

Function	Flood Control	Water Supply	Total Cost
Separable Costs	$0	$0	$0
Joint-Use Costs	$59,800	$5,200	$65,000
% Joint Use Costs	91.95%	8.05%	100%
Total Costs	$59,800	$5,200	$65,000

[1] Preliminary.

Table 7-6
Cost Apportionment Summary - NED Plan

Item	Federal ($)	Non-Federal ($)	Total ($)
FLOOD CONTROL Lands and Damages	0	7.984.000	7.984.000
Relocations	0	3.552.000	3.552.000
LERRD Flood Control Allocation [1]		11.536.000	11.536.000
Cash Contribution	19.600.000	1.638,700 [2]	21.238.700
TOTAL Flood Control	19,600,000 59.80%	13,174,700 40.20%	32,774,700
IRRIGATION WATER SUPPLY [3] Lands and Damages	0	699.000	699.000
Relocations	0	311.000	311.000
LERRD Water Supply Allocation	0	1.010.000	1.010.000
(65% Fed and 35% Non-Fed (Cash Contribution)	1.865.000	(5.700)[4]	1.859.300
TOTAL Water Supply	1.865.000	1.004.300	2.869.300
Total First Cost	21.465.000	14.179.000	35.644.000
Total Cash	21.465.000	1.633.000	23.098.000
Total LERRD	0	12.546.000	12.546.000
Total Share	21.465.000 60.22%	14.179.000 39.78%	35.644.000

[1] LERRD's allocation to flood control purpose are 91.95% of total LERRD. See Table 7-3 for derivation of allocation percentage. LERRD costs allocated to flood control 100% non-Federal sponsor responsibility.
[2] 5% cash contribution of the cost allocation to flood control.
[3] LERRD's allocated to water supply purpose are 8.05% of total LERRD. See Table 7-3. LERRD's allocated to water supply are acquired by the non-Federal sponsor but are cost shared on 65-35% basis.
[4] () denotes a negative number.

REPORT OF THE DISTRICT ENGINEER

EXECUTIVE SUMMARY

INTRODUCTION

This feasibility report presents the results of studies on alleviating flooding and other water resource problems on the Kaweah River, its distributaries, and Tulare lakebed. The study also includes the Dry Creek drainage basin, a major tributary to Kaweah River below Terminus Dam. The flood plain extends along the Kaweah and St. Johns Rivers, lower Kaweah River, and Cross Creek, and includes Tulare lakebed and the city of Visalia. An environmental impact statement/ environmental impact report (EIS/EIR) has also been prepared. The non-Federal sponsors are the Kaweah Delta Water Conservation District (KDWCD), city of Visalia, and Tulare County and Kings County.

This study investigated the feasibility of providing (1) increased flood protection to the downstream area which includes the city of Visalia, other urban areas, and agricultural land and (2) increased upstream storage for irrigation water supply. Terminus Dam and Lake Kaweah, constructed by the Corps of Engineers in 1962, are operated by the Corps of Engineers for flood control and storage of irrigation water. Recreational facilities on Lake Kaweah were constructed by the Corps, a public entity, and a private party. The dam is located on the Kaweah River about 20 miles east of Visalia. Currently, the dam controls flows from the reservoir on the Kaweah River up to about a 46-year flood event.

MEASURES AND ALTERNATIVES

Measures to provide increased flood protection and water supply storage were investigated. These measures included upstream storage on tributaries to the main stem of the Kaweah River; enlargement of Lake Kaweah; construction of channel and levee improvements downstream from the existing reservoir; diversion of floodflows into the existing Friant-Kern Canal (a U.S. Bureau of Reclamation facility); a dam on Dry Creek; downstream detention basins below Terminus Dam on Kaweah River; reservoir dredging; and nonstructural measures.

The only structural plan to survive the screening of measures and alternatives was the plan to raise the spillway of Terminus Dam to provide more flood control and irrigation water supply storage. The final alternatives include:

Alternative 1 - No Action. Under the no-action plan, no Federally constructed flood control projects would be constructed. The flood threat to

downstream areas such as the cities of Visalia and Farmersville and the agricultural land on the alluvial fan and in Tulare lakebed would not be affected by a Federal project.

Alternative 2 - 21-Foot National Economic Development (NED) Spillway Raise. An optimization process was used to identify a 21-foot spillway raise as most viable from a Federal national economic development perspective. This plan would raise the spillway 21 feet and would provide an additional 42,600 acre-feet of flood control and irrigation water supply storage at Lake Kaweah. About a 69-year level of flood protection would be provided against uncontrolled spilling from Terminus Dam. Operations of the dam and reservoir would be similar to the current operational plan. Under this operation, 7,000 acre-feet of conditional rain flood storage space would be maintained over the life of the project. The net benefit for this alternative average $656,000 per year over the life of the project.

Alternative 3 - Raising the Spillway at Terminus Dam by 21 Feet and Change Conditional Rain Flood Storage. This locally preferred plan (LPP) would provide an additional 42,600 acre-feet of flood control storage and irrigation water supply at Lake Kaweah. The reservoir operation would be modified to include a 12,000 acre-foot conditional rain flood pool over the life of the project. About a 66-year level of flood protection would be provided against uncontrolled spilling. This plan, permitting a larger pool to be maintained during the rainy season, provides greater security for existing fish and wildlife resources as well as for existing recreation users. The first cost of this alternative is $35.9 million, and average annual benefits are $3.4 million.

Each of the action alternatives would include features to mitigate adverse environmental impacts.

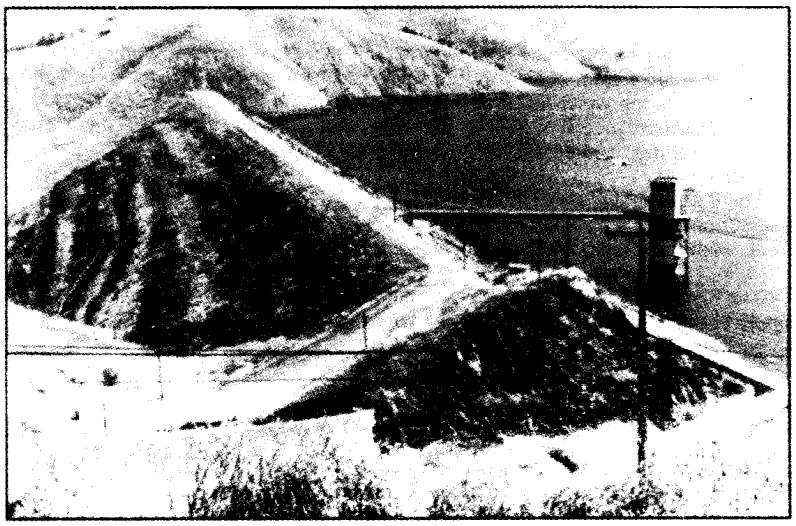
SELECTED PLAN

The NED plan is the Corps' recommended selected plan. The project cost of the NED plan and LPP are identical (investment cost of $35,850,000 and average annual cost of $3,092,000). The benefit-to-cost ratio for the NED plan is 1.21, and for the LPP is 1.18. The NED produces more flood control benefits than the LPP, which, of the two plans, maximizes water supply benefits. Both plans have recreational losses due to inundation of existing recreational facilities. The non-Federal sponsor prefers the LPP because it provides a more balanced project through the added security provided to the existing environmental and recreation resources. However, the non-Federal sponsor recognizes the Corps' recommendation of the NED plan, since it produces the maximum flood control benefits.

Spillway modifications include placing a 21-foot-high concrete ogee weir across the spillway sill and widening the spillway from 307 to 455 feet. Relocations include State Highway 198 Horse Creek Bridge and utility powerlines. Facilities at Kaweah Recreation Area and Horse Creek Recreation Area would be inundated whenever the lake fills to maximum gross pool. Only vault toilets and the Tulare County boat patrol office would be resited above the new gross pool. The boat ramp at Lemon Hill Recreation Area would be extended to the new gross pool elevation.

A total of 333 acres of riparian scrub and forest oak woodland and savannah habitats at Lake Kaweah would be adversely affected by the plan. Mitigation includes creation and management of 440 acres of oak woodlands, savannah, and riparian habitat downstream from Terminus Dam along the Kaweah River. Mitigation for reduced floodflows into the Tulare lakebed would require purchase of 366 acres in or adjacent to the Tulare lakebed and creation of wetland habitat. The mitigation plan developed by the Corps was fully coordinated with the U.S. Fish and Wildlife Service prior to circulation of the draft report for outside review.

Chapter 1
Introduction



Terminus Dam and Lake Kaweah. Constructed in 1962 with an initial capacity of 150,000 acre-feet, it provides flood control and irrigation water supply storage, recreation, and hydropower benefits.

Chapter 1 INTRODUCTION

PURPOSE AND SCOPE

This report summarizes the results of the feasibility phase of the Kaweah River Basin Investigation.

The purpose of this study is to determine if there is a feasible flood control and water resources project in the Kaweah River basin. A feasible project is defined as one that meets the water resource-related needs of the local area; has a Federal interest, in accordance with Federal principles and guidelines; meets all applicable laws and statutes; and possesses environmental compatibility.

The Kaweah River basin study area (as shown in figure 1-1) is in Tulare and Kings Counties and includes the basins and flood plains of the Kaweah River, Dry Creek, Mehrten Creek, and Yokohl Creek, including Tulare lakebed.

The primary objective is to increase flood protection and irrigation water supply in the study area, in accordance with the Feasibility Cost Sharing Agreement.

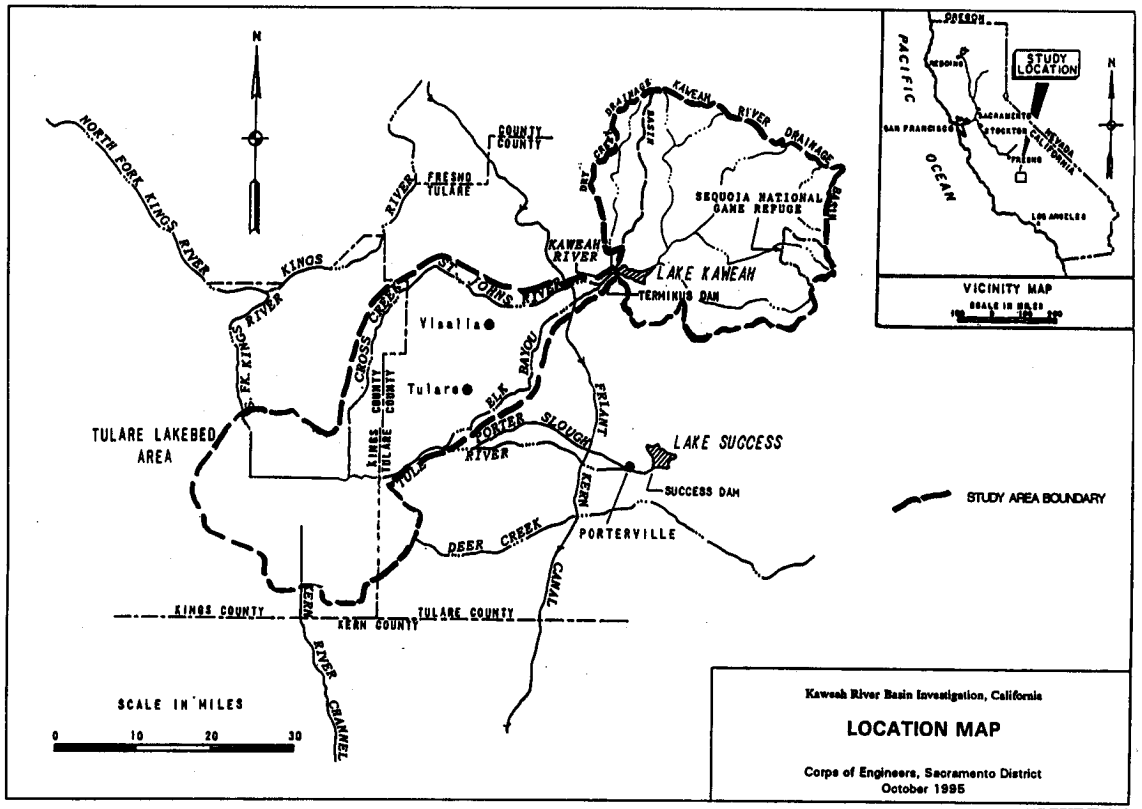
STUDY AUTHORITY

This authority for the study is contained in the 1964 Congressional Resolution of the House Committee on Public Works, a portion of which reads as follows:

> *Resolved by the committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on Sacramento-San Joaquin Basin Streams, California, published as House Document No. 367, 81st Session, and other reports...with a view to determining whether any modification of the recommendations contained therein are advisable at this time, with particular reference to further coordinated development of the water resources in the San Joaquin River Basin, California.*

STUDY PARTNERS AND COORDINATION

This study was conducted in response to a request from the Kaweah Delta Water Conservation District (KDWCD), the non-Federal lead sponsor. Coordination was conducted with the U.S. Fish and Wildlife Service (FWS), U.S. Bureau of Reclamation (USBR), city of Visalia, Tulare County and Kings County, Department of Fish and Game (DFG), and Department of Water Resources (DWR).



Kaweah River Basin Investigation, California

LOCATION MAP

Corps of Engineers, Sacramento District
October 1995

FIGURE 1-1

A public workshop was held at the initiation of the reconnaissance study in Visalia on March 27, 1986. A second meeting, following the circulation of the reconnaissance report, was held March 18, 1987. A reconnaissance report was completed in July 1987.

The reconnaissance study was followed by the initiation of the feasibility phase study, in response to the signing of a Feasibility Cost Sharing Agreement (FCSA) on January 27, 1988, by the Corps and the KDWCD, the non-Federal lead sponsor of the study. The feasibility study was initiated on February 18, 1988. Cost-sharing sponsors with the KDWCD are Tulare County, Kings County, and the city of Visalia. A notice of intent to prepare a feasibility report was circulated in March 1988 to solicit comments for consideration during the report process. A study management team composed of participating agencies and Corps technical team members was formed to manage technical studies and participate in the evaluation of alternative plans. An Executive Committee of representatives from the participating agencies was formed when the feasibility study was initiated, and meetings were held periodically.

PRIOR STUDIES AND REPORTS

Information on water and related resources of the Kaweah River basin is available in prior reports prepared by the Corps and other agencies. Following are brief descriptions of the more significant reports.

Federal Agencies - Corps of Engineers, Sacramento District

"Survey Report, Flood Control, Sacramento and San Joaquin River Valleys, California, Kaweah and Tule Rivers, Proposed Flood Control Improvement," April 1940. This report demonstrated a need for a flood control project.

"Preliminary Definite Project Report, Kaweah and Tule Rivers, California, Terminus Project, Kaweah River, California," June 1949. Reservoir plans were further refined in this report.

"General Design Memorandum for Terminus Project, Kaweah River, California," December 1957. Includes designs for the existing project.

Flood Reports, Sacramento District, 1950, 1952, 1955, 1958, 1963, 1966-67, 1968-69, 1977-78, 1982 and 1986. Reports documenting the extent and effects of floods in the Kaweah River and Tulare Lake basins.

"Terminus Dam and Reservoir, Kaweah River, California," August 1966. Geology, paleontology, flora and fauna, archeology, and history of the area, prepared in cooperation with the National Park Service.

"Reservoir Regulation Manual, Terminus Dam (Lake Kaweah), Kaweah River, California," June 1962, revised November 1971. Reservoir regulation manual for Terminus Dam.

"Flood Plain Information, Sand and Cottonwood Creeks and the Lower Kaweah River, Visalia, California," May 1972. Flood Plain Information Report. This report presented information on flood hazards along Sand and Cottonwood Creeks, the Kaweah River, and many distributary streams in the vicinity of Visalia and other communities in northwest Tulare County. Historical flooding was described and intermediate project and standard project flood plains were delineated. Data for these flood plains were gathered from precipitation records and computed peak flows of floods up to the magnitude of the Standard Project Flood. Included flooded profiles on St. Johns and Kaweah Rivers and Cross and Packwood Creeks.

"Office Report, Planning Branch, Corps of Engineers," August 1972. This document reports results of the San Joaquin River Basin Investigation, Phase I studies, for the Kaweah River. It describes the flood problems, flood events, water supply, hydrology, damages and benefits of flooding, and desires of local interests in the area. Benefit-cost ratios were computed for the specified alternatives. These ratios were less than one to one, and the study was terminated; however, further studies were recommended to determine if flood protection could be provided with less expensive alternatives.

"Lake Kaweah Master Plan, Design Memorandum No. 11," September 1976. Master plan to guide administration of public use and development of all project lands and waters at Lake Kaweah.

"Flood Emergency Request, PL 84-99, Terminus Dam, Kaweah River, Success Dam, Tule River, California," May 1978. Barricade study for emergency flood control, Terminus Dam.

"Section 205 Initial Appraisal, Kaweah River Basin," 1985. A 500-acre-feet detention basin at McKays Point was recommended for construction to reregulate hydropower releases from Terminus Dam and reduce floodflows from Dry Creek that flood Tulare lakebed. This study was terminated because a majority of the benefits were to hydropower rather than for flood control.

"Initial Appraisal, Section 205, Cross Creek," 1985-86. Flooding from Cross Creek due to a dilapidated headgate and 1,200 cfs reduction in capacity of Cross

Creek was investigated. Plans called for relocating the Lakeside Ditch headgate, and the Cross Creek diversion headgate, and constructing a spill structure in Lakeside Ditch. The benefit-cost ratio was 1.2:1. Local interests decided to correct the problems themselves.

"Kaweah River Basin Investigation, California, Reconnaissance Report," July 1987. This report recommended further investigation of four alternatives that appeared to be economically feasible. They consisted of (1) enlarging Lake Kaweah, (2) constructing a small Dry Creek detention basin, (3) constructing a large Dry Creek reservoir to serve as offstream storage for the Kaweah River drainage basin (this included an enlarged Lake Kaweah connected to Dry Creek by a tunnel), and (4) constructing Limekiln Reservoir.

"Lake Kaweah Intensive Cultural Resource Survey," July 1988. The Institute of Archaeology, University of California, Los Angeles for the U.S. Army Corps of Engineers.

"Geologic and Seismologic Investigation, Success and Terminus Dams, Lake Success and Lake Kaweah, Tule and Kaweah Rivers, California," July 1988.

"Draft Terminus Dam (Lake Kaweah), Kaweah River, California, Water Control Manual," March 1990.

Federal Agencies - FEMA

"Flood Insurance Study, Tulare County, California," July 1985, Federal Emergency Management Agency.

Other Agencies

"Three Rivers Soil Conservation District, Report on Feasibility of 26 Dam Sites Located Upstream of Terminus Dam," 1960. Investigated upstream flood detention damsites. No sites were found to be feasible.

"Flood Control Master Plan for the County of Tulare, California," June 1971. Murray, Burns, and Kienlen Consulting Civil Engineers, Sacramento, CA.

"Report on Irrigation, Drainage and Flooding in the Tulare Lake Basin," September 1981. Tulare Lake Basin Water Storage District. Report on irrigation, drainage, cropping practices, flood control, and historical flooding in the Tulare Lake basin.

"Terminus Power Project, Project No. 3947," December 1984. The Kaweah River Power Authority application for license to construct a hydropower plant at Terminus Dam.

"State Reclamation Board, FIRM study for Tulare and Kings County. Preliminary Study," 1985.

"Kings County Flood Insurance Study Hydrologic Report - Cross Creek and Tule River at Tulare Lake," 1985. Gill and Pulver Engineers Inc., Sacramento, CA.

"California Water: Looking to the Future, Bulletin 160-87," November 1987. California Department of Water Resources. Status of water supply in California.

"Statistical Appendix," January 1988. California Department of Water Resources. Statistical data on water supply in California.

"Limekiln Reregulating Dam," 1990. Prepared for Kaweah Delta Water Conservation District by Tudor Engineering Company. Investigated the feasibility of constructing a reregulation dam below the confluence of Dry Creek and the Kaweah River. Dam would provide comprehensive flood protection from Dry Creek and Kaweah River at the Limekiln site. The alternative was not economically feasible.

U.S.G.S. maps of scale 1:24,000 are available for most of the study area. The remaining area is covered by U.S.G.S. maps of scale 1:62,500.

Chapter 2
Study Area Description

Downtown Visalia in 1956.

Chapter 2 STUDY AREA DESCRIPTION

SETTING

The study area is located 45 miles southeast of Fresno, California. It encompasses approximately 1,300 square miles of the Kaweah River upper basin; the Dry Creek, Yokohl Creek, and Mehrten Creek basins; the alluvial flood plain; and the Tulare lakebed. The study area extends from the western slopes of the Sierra Nevada to its terminus in the Tulare lakebed. The study area is within Tulare and Kings Counties. The Kaweah River basin is bounded by Kings River basin on the north, Kern River basin on the east, and Tule River basin on the south. Elevations range from 12,634 feet in the Sierra Nevada to 510 feet at the foot of Terminus Dam, 325 feet at Visalia, and approximately 175 feet at the lowest point in Tulare lakebed.

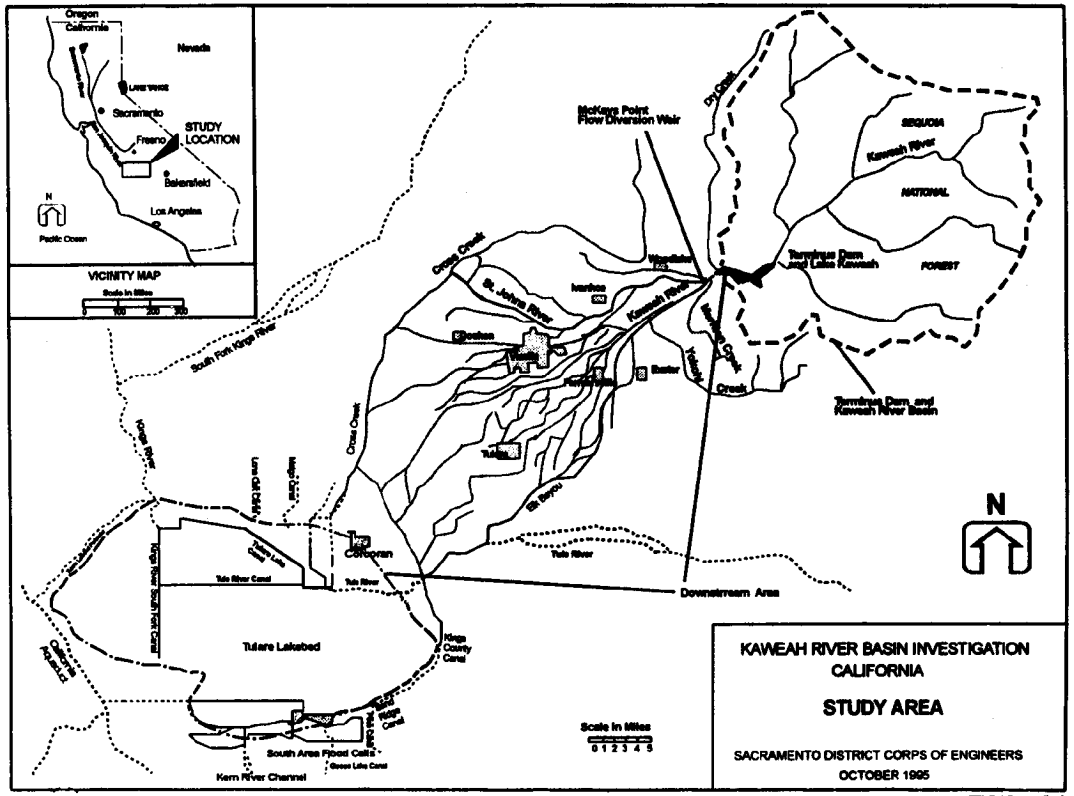
For descriptive purposes, the study area is divided into three reaches in this report: (1) the Terminus Dam and Kaweah River basin (this includes Lake Kaweah and its watershed), (2) the downstream area, (this area encompasses the basin below Terminus Dam and upstream from the Tulare lakebed) and (3) the Tulare lakebed.
A study area map is shown in figure 2-1.

Terminus Dam and Kaweah River Basin

The Kaweah River originates from a group of glacial lakes in the Sierra Nevada near Triple Divide Peak at elevation 12,634 feet, above mean sea level (m.s.l.). A portion of the drainage basin is within the Sequoia National Park. The tributaries flow through steep narrow canyons from the headwaters to the foothills. There are three main forks which join near the town of Three Rivers. The river flows westerly for about 8 miles into Lake Kaweah. Terminus Dam and Reservoir (Lake Kaweah) are located in the foothills about 20 miles east of Visalia. Land adjacent to the Lake has moderate to steep slopes and rises to an elevation of just below 3,000 feet. A map of the Terminus Dam and Kaweah River basin reach is shown in figure 2-2.

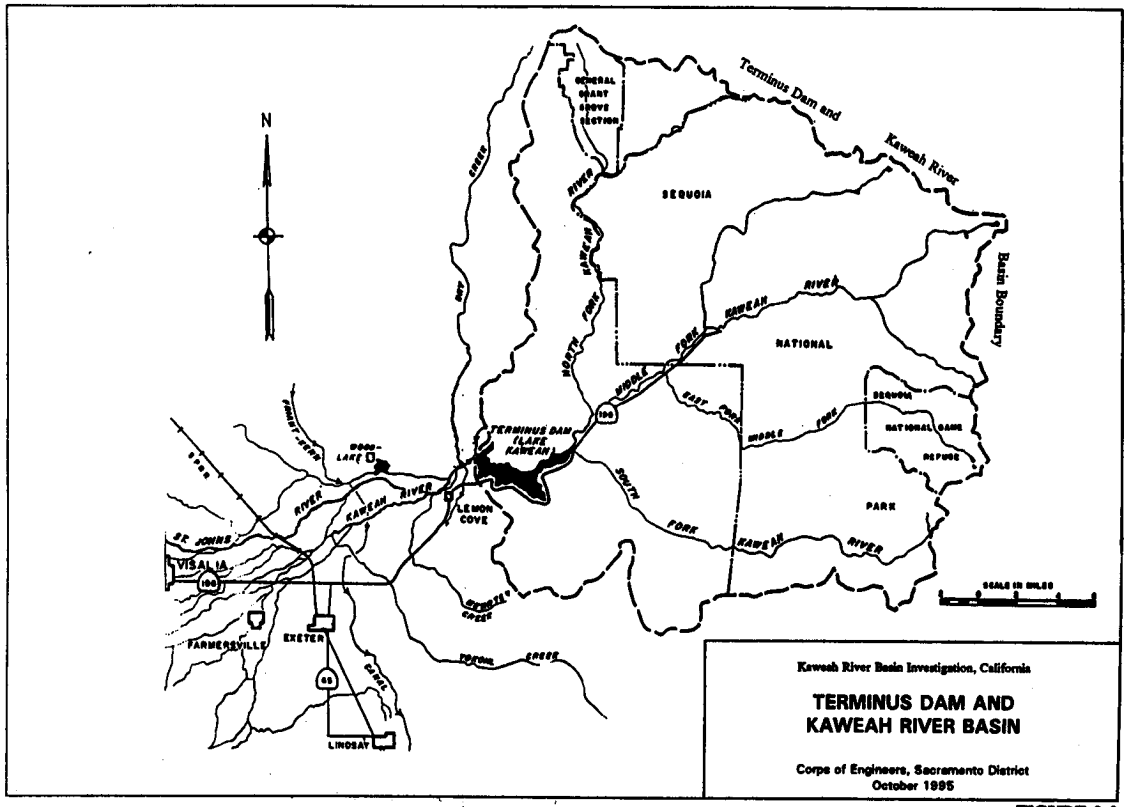
Downstream Area

One mile below Terminus Dam, the river emerges onto an alluvial fan near the town of Lemon Cove. Dry Creek flows into the Kaweah River about 1 mile downstream from Terminus Dam. The Dry Creek watershed is a narrow area of about 82 square miles on the western slope of the Sierra Nevada. It is separated from the Kaweah River basin by broad hills and steep terrain lands adjacent to the streams. Elevations range from 480 feet at the confluence with the Kaweah River



FILE: 2.HFX (1 NOV 95)

FIGURE 2-1



Kaweah River Basin Investigation, California

TERMINUS DAM AND KAWEAH RIVER BASIN

Corps of Engineers, Sacramento District
October 1995

FIGURE 2-2

to 7,650 feet in the headwaters. Dry Creek flows through low foothills for about 25 miles before emerging onto the valley floor and joining the Kaweah River.

Three miles below Terminus Dam at the Mckays Point Weir (also known as *Mckay Point*), the Kaweah River divides into two channels—the St. Johns River and Kaweah River. A few miles below Mckays Point, the Kaweah River branches out into many smaller distributary channels typical of an alluvial fan delta. Visalia is located on this alluvial fan. The apex of the fan is naturally defined near the town of Lemon Cove, 1 mile upstream from Mckays Point. The fan has been heavily disturbed by human activity and the distributaries were channelized for irrigation. Although the St. Johns River currently begins at Mckays Point, the location where it has historically diverged from the Kaweah River has varied. Excess flows from the Kaweah, Kings, Tule, and Kern Rivers and other local sources enter Tulare lakebed through a network of creeks and irrigation canals. Mehrten and Yokohl Creeks flow into the Kaweah River below Mckays Point. Mehrten and Yokohl Creeks drain about 93 square miles. A map of the downstream area reach is shown in figure 2-3.

Tulare Lakebed

The Tulare lakebed, which covers 200,000 to 300,000 acres, is a natural sink in the lower San Joaquin Valley with a lowest elevation of 175 feet. Formerly a large, shallow lake, it was reclaimed for agriculture beginning in the late 1800's. The lakebed is largely developed for agriculture and is essentially uninhabited. Four major rivers drain into the Tulare lakebed as channelized canal systems—Kings River from the north, Kaweah River (Cross Creek) from the northeast, Tule River from the east, and Kern River from the south. All four major rivers have upstream flood control dams—Pine Flat Dam on the Kings River, Terminus Dam on the Kaweah River, Success Dam on the Tule River, and Isabella Dam on the Kern River. The Tulare lakebed is shown in figure 2-4.

Floodwater reaches the Tulare lakebed about once every 3 years. This occurs from unregulated streamflow or when upstream reservoirs cannot adequately regulate general rain or snowmelt floods, and when flows exceed the capacity of upstream spreading facilities and irrigation demand. The Tulare lakebed is essentially a closed basin without an outlet; therefore, it is subject to extended periods of inundation by large floods. Tulare lakebed is not linked to the San Joaquin River basin except during rare flood events when the Tulare lakebed fills and spills into the San Joaquin River basin via the South Fork of the Kings River. This last occurred in 1878, before major upstream flood control projects were built on the upstream river basins. As a result of the 1983 flood, floodwater

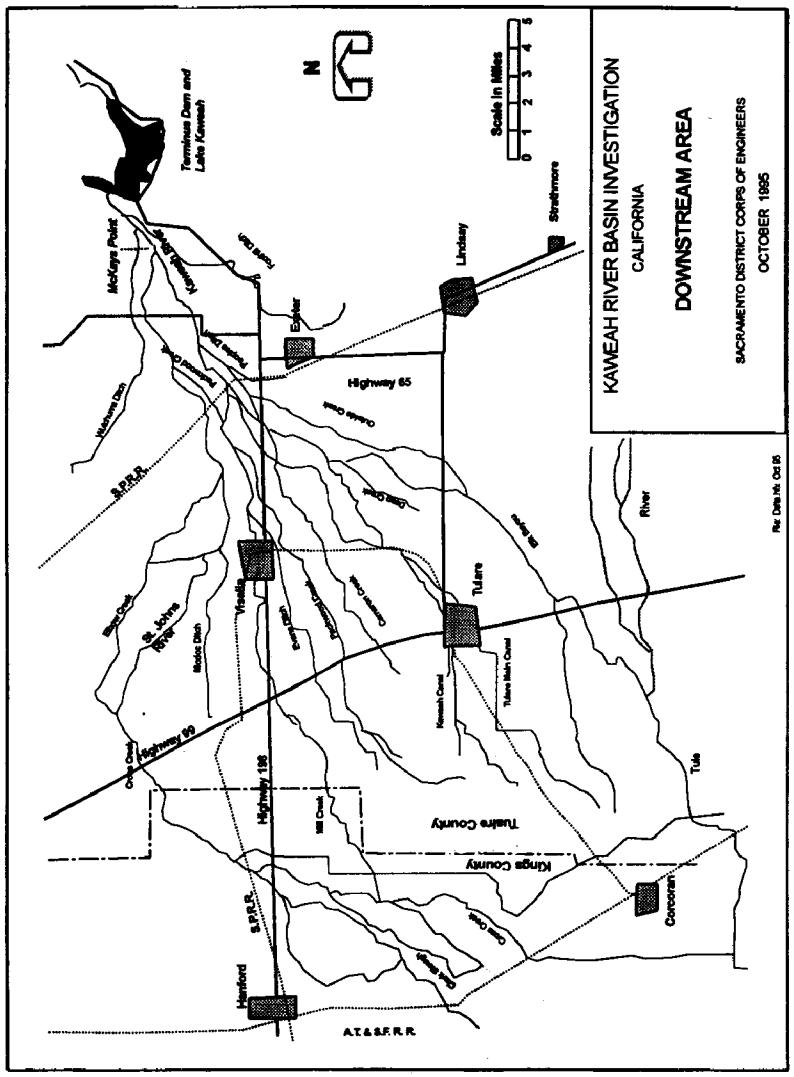

KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
DOWNSTREAM AREA
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995
Scale in Miles
0 1 2 3 4 5
N
Terminus Dam and Lake Kaweah
McKays Point
Kaweah River
Lindsay
Strathmore
Exeter
Highway 65
Visalia
Tulare
Highway 99
Highway 198
Tulare County
Kings County
Corcoran
Hanford
S.P.R.R.
A.T.&S.F.R.R.
St. Johns River
Tule
River

FIGURE 2-3

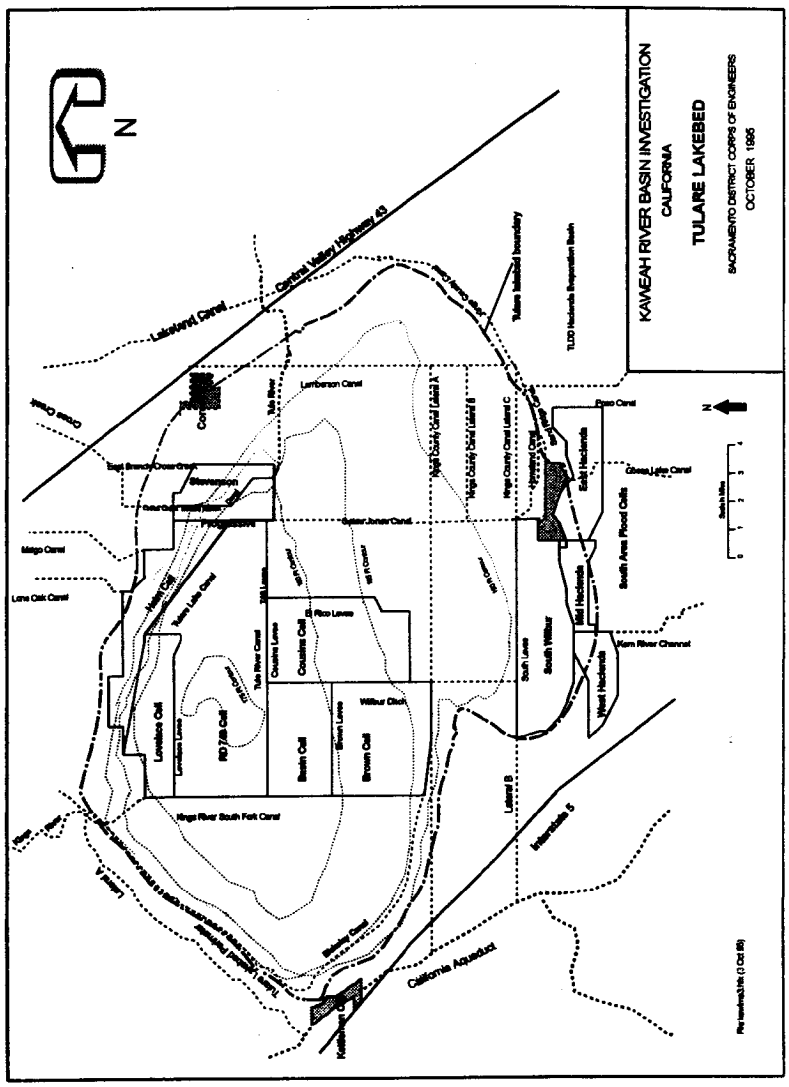

KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
TULARE LAKEBED
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995
N
Lakeland Canal
Central Valley Highway 43
Lumberson Canal
Tule River
Stevenson
Progressive
Mango Canal
Lone Oak Canal
Tulare Lake Canal
Lovelace Cell
RD 748 Cell
Cousins Cell
Basin Cell
Brown Cell
Willbur Ditch
Kings River South Fork Canal
Lateral B
Interstate 5
California Aqueduct
Kettleman Cr
Tulare lakebed boundary
TLDD Hacienda Evaporation Basin
Poso Canal
Goose Lake Canal
East Hacienda
South Area Flood Cells
Mid Hacienda
South Willbur
West Hacienda
Kern River Channel
Lateral A
Lateral C
Lateral B

FIGURE 2-4

was pumped northward (about 90,000 acre-feet) from the Tulare lakebed into the South Fork of the Kings River and into San Joaquin River; however, this pumping was later terminated to prevent the introduction of non-endemic white bass from the lakebed into the San Joaquin River and Sacramento-San Joaquin Delta. The DFG started an eradication program in 1983, and white bass were eradicated from Lake Kaweah and Lake Success to the Tulare lakebed.

EXISTING CONDITION

Climate

The lower basin has a temperate Mediterranean climate. Rainfall in the area varies from an average of 6 inches in the San Joaquin Valley to about 50 inches in the Sierra Nevada, with about 13.86 inches at Lake Kaweah. Temperatures range between a summer high near 110° F to a winter low near 30° F.

Summers at the upper elevations are cool with temperatures averaging in the low to mid-60's, and winters are severe with temperatures dropping below freezing. The valley floor is characterized by hot dry summers and moderate winters.

Winds are typical of those throughout the San Joaquin Valley and low foothill area. Winds usually come from the northwest, though they may reverse during the winter. Typically, winds move up the drainage basin during the early morning and downward toward the valley in the evening. Fog is common from late November through mid-February on the valley floor, and wind is negligible except during storms.

Geology and Soils

The study area occupies a portion of the Sierra Nevada Fault block which was elevated and tilted westward during Pleistocene time. Subsequent glaciation and stream erosion have carved the present landscape. The western portion of Tulare County is covered by Quaternary and recent alluvium eroded from the block.

The oldest rocks are remnants of Paleozoic and Mesozoic marine sedimentary deposits, which include limestone, shale, sandstone, limy mudstone, and interbedded volcanic rocks. Tertiary sedimentary rocks are known in the Terra Bella-Deer Creek area, and Miocene sandstone is exposed in a small outcrop at the extreme southern edge of Tulare County, west of White River. With the exception of this outcrop, western Tulare County from the valley to the foothills is covered

with unconsolidated Quaternary and recent flood plain, terrace, and basin deposits. From the foothills eastward, Quaternary and recent sediments are restricted to river gravels and terraces and to glacial debris filling lakes.

The soils in the Kaweah River basin can be broadly classified into two types. One is shallow, well-drained, slightly acidic, rocky, medium textured, and developed on slates, schists, volcanic debris, and serpentine bedrock. Soils of this type are reasonably stable with adequate vegetation. The other soil type is moderately deep, moderately coarse-textured, well-drained, slightly acidic, and granitic. Soils of this type are subject to severe erosion. Farther southwest along the Kaweah River, the flood plain area consists of moderately deep, nearly level to gently rolling well-drained loams underlain with hardpan.

Along Dry Creek, the soil series consists mainly of sandy loam, well-drained and gently sloping. The surface layer is dark gray and gray sandy loam with moderately rapid permeability and a low erosion hazard. Soils on the bottom of Dry Creek consist of the Tujunga series. This sandy soil is a very deep soil layer of high permeability and low available water capacity. The slope is smooth with a mild erosion hazard.

Rocks of the Calaveras Complex are found as numerous roof pendants with the Jurassic-Cretaceous plutonic rocks of the Sierra Nevada batholith. These rocks had originally extended across much of the Sierra Nevada but have been mostly stripped off by uplift and subsequent erosion. The Lemon Cove Schist and Quartzite that underlie Terminus Dam and portion of Dry Creek probably belong to this unit. The portion of the basin above 9,000 feet elevation has either a very thin mantle of soil or exposed rock. The Kaweah River basin generally encompasses an area underlain by granitic or metamorphic rock base and sparse soil cover.

Seismicity and Faulting

No faults have been identified in the immediate area around Terminus Dam; however, at least 50 faults are active or potentially active within 100 miles of the dam. (See figure 2-5.)

Numerous earthquakes with magnitude 3.7 and greater have occurred within 100 miles of Lake Kaweah. The active faults considered to have a potential impact on Terminus Dam are the San Andreas Fault, Owens Valley Fault Group, White Wolf Fault, and Garlock Fault. These faults are distant from Terminus Dam but are known to be active with long-duration shaking. Data on these fault systems are presented in table 2-1. The extensive examination of the Quaternary geology within the study area indicated that the peak ground acceleration for the

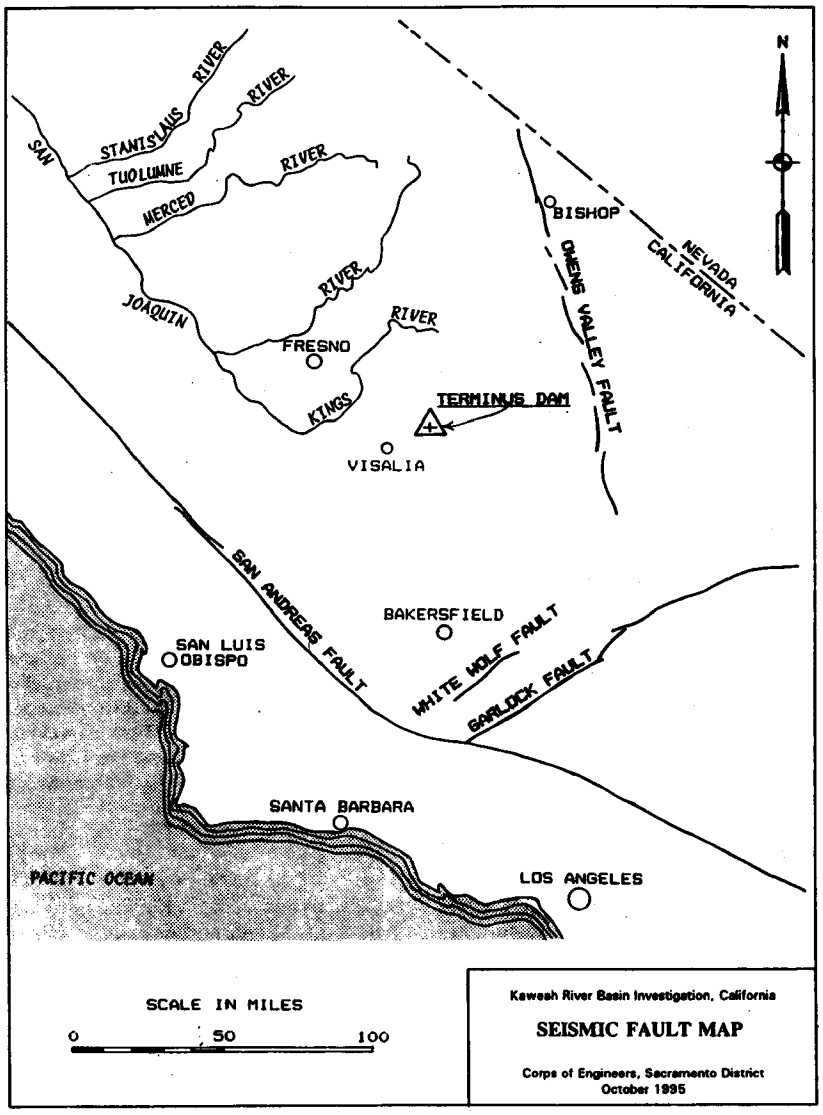

N
SAN
JOAQUIN
STANISLAUS
RIVER
TUOLUMNE
RIVER
MERCED
RIVER
RIVER
KINGS
RIVER
FRESNO
VISALIA
TERMINUS DAM
BISHOP
OWENS VALLEY FAULT
NEVADA
CALIFORNIA
SAN ANDREAS FAULT
BAKERSFIELD
WHITE WOLF FAULT
GARLOCK FAULT
SAN LUIS
OBISPO
SANTA BARBARA
LOS ANGELES
PACIFIC OCEAN
SCALE IN MILES
0
50
100
Kaweah River Basin Investigation, California
SEISMIC FAULT MAP
Corps of Engineers, Sacramento District
October 1995

FIGURE 2-5

Table 2-1
Active Faults near Terminus Dam

Source Fault	Richter Magnitude	Distance to Terminus Dam (miles)	Recurrence Interval (years)
San Andreas	8+	85 (west)	160
Owens Valley	8+	55 (east)	150-200
White Wolf	7.75	78 (south)	uncertain
Garlock	7.5	92 (south)	infrequent

Source: "Success and Terminus Dams - Lake Success and Lake Kaweah - Tule and Kaweah Rivers, California - Geologic and Seismologic Investigation," July 1988.

area, which has a 90 percent chance of not being exceeded in 100 years, is approximately 0.20 g.

The Owens Valley and San Andreas Faults are most likely to generate critical motions within an area of influence to Lake Kaweah. Greater amounts of ground motion would be likely from the Owens Valley Fault group. More frequent recurrence of earthquakes would be likely from the southern segments of the San Andreas Fault. Past records indicate that the magnitude of any future earthquake from either of these faults could be 8+ on the Richter Scale. A 1988 Corps report indicated that two earthquakes had epicenters within 100 miles of Terminus Dam: (1) the Kern River Canyon earthquake registered between 4 and 5 on the Richter Scale and (2) the Coalinga earthquake of 1986 registered 6.5 on the Richter Scale. Neither of these earthquakes affected the structural integrity of Terminus Dam.

Precipitation

Approximately 90 percent of the precipitation occurs from November through April and generally occurs as rain below 5,000 feet and as snow above that elevation. Occasionally warm winter storms produce rain up to 11,000 feet, and during extremely cold winters snow has occurred on the valley floor.

Runoff

Average annual runoff is 442,200 acre-feet from the Kaweah River system and 19,059 acre-feet from Dry Creek. The monthly mean volume and percentage of annual flow of the Kaweah River immediately below Terminus Dam is shown in table 2-2.

Table 2-2
Kaweah River Mean Monthly Flow
Below Terminus Dam

Month	Mean Volume (acre-feet) 1904-86	Percent of Annual Flow
January	26,000	6.01
February	32,900	7.44
March	46,100	10.43
April	66,800	15.11
May	106,900	24.17
June	85,200	19.27
July	31,500	7.12
August	8,700	1.97
September	4,700	1.06
October	5,200	1.18
November	8,900	2.01
December	18,700	4.23
Total	442,000	100

Floods on the Kaweah River are of two types, winter rain floods and spring snowmelt floods. The rain floods generally occur between November and March; are caused by heavy precipitation; and are characterized by sharp, high peaks of short duration and comparatively small volumes. Lake Kaweah has not spilled during a rain flood since the completion of Terminus Dam in 1962. It filled in December of 1966 and nearly filled in 1969 as a result of rain floods. Snowmelt floods between March and July generally do not produce the high peak flows of winter-type floods; however, they have much longer durations and larger runoff volumes. Peak snowmelt season flows rarely exceed stream channel capacities, but they may exceed irrigation and spreading capability for extended periods on the Kaweah River alluvial flood plain, causing floodwater to flow into the Tulare lakebed. Lake Kaweah fills approximately 1 out of every 3 years during the snowmelt season.

Mining

Copper, gold, molybdenum, feldspar, gem materials, tungsten, uranium, thorium, limestone, and sand and gravel have all been mined in Tulare County. Most of the mines produce sporadically and in relatively small quantities. Only three mines, producing sand and gravel, are currently active. Two are located along Dry Creek, and one is located 2 miles downstream from Terminus Dam along the Kaweah River. Natural gas is also produced in Tulare County. There are no tungsten or mineral mines in or around the proposed project areas.

Population

Population in Tulare County was 311,921 in 1990, a gain of 30 percent since 1980. The population of Kings County was 101,500 in 1990, a gain of 54 percent since 1980. The city of Visalia had a population of 75,636 in 1990, an increase of 65.4 percent since 1980. The city experienced a 3.2 percent population increase from 1993 to 1994. The other urbanized centers in the study area and their 1990 population are: Lindsay (8,338), Exeter (7,276), Farmersville (6,235), Tulare (33,250), Corcoran (13,380), and Woodlake (5,678).

Land Use

The economy of the valley is primarily agriculture and related support industries. A wide variety of crops and livestock are produced. Major crops are cotton, safflower, alfalfa, wheat, citrus fruits, deciduous and subtropical fruits, nuts, and grapes. Cattle and hog farming are major industries in Tulare County. Cattle and turkeys are an important industry in Kings County. In the Sierra Nevada, mining, lumber, and recreation are significant sources of the area's economy. The majority of land in the Tulare lakebed is developed for agriculture. The main crops are cotton, safflower, seed alfalfa, wheat, and barley.

Socioeconomic Conditions

Income. The median family income in Tulare County is approximately $26,500, far below the State median of $40,500. In the downstream urban areas, the median family income was about $33,000 in 1990.

Industry. Agriculture and agriculture-related industries are the economic base of Tulare and Kings Counties. Nearly 20 percent of the employed workforce in Tulare and Kings Counties is in the agriculture business. Tulare County ranks as the second most productive county in the United States. Net profit from agricultural sales in Kings County was $113 million in 1992.

Property Values. Average property values for single-unit homes in 1990 were $70,700 in Kings County and $73,400 in Tulare County. These figures are well below the State averages.

Public Facilities/Services. Public facilities consist of Federal, State, county, and city facilities including municipal buildings, such as schools, fire and police stations, and public transportation.

Transportation. Route 99 is the major north-south highway, and Route 198 is the major east-west route. Route 65 is classified as a principal arterial that serves many small communities in eastern Tulare County. The area is dependent on the automobile and will remain so for some time. Tulare County is crossed by two transcontinental railroads—the main lines of the Southern Pacific and Santa Fe Railroads traverse the county from south to north. There are three major airports: Medford Field in the city of Tulare, the city of Visalia Municipal Airport, and the city of Porterville Municipal Airport.

Air Quality

Lake Kaweah is within the San Joaquin Valley air basin designated by the California Air Resources Board. The board operates an air quality monitoring station in Visalia that measures all critical parameters, including ozone, carbon monoxide, nitrogen dioxide, sulphur dioxide, 10 micron particulates, and suspended particulates. Generally, air quality is influenced by wind direction and velocity, geography, vegetation, and climate of the region, as well as the volume of natural and artificial pollutants introduced into the air basin. Temperature inversions at altitudes of 700 to 1,000 feet trap the products of agricultural activity, vehicular emissions, and pollutants imported from the San Francisco Bay area. Particulate levels are high in May and June when winds blow dust or dirt from freshly plowed fields to the west (Tulare lakebed and local area). According to State Environmental Protection Agency's Air Resources Board, Tulare County is a "nonattainment zone" for particulate matter and ozone.

Noise

The primary source of noise is from traffic along Highways 99 and 198. Land uses, generally for agriculture and ranching, do not typically generate high noise levels, with the exception of air spraying of pesticides and agricultural machinery. Noise levels at Lake Kaweah consist of background noise of 40 to 65 decibels from recreational use on the lake, principally boating.

Water Supply

Lands able to receive irrigation service from the Kaweah River are situated within a gross area of approximately 400,000 acres on the easterly slope of the San Joaquin Valley, extending some 20 miles north and south and 30 miles east and west. (See figure 2-6.) The northerly and westerly boundaries of the area coincide, in general, with the southerly boundary of Alta and Ivanhoe Irrigation Districts and the easterly boundary of Peoples Ditch Company of the Kings River service area. The area is bounded approximately on the east by Exeter and Lindmore Irrigation Districts and on the south by the northerly boundary of Lower Tule River Irrigation District and the southern portion of Corcoran Irrigation District. The center of the main Kaweah River delta area extends southwesterly from the delta's head near Lemoncove to the town of Waukena near Tulare-Kings County line. Most of the areas served are organized as mutual ditch companies and irrigation districts. Gross areas entitled to the use of surface diversions from the Kaweah River are approximately 270,000 acres. Diversion from canals by landowners are governed by their rights and priorities which have been established through appropriation, historical use, court decision, and stipulations. Deliveries of service contract irrigation water from the Friant-Kern Canal are made to the Tulare Irrigation District and Ivanhoe Irrigation District.

Water Quality

The Kaweah River and Lake Kaweah provide habitat for fish and wildlife, irrigation water supply, hydropower, and recreation. Thermal stratification in Lake Kaweah in the summer is weak because of shallow reservoir depths. The dissolved oxygen concentrations normally remain above zero in the hypolimnion during the summer due to the shallow depth of the lake. Therefore, the lake does not serve well as a two-story fishery with warmwater fish in the top portion of the lake and coldwater fish in the bottom portion.

Phytoplankton testing over the years has found no excessive blooms. Light clarity of the surface waters is satisfactory, ranging from 6.5 to 9 feet. No reportable concentrations of pesticides, herbicides, or PCB have been found in the lake waters.

Potential water quality contamination sources for the lake include septic facilities in the leucocyte campground and adjacent rural community and a site where a leaking underground gasoline storage tank owned by Tulare County was removed.

Ground-water sampling downstream from Terminus Dam showed that electrical conductivity, hardness, nitrates, and boron were high in a few of the

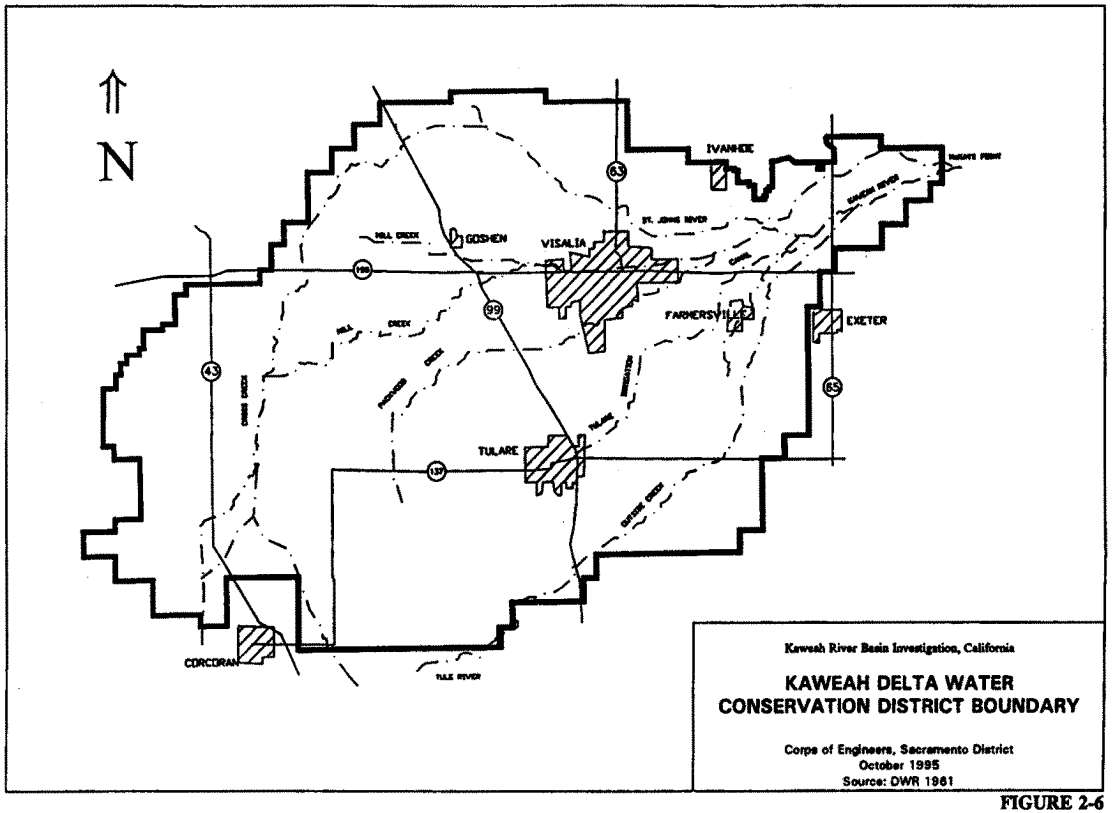

N
IVANHOE
GOSHEN
VISALIA
FARMERSVILLE
EXETER
TULARE
CORCORAN
TULE RIVER
Kaweah River Basin Investigation, California
KAWEAH DELTA WATER
CONSERVATION DISTRICT BOUNDARY
Corps of Engineers, Sacramento District
October 1995
Source: DWR 1961

FIGURE 2-6

wells, which did not meet either irrigation requirements or drinking water standards.

Ground water in the Tulare lakebed is generally good, and all toxics are below the maximum contaminant level for drinking water standards. The salinity in the subsurface is being managed by a salinity disposal system. All agricultural standards for pesticides, herbicides, and other organic compounds were below or within acceptable limits (California Code of Regulations, Title 22; U.S. Army Corps of Engineers, 1993; The Resources Agency, 1993).

Vegetation and Wildlife

The vegetation of the project area is an important component of wildlife habitat. The diversity of habitat types in the project area supports a variety of wildlife species, especially birds. The oak woodlands and accompanying grasslands around the reservoir provide habitat for a number of mammals, various raptors, and birds.

Wildlife in the downstream area rely mainly on the riparian corridors and oak-woodland habitats. Wildlife in the Tulare lakebed consist mainly of migratory waterfowl, shorebird, and other water birds of the Pacific Flyway. Areas flooded intermittently and seasonally in the lakebed provide important habitat for a variety of species.

Terminus Dam and Kaweah River Basin Plant. Communities in this area are typical of the lower western slope of the Sierra Nevada. Grasslands, live and blue oak woodlands, riparian forest, and riparian scrub are the dominant plant communities.

Downstream Area. Three major categories of natural habitat are found in this area: riparian forest, oak woodland, and grassland.

Land use downstream from Terminus Dam is closely tied to agriculture. Much of the agricultural land between Terminus Dam and Visalia is planted in citrus and deciduous fruit orchards interspersed with mixed vegetable crops. Generally, the land has been cultivated up to the edge of the floodways of the Kaweah River's natural distributaries and tributaries, leaving little or no margin between the cultivated land and the instream riparian vegetation.

As the Kaweah River branches onto the San Joaquin Valley floor, urban land uses combine with agriculture to further reduce riparian vegetation. Vegetation becomes sparse or absent as the river divides into various distributaries approaching the Tulare lakebed.

Tulare Lakebed. The historical wetlands of the Tulare lakebed have been replaced with agricultural fields, floodwater detention basins, and evaporation ponds. Currently, the storage of seasonal and intermittent floodwaters in the Hacienda and South Wilbur flood areas provide incidental habitat in the lakebed. Farming practices have eliminated most native vegetation. Small portions of the South Wilbur and Hacienda flood areas are partially vegetated.

Fisheries

Terminus Dam and Kaweah River Basin. Fish resources in Lake Kaweah include both warmwater and coldwater species. A complete list of fish species in Lake Kaweah is included in Appendix A of the EIS/EIR. The California Department of Fish and Game (DFG) annually stocks Lake Kaweah with rainbow trout in the winter and spring when the water temperatures are low enough to support the fish. Trout are stressed by and may not survive the high water temperatures and low dissolved oxygen levels prevalent in the summer when the reservoir is drawn down from irrigation releases. Some fish may move into the cooler waters of the Kaweah River as summer reservoir conditions occur, allowing survival of some coldwater fish species for more than one year. The majority of fish taken by anglers are bluegill, rainbow trout, and largemouth bass.

Downstream Area. The historic intermittent nature of instream flows in the Kaweah River have had a profound effect on the fishery. It is unlikely that a stable, permanent fishery ever existed on the river since flows were based on seasonal runoff from the Sierra Nevada and were interrupted for 4 to 8 months every year.

As a result of construction of various water management structures, there are several areas along the St. Johns River with standing water even during periods when water is not being released from Kaweah Reservoir. Fish species present in the lower Kaweah and St. Johns Rivers are introduced by releases from the reservoir and the Friant-Kern Canal. Releases from Terminus Dam are introduced into the lower reaches of the Kaweah River at the Terminus Forebay. Water is diverted from the Friant-Kern Canal into the lower Kaweah and St. Johns Rivers near Woodlake.

Tulare Lakebed. In the late 19th century, commercial fisheries existed in the Tulare lakebed as well as commercial markets for frog legs, waterfowl, and turtles. Because of the changes in the lakebed and the current agricultural practices, fish presently inhabit only the canals in the area. However, fish can inhabit the lakebed when it is flooded.

Potentially Affected Species

Potentially affected species include the California jewel flower, Kaweah brodiaea, San Joaquin adobe sunburst, mountain plover, western snowy plover, heartscale, brittlescale, lesser saltscale, lost hills saltbrush, recurved larkspur, spiny-sepaled coyote-thistle, San Joaquin wooly threads, valley elderberry longhorn beetle, San Joaquin kit fox, tipton kangaroo rat, California condor, bald eagle, osprey, peregrine falcon, Swainson's hawk, foothill yellow-legged frog, tricolor blackbird, white-faced ibis, blunt-nosed leopard lizard, and Kaweah brodiaea. Of these species, the Kaweah brodiaea, the spiny-sepaled coyote-thistle, and the valley elderberry longhorn beetle have been identified in the area. The Tulare lakebed is along the Pacific Flyway, a route for migrating shorebirds and waterfowl. Additional information can be found in Chapter 3 and Appendix C of the EIS/EIR.

Cultural Resources

Prehistoric occupation of the Kaweah River basin began 3,000 years ago. Several village sites are associated with the Yokuts Indians who historically inhabited the region. A cultural resources survey completed prior to completion of Terminus Dam in 1962 identified 30 archeological sites, consisting of villages, cemeteries, petroglyphs (rock art), hunting blinds, and food-processing stations (bedrock mortars and metate slicks).

A cultural resources survey for the expanded area of potential impact around Lake Kaweah was completed in 1990. No newly discovered archeological resources were found in the Lake Kaweah area. One previously recorded site along the Kaweah River could not be relocated and may have been destroyed, but three other known sites were relocated and evaluated. Seven sites reported by University of California, Los Angeles (UCLA) in the Lake Kaweah area were also evaluated. In 1984, an Intensive Cultural Resources Survey was conducted by the UCLA Archeology Department for Lake Kaweah. This survey produced evidence of the Limekiln quarry of 1888. Loading ramps, quarry pits, mine shafts, and railroad ties are evident. The extracted lime from the quarry was used for cement and other building materials for the construction of many San Joaquin Valley communities.

The Tulare lakebed was believed to have been highly populated area in prehistoric times. Three major village sites were identified along the 1880's era shoreline.

Recreation

Lake Kaweah has four major recreation facilities: Horse Creek, the Kaweah Recreation Area, Lemon Hill, and Slick Rock. These were constructed and are operated by the Corps. The camping facilities are limited to 80 developed campsites at Horse Creek for tents, recreational vehicles, and trailers. Other locations around the lake also provide fishing, swimming, and picnicking. A full-service marina at Lemon Hill provides gasoline, berths, docks, mooring, boat rentals, and a four-lane boat launching ramp. A number of portable restrooms are located around the lake, while flush restrooms and showers are present at Horse Creek and Kaweah Recreation Area. Lake Kaweah has a mean pool surface area of 1,065 acres and 1,913 surface acres at gross pool (694 feet).

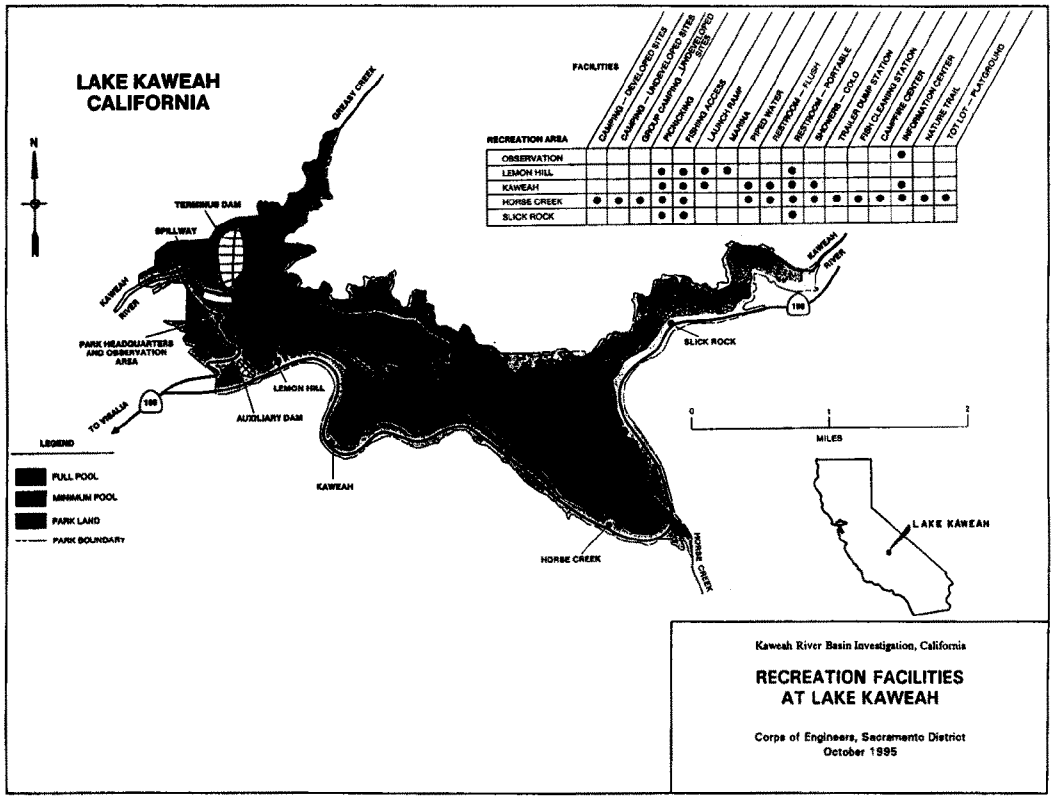
There are a total of 130 parking spaces for cars and 160 car-trailer combinations. Limited use of those areas is severely restricted because parking is limited at the Lemon Hill and Kaweah Recreation Area. Visitors parking along the sides of Highway 198 create rather hazardous situations with high-speed traffic close to recreational parking. This safety hazard was tempered by the addition of a new parking area at the Lemon Hill area. The new parking lot has 50 additional spaces for cars and 80 new car-trailer combination spaces. A map of the recreation facilities at Lake Kaweah is shown in figure 2-7.

Along the Kaweah River below Terminus Dam, some recreation improvements have been made. Cities within Tulare County, including Visalia, maintain parks and provide community centers for recreation purposes. These recreational sites often include swimming pools, playgrounds, and ball fields for either public or private use.

No recreational facilities or areas are known to exist within the Tulare lakebed.

Hazardous, Toxic, and Radioactive Wastes (HTRW)

An Environmental Site Assessment (ESA) was conducted by DWR in 1995 to identify HTRW sites associated with the Kaweah River basin project. The Lake Kaweah assessment area included Lake Kaweah and all land within 1 mile of the lake, while two downstream areas which are proposed as mitigation sites were also surveyed for HTRW sites. The assessment area did not encompass the entire study region as referenced in other sections of this document because adverse impacts to HTRW sites are not expected to occur downstream from Terminus Dam. During collection of data, existing photographs and records, were reviewed,



FACILITIES

RECREATION AREA	CAMPING – DEVELOPED SITES	CAMPING – UNDEVELOPED SITES	GROUP CAMPING – UNDEVELOPED SITES	PICNICKING	FISHING ACCESS	LAUNCH RAMP	MARINA	PIPED WATER	FLUSH TOILET	RESTROOM – FLUSH	RESTROOM – PORTABLE	SHOWERS – COLD	TRAILER DUMP STATION	FISH CLEANING STATION	CAMPFIRE CENTER	INFORMATION CENTER	NATURE TRAIL	TOT LOT – PLAYGROUND
OBSERVATION																●		
LEMON HILL				●	●	●	●			●								
KAWEAH				●	●	●		●	●	●	●					●		
HORSE CREEK	●	●	●	●	●			●	●	●	●	●	●	●	●	●	●	●
SLICK ROCK				●	●					●								

Kaweah River Basin Investigation, California

RECREATION FACILITIES AT LAKE KAWEAH

Corps of Engineers, Sacramento District
October 1995

FIGURE 2-7

sites were visited, and interviews were conducted with appropriate personnel from Federal, State, and local agencies. The ESA is attached as documentation.

EXISTING WATER RESOURCE PROJECTS

Terminus Dam and Lake Kaweah Basin

Terminus Dam and Reservoir (Lake Kaweah) are a multipurpose dam and reservoir completed by the Corps in 1962 to provide flood control and irrigation water supply storage. (See photo 2-1.) It is 20 miles upstream from Visalia and about 1 mile upstream from the confluence of Dry Creek and Kaweah River. Terminus Dam and Lake Kaweah were authorized by the Flood Control of 1944, Public Law 78-534, in accordance with the recommendations of the Chief of Engineers in Flood Control Committee Document No. 1, Seventy-eighth Congress, second session. The water rights to the conservation water stored by the dam are owned by the members of Kaweah and St. John Rivers Association.

Photo 2-1: Terminus Dam and Lake Kaweah

Terminus Dam was constructed with 150,000 acre-feet of storage capacity—142,000 acre-feet of joint-use flood control and irrigation water supply storage and 8,000 acre-feet of sediment storage. Since 1962, approximately 7,000 acre-feet of sediment has accumulated in the reservoir, leaving about 1,000 acre-feet of sediment storage. During the rain season, when water is available, the sediment pool has filled and has been used for recreation (i.e., boating and fishing) and to support fisheries. However, the sediment pool can be fully evacuated during the snowmelt season; therefore, there is no dedicated permanent minimum pool for recreation and fisheries.

In 1970, the flood control operation at Terminus Dam was revised to include conditional storage (i.e., precipitation parameter). The operation allows storage of an additional 7,000 acre-feet of conditional space for "carryover" water during the rain season on top of the sediment pool when antecedent rainfall conditions are favorable. During most years since 1970, favorable rainfall conditions and available water have allowed more than 2,200 acre-feet of storage during the rain season. These conditions have enhanced recreation and fisheries at Lake Kaweah and irrigation operations.

Terminus Dam consists of a rolled earthfill main dam structure and an auxiliary dam, outlet works consisting of a control tower, intake structure with trashracks and three gated rectangular conduits measuring 5 feet by 9 feet, and an ungated spillway. Lake Kaweah has a surface area of 1,913 acres at a gross pool elevation of 694 feet. The main dam is 250 feet high and 2,375 feet long. An auxiliary earthfill dam 130 feet high and 870 feet long lies to the south of the main dam. The crest is at elevation 750 feet and base at 520 feet.

The spillway is an ungated, broadcrested weir with a notch on the bottom channel which has a width of 307 feet and sill elevation at 694 feet. The notch is a concrete-lined channel 135 feet wide and 14.4 feet deep and is designed to pass a flow of 22,000 cfs. The notch spans 135 feet of the total 307 foot bottom width of the spillway channel. The notched section is set at the existing gross pool elevation of 694 feet. The remaining weir crest is set at 708.4 feet. The side slopes of the spillway channel are 1.0 vertical on 0.5 horizontal. The exit channel is 200 feet long with a supercritical invert slope of 0.01. (See plate 1.)

The outlet works consist of three 5- by 9-foot rectangular conduits with slide gates and a total release capacity of 8,500 cfs. The outlet works are located at the base of the dam (520 feet), which allows for the entire reservoir to be evacuated. In 1990, a 17-megawatt hydroelectric powerplant was retrofitted to Terminus Dam by the Kaweah River Power Authority. Power is generated only during irrigation and flood control releases and is sold to Southern California Edison Company.

Approximately 3,071 acres in project lands were acquired at Terminus Dam and Lake Kaweah. Of this total, 2,752 acres were acquired in fee, 310 acres in flowage easement, and 9 acres in other easements. There is an outgrant easement of 192 acres to the State of California for highway right-of-way.

The recreation facilities at Lake Kaweah were constructed by the Corps and transferred to Tulare County for operation and maintenance and additional developments in June 1962 under terms of a 25-year license. In April 1972, Tulare County relinquished all planning, development, and management of public

recreation areas at Lake Kaweah back to the Corps. Since that time, upgrading of existing recreation areas for public health and safety, and operation and maintenance of facilities at the reservoir have been by the Corps. For the public's benefit, an area of land and water at Lake Kaweah has been outleased for development and operation of the commercial marina concession on the lake (currently at the Lemon Hill Recreation Area).

Southern California Edison Company Hydroelectric Plants

Three small hydroelectric powerplants 10 miles upstream from Terminus Dam produce a total capacity of 6,700 megawatts and average annual output of 40 megawatts. These powerplants are owned and operated by the Southern California Edison Company. The regulatory storage capacity of the plants is small and does not affect the operation of Terminus Dam.

Central Valley Project - Friant-Kern Canal

The U.S. Bureau of Reclamation's Central Valley Project (CVP) is the largest water storage and delivery system in California; it consists of 18 Federal reservoirs and 4 reservoirs jointly owned by the State. Friant Dam and Reservoir (Millerton Lake), 60 miles north of Visalia, control flows from the San Joaquin River; the reservir has a storage capacity of 520,500 acre-feet. The Friant-Kern Canal is 152 miles long and supplies irrigation water from Friant Dam to service areas in the lower San Joaquin Valley to the south. The canal crosses, via siphons, the St. Johns and Kaweah Rivers about 3.5 miles downstream from Mckays Point. The Friant-Kern Canal has a maximum capacity of 5,000 cfs that gradually decreases to 2,000 cfs at its terminus at the Kern River near Bakersfield. Floodwater from the Kaweah River has been pumped into the canal to reduce downstream flooding in the Tulare lakebed on three occasions (1978, 1982, and 1983). However, consent is required from the USBR to use the canal for flood control. The canal is not a reliable flood control measure and cannot be used when it is full or when downstream demand is insufficient. Deliveries of service contract irrigation water from the Friant-Kern Canal are made to the Tulare Irrigation District and Ivanhoe Irrigation District.

State Water Project - California Aqueduct

The California Aqueduct is an integral part of the State Water Project. It consists of a 444-mile-long water conveyance system that transports irrigation and municipal water from the Banks Pumping Plant at the Sacramento-San Joaquin Delta to Lake Perris in Southern California. It includes 1 million acre-feet of the 2 million acre-foot San Luis Reservoir which stores excess water above immediate system needs during winter flows from the Sacramento-San Joaquin Delta.

Deliveries of State Water Project water from the California Aqueduct are provided to Tulare Lake Basin Water Storage District which has a contract for 118,500 acre-feet per year of entitlement water. It is delivered to the lakebed via two lateral canals—Lateral A near Kettleman City and Lateral B a few miles to the south.

Mckays Point Weir

Three miles downstream of Terminus Dam at Mckays Point, a flow split structure divides flows south into the lower Kaweah River and north into the St. Johns River channels. (See photo 2-2.)

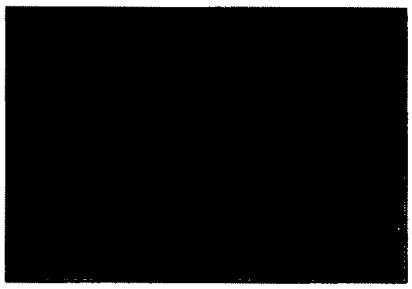


Photo 2-2 - Mckays Point Flow Split Weir

The flow split is accomplished by means of a fixed broad-crested weir consisting of two sections, each 113.6 feet long, equipped with flashboards, with the same crest elevations, and each crossing the head of each channel. The structure has a maximum operating capacity of approximately 5,500 cfs. For flows exceeding 5,500 cfs, flow splits are unpredictable, and channel capacities may be exceeded downstream on either the lower Kaweah River or St. Johns River. The flow split structure was refurbished in 1962 as part of the Terminus Dam project.

Channels

Below Mckays Point, the St. Johns River flows west 23 miles, passes north of the city of Visalia, and unites with Cottonwood Creek to form Cross Creek, which flows southwest 35 miles to the Tulare lakebed. The Kaweah River flows southwest below Mckays Point and divides into numerous distributaries. The Kaweah River divides into Mill Creek, Packwood Creek, Cameron Creek, and Deep Creek, and other distributaries. Some distributaries and canals come together to form Elk Bayou and flow southwesterly to connect with the Tule River 25 miles downstream. Mill Creek is a main distributary that passes under and through portions of Visalia in a closed conduit. Packwood, Cameron, and Deep Creeks flow south of Visalia. The distributaries also function as canals to deliver irrigation water to service areas downstream. Numerous irrigation ditches and canals

branch out from the distributaries and criss-cross the flood plain downstream from Mckays Point. The canals are very small, with capacities ranging from 9 cfs to 700 cfs. The Kaweah River distributaries are shown in figure 2-3.

Spreading Basins

Local water interests constructed spreading basins and percolation ponds to store floodwater from the Kaweah River and for ground-water recharge. The basins have a combined capacity of 18,845 acre-feet and individual capacities of 20 to 9,000 acre-feet. (See figure 2-8.) The basins are operated by non-Federal interests and are used as a part of the flood control operation of Terminus Dam. Flood releases and unregulated local flows exceeding irrigation uses are diverted to the spreading basins, with excess going to the Tulare lakebed. The average spreading demand is 42,600 acre-feet per month.

Levees

Most of the channels downstream from Terminus Dam in the alluvial flood plain do not have levees. Levees on the St. Johns River below Mckays Point are intermittent on banks beginning 8 miles downstream from Mckays Point to the confluence of Cross Creek, roughly 18 miles. Levees on the left bank of the St. Johns River protect urban areas in north Visalia and are generally better reinforced than levees on the right bank.

Tulare Lakebed

Agricultural lands in the Tulare lakebed receive flood protection from an extensive system of levees and leveed canals. During periods of flooding, these levees confine floodwaters, allowing the remaining lands to be farmed. Generally, farmland is systematically flooded when floodwater entering the lakebed exceeds the capacity of the water conveyance system (i.e., canals). During flood events, floodwater is moved to noncropped water storage facilities at the south end of the lakebed, called the "south flood area." If the conveyance system is unable to move all floodwater to the south flood area, then farmland in the lakebed or "main area" is flooded. Levees were first built in the late 1800's by local landowners. Reclamation districts formed under the California general reclamation district laws led to improvements and construction of additional levees. Since 1983, there have been few changes to the levees. The 103 miles of levees in the Tulare lakebed are up to 35 feet wide at the crowns, 19 feet high, and 110 feet wide at the base. Most of the water rights for the diversion of Kaweah River water for irrigation have been transferred to the Kaweah Delta Water Conservation District by Tulare lakebed interests.

Source: Kaweah Delta Water Conservation District Map, November 1969

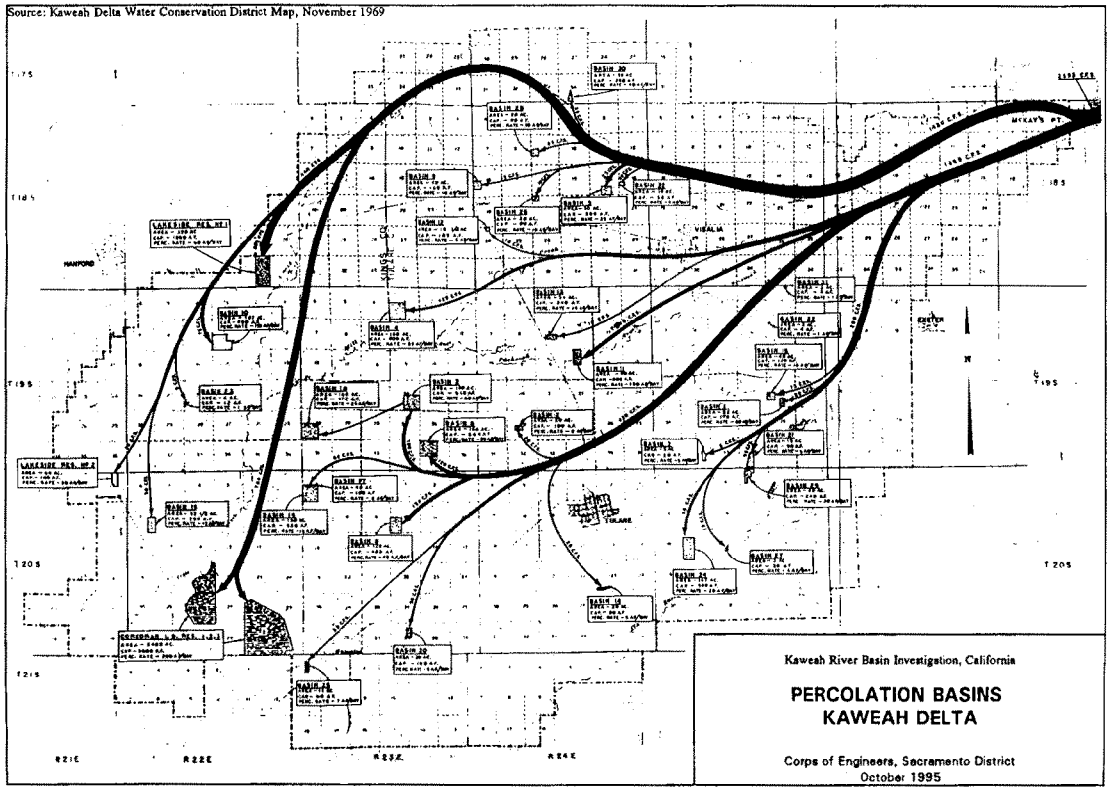


FIGURE 2-8

A 14-mile pipeline, 17 miles of canals (Main Drain Canal), and a series of pumps collect and convey subsurface drainage waters to 2,900 acres of evaporation basins, primarily at the south fringe of the Tulare lakebed. The Tulare Lake Drainage District is responsible for disposing of approximately 10,000 acre-feet of saline drainage water per year. The channel and levee system in the lakebed is shown in figure 2-4.

FUTURE CONDITION WITHOUT-PROJECT

Land Use

Future land uses in the foothill area around Lake Kaweah, Dry Creek and near Three Rivers are expected to change slightly, if at all.

Land use and population of the Tulare lakebed are also expected to remain essentially the same. The city of Corcoran experienced a 1.0 percent population increase from 1993 to 1994. According to the Tulare County Land Bureau and California Farm Extension Service, land ownership and division of parcels could change, but land use and crops are expected to remain the same. Salinity in the Tulare lakebed subsurface is expected to continue to be a manageable problem in regard to saline drainage disposal.

The California Farm Extension is concerned that some lands may go out of production due to ground-water overdrafting in the lower and upper San Joaquin Valley. Overdrafting is lowering the ground-water table and increasing the cost of pumping. It is unknown what impact this will have on future agriculture in the area and what future effect overdrafting would have on ground-water elevations at specific locations. It is assumed that the area under cultivation would remain basically the same as now over the next 100 years; however, economics and the availability of water could limit expansion of land under cultivation.

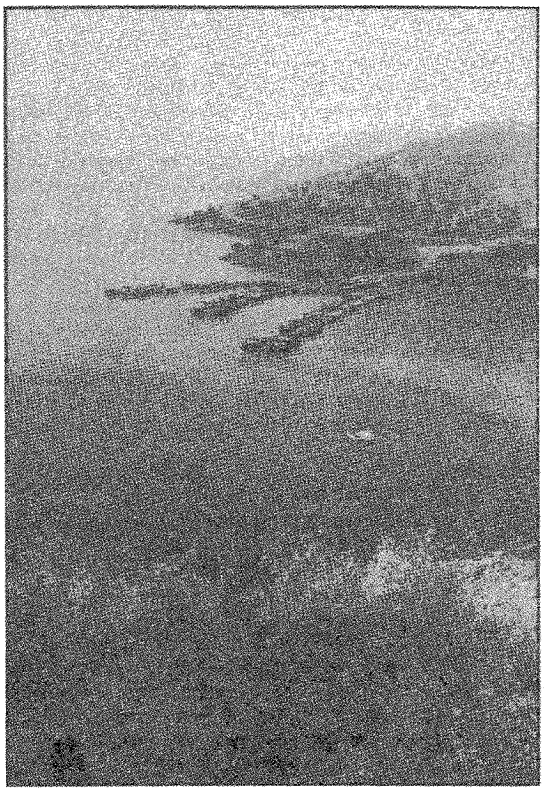
Terminus Dam and Lake Kaweah

On the basis of recorded sediment accumulation in 1977 and estimated sediment inflow since that time, it is estimated that the total storage capacity of Lake Kaweah will be reduced to about 140,700 acre-feet by the year 2000. Flood control and irrigation water supply storage space will continue to diminish as sediment accumulating in the reservoir decreases the level of flood protection that Terminus Dam provides and decreases the supply of irrigation water.

Recreation usage is also expected to decline as storage space is lost to sediment accumulation over time. The ability to effectively maintain—without

unreasonable reductions in flood control—the 7,000 acre-feet of conditional rain flood storage space will be lost to sediment accumulation in the near future. As the conditional rain flood storage space diminishes, there will be less capacity to store water for flood protection during fall and winter months for recreation and fisheries.

Chapter 3
Problems, Needs, and Opportunities



Mehrten Marina at Lake Kaweah. The declining sediment storage space and drought conditions have lowered lake levels during the winter season and end of the summer.

Chapter 3

PROBLEMS, NEEDS, AND OPPORTUNITIES

FLOODING

General

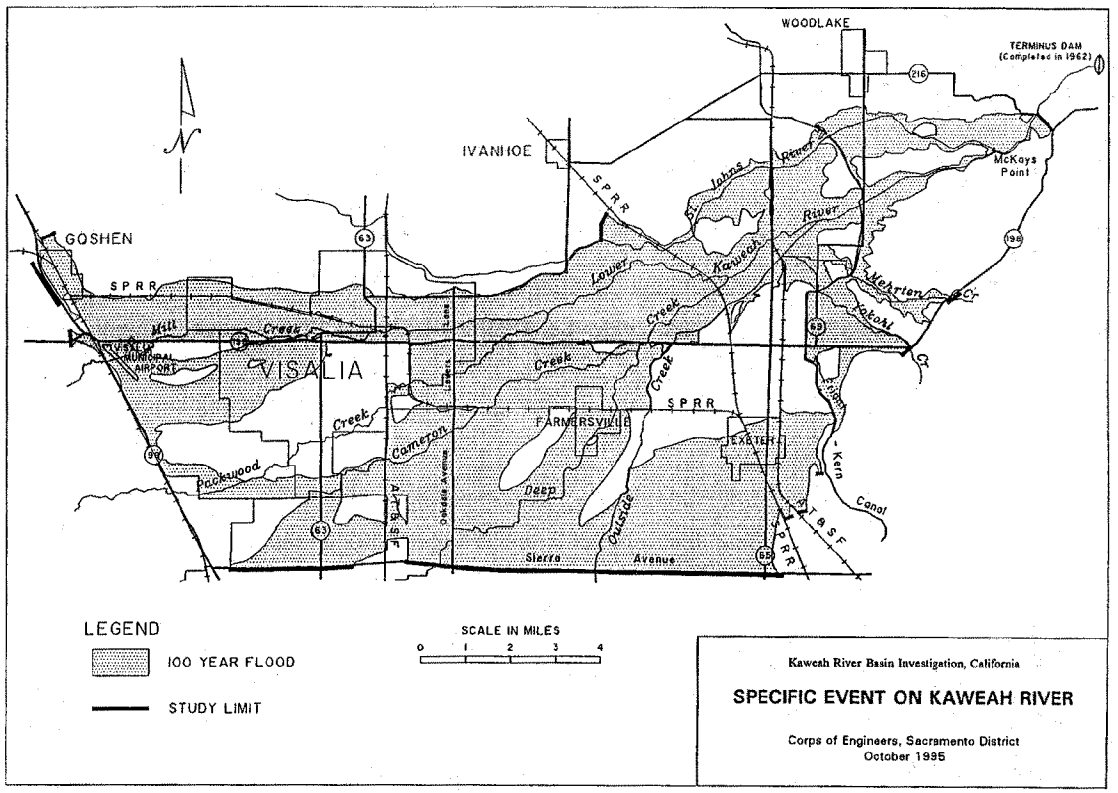
Major floods on Kaweah River and its distributaries can generally occur any time from November through July. Flooding can be from two types of floods rain and snowmelt. Snowmelt floods generally occur February through July and are characterized by long periods of runoff, large volume, and moderate peak flows that are confined within the channels. Rain floods occur during the period November through March and are characterized by high peak flows of a shorter duration (i.e., few days) that exceed the capacity of downstream channels. This type of flood results from high intensity rainfall over the river basins. Rain and snowmelt floods can generate inflow into the Tulare lakebed, which is a terminus for the Kaweah, Kings, Tule, and Kern Rivers.

Unregulated flows from Dry, Yokohl, and Mehrten Creeks, and other streams enter the Kaweah River downstream from Terminus Dam. There are no major levee systems in downstream channels, except an intermittent system of levees on the St. Johns River that protect Visalia on the north. Capacities of downstream channels are small and are used mainly for irrigation.

Flood Plains

The areas affected by the Kaweah River flooding are the downstream area below Terminus Dam and the Tulare lakebed. The downstream area flood plain is a large alluvial fan comprising 200,000 acres. Flooding on the Kaweah River alluvial fan is characterized by shallow sheet flow with depths up to 3-4 feet and high velocities at the apex, where the gradient is steepest.

Although the Kaweah River alluvial fan has been modified by human activity, such as farming, roads, development, and channelization, etc., overflows from the low-capacity channels and distributaries form sheet flow over urban and agricultural areas. The alluvial flood plain includes the communities of Visalia, Farmersville, Tulare, Ivanhoe, and Goshen. State Highways 99, 63, and 65; two railroads; and the Friant-Kern Canal traverse the flood plain and can influence the direction of flows and create ponding. State Highway 198 bisects the flood plain east to west and tends to divert flows west toward Visalia. The 100-year flood plain east of Highway 99 and north of Sierra Boulevard is shown in figure 3-1.



LEGEND

100 YEAR FLOOD

STUDY LIMIT

SCALE IN MILES

0 1 2 3 4

Kaweah River Basin Investigation, California

SPECIFIC EVENT ON KAWEAH RIVER

Corps of Engineers, Sacramento District
October 1995

FIGURE 3-1

Agricultural damages within the downstream area upstream from Tulare lakebed are sustained when the channel capacities of the St. Johns River or lower Kaweah River below the Mckays Point diversion structure are exceeded, which occurs within 5,500 cfs in the Kaweah River above Mckays Point. Farmlands in the Tulare lakebed are damaged when flows into the lakebed exceed approximately 1,500 cfs. However, costs can be incurred in pumping floodwater at flows less than 1,500 cfs.

Historic Flood Damages - Downstream Area

Flood records along the Kaweah River date to the mid-1800's and show that major floods prior to 1900 occurred in January 1862, December 1867, and February 1893. In the 1900's, major rainfloods prior to construction or Terminus Dam occurred in 1906, 1916, 1917, 1937, 1950, and 1955, and a major snowmelt flood occurred in 1958. Major storms since the construction of Terminus Dam were in 1966, 1969, 1978, and 1983. Flood damages to the Tulare lakebed have been caused by both rain floods and snowmelt floods.

The most damaging and largest recorded rain flood before the construction of Terminus Dam was in December 1955, when flows in the Kaweah River peaked at 87,300 cfs. The largest rain storm of record occurred in December 1966, shortly after Terminus Dam was built. This storm produced a record peak inflow into Terminus Dam.

1950. The storm of November 19, 1950, produced a peak flow of 53,000 cfs at Mckays Point and a volume of 69,000 acre-feet. It flooded approximately 48,000 acres. Up to 50 acres of urban land were flooded in Visalia, Woodlake, and Farmersville. Considerable damages were sustained to railroad tracks, bridges, and pasture. A rain storm on December 4, 1950, created a peak flow of 14,500 cfs at Mckays Point and caused a small amount of damage.

1955. The storm of December 1955 flooded 126,200 acres. Because Terminus Dam was not yet built, flooding was completely unregulated, and the peak flow at the Three Rivers gaging station (near Terminus Dam site) was 87,300 cfs. The estimated flood volume was 120,000 acre-feet. Most of the flooding occurred along the major distributaries such as the St. Johns River; Mill, Cameron, Packwood, and Cross Creeks; and Elk Bayou. Urban areas and roads were damaged, irrigation diversion structures were washed out, and farmland was inundated to depths of 1 to 4 feet for periods of 2 to 3 days.

1958. The rain floods of February through April 1958 and the snowmelt floods of May and June 1958 flooded 8,500 acres and damaged agricultural and urban areas.

1966. The storm of December 1966, which occurred shortly after Terminus Dam was built, flooded 8,090 acres downstream from Terminus Dam. Damages were to public facilities, urban areas, and agricultural lands. Public facilities accounted for 33 percent of the damages. Peak flow into Terminus Dam from the Kaweah River reached 105,000 cfs and 14,500 cfs from Dry, Mehrten, and Yokohl Creeks. Terminus Dam controlled Kaweah River flows to 5,670 cfs.

1969. Two large storms during January and February 1969 produced peak inflows of 35,600 cfs and 20,700 cfs, respectively, into Lake Kaweah. The inflow was completely controlled by the dam until flows from downstream tributaries subsided. Peak flow from Lake Kaweah was 4,342 cfs. The peak flow from Dry Creek was about 6,020 cfs, and the peak flow at Mckays Point was 6,750 cfs. Without the dam, the runoff would have reached 40,000 cfs at Mckays Point. The two storms damaged many roads, parks, and recreation facilities above Terminus Dam. Below Terminus Dam on the Kaweah River delta, 15,570 acres were flooded.

1978. The storm of February 1978 was a fairly large storm, although it only produced a flow of 955 cfs below Terminus Dam; 8,530 acres were flooded downstream from Terminus Dam.

Flood damages from rain events to areas below Terminus Dam, but excluding the Tulare lakebed, are presented in table 3-1.

Historic Flood Damages - Tulare Lakebed

Flooding in the Tulare lakebed can result from inflow from rain flood events, snowmelt events, and a combination of rain and snowmelt events. Although the lakebed is fed by four major streams, the Kaweah River contributes a large percentage of the total flow to the lakebed because of the large capacity of reservoirs and other facilities on other streams. Pine Flat Dam and Reservoir on the Kings River has a capacity of 1 million acre-feet, and downstream flows can be directed either north into the San Joaquin River (and other channel bypasses) or south into the Tulare lakebed. The Kings River project directed the minimization of flooding in the Tulare lakebed by directing flows into the San Joaquin River. The Kern River, although a large system, typically contributes a very small percentage of flooding because of the Kern River Intertie, which transfers floodwater to the California Aqueduct. The history of flooding in the Tulare lakebed caused by rain and snowmelt flooding is discussed below.

Table 3-1
Rain Floods Below Terminus Dam [1]

Flood Date	Flow Below Mckays Point (cfs)	Flood Frequency (%)	Flood Frequency (Yr)	Flood Damages Flood Year ($)	Flood[2] Damages 1994 ($)	Damages Prevented Flood Year ($)	Damages Prevented 1994 ($)	Area Flooded (Acres)
Nov 50	53,000	0.8	125	$1,099,000	$6,817,448	[3]	[3]	47,600
Dec 55	87,300[4]	0.43	232	$11,845,000	$66,075,653	[3]	[3]	126,200
April 58	5,900[4]	-	-	$65,000	$340,965	[3]	[3]	8,500
Dec 66	5,670	2.5	40	$1,013,000	$4,674,182	$22,500,000	$103,819,444	5,090
Jan 69	6,750	8.2	12	$3,205,000	$13,055,790	$7,500,000	$30,551,771	15,570
Feb 78	955	30	3	$1,858,000	$4,139,957	$8,535,000	$19,016,132	8,530

[1] Does not include damages to Tulare lakebed.
[2] From Consumer Price Index Conversion.
[3] Not applicable. Terminus Dam not constructed.
[4] Flows measured at Three Rivers, CA. Flows and flood frequencies represent both pre- and post-Terminus Dam conditions.

1950. The rain storms of November and December 1950 caused an inflow of 78,000 acre-feet into the Tulare lakebed from the Kaweah, Kings, and Tule Rivers. About 10,600 acres were flooded in the lakebed. The Kaweah River contributed about 14,400 acre-feet of this flow. Flood damages were sustained to barley crops, ditches, wells, pumps, machinery, roads, and levees.

1955. The rain storms of December and January caused an inflow of about 55,000 acre-feet into the Tulare lakebed from the Kaweah and Tule Rivers. An additional 10,000 acre-feet of floodwater reached the lakebed in February. About 7,600 acres were flooded in the lakebed. Damages were sustained to barley crops, irrigation equipment, and levees.

1958. The rain floods of February, March, and April, and snowmelt floods of May and June caused an inflow of 175,000 acre-feet into the lakebed, of which 72,800 acre-feet was from the Kaweah River. About 24,000 acres were flooded in the lakebed. Damages were sustained to crops, roads, levees, irrigation systems, stream channels, and utilities.

1966. The rain flood of December 1966 caused an inflow of 32,000 acre-feet into the Tulare lakebed from the Kings, Kaweah, Tule, and Kern Rivers. Damages were sustained to barley crops, machinery, and levees.

1969. The rain storms of January and February caused an inflow of 296,000 acre-feet into the lakebed. The snowmelt floods from April through June produced peak storage of approximately 1 million acre-feet in the lakebed. Approximately 88,000 acres were flooded, and some lands were flooded for

3 years. Damages were sustained to crops (loss of prepared seedbeds and loss of crop production during the inundated period) and levees. Damages were also incurred in the cost of dewatering and flood fighting.

1978. The rain flood of February 1978 caused an inflow of 32,000 acre-feet into the lakebed. Additional flow entered the Tulare lakebed through June 1978. Damages were sustained to crops and levees.

1983. The rain storm and snowmelt floods from January through July caused an inflow of 935,000 acre-feet into the lakebed. About 101,600 acres were flooded in the lakebed, and some lands were flooded for 2 years. Damages were sustained to crops, loss of crop production, levees, and roads. Flood damages were minimized by conveying floodwaters to the south flood area and by pumping floodwaters into the Friant-Kern Canal and the South Fork of the Kings River for disposal through the San Joaquin River.

The Tulare lakebed flood damages are presented in table 3-2.

Future Flooding

The potential exists for greater flooding than has occurred in the past. To date, there have been over 13 major rain floods beginning with the first account of flooding back in 1861. Hydrologic studies indicate that future floods in the area could be significantly more severe than any flood in the past. Based on flood records going back 126 years, four of the most severe rain floods on record have occurred in the past 41 years.

Based on the level of flood protection currently provided by Terminus Dam, the downstream area, including the city of Visalia and Tulare lakebed, is still at risk. The general economy and welfare of the people working and living in the downstream area and Tulare lakebed would be adversely affected by any flooding.

Appropriate measures need to be taken to reduce the potential flood threat. Increased flood protection for Visalia, the agricultural land along the Kaweah River, St. Johns River, Cross Creek, and the Tulare lakebed region would be an appropriate solution to the problem.

Table 3-2
Tulare Lakebed Flood Damages [1]

Water Year	Period of Inflow	Maximum Storage (acre-feet)	Area Flooded (acres)	Dewatering Completed	Estimated Flood Damages (Flood Year)
1950	Nov-Dec	68,000	10,600	NA [2]	$810,000
1955	Dec-Feb	65,000	7,600	NA	$573,000
1958	Feb-Jun	175,000	24,000	NA	$2,281,000
1967	Dec	32,000	NA	NA	$8,160,000
1969	Jan-Jun	1,000,000	88,000.00	Sep 71	$11,000,000
1978	Feb-Jun	80,000	32,000 [3]	Jul 78	$9,547,000
1980	Feb-Jun	140,000	43,500 [3]	Jun 80	NA [2]
1982	Apr-May	52,000	22,500 [3]	May 82	NA [2]
1983	Jan-Jul	935,000	101,600 [3]	Jan 85	NA [2]
1986	Mar	90,000	27,500 [3]	May 86	NA [2]

[1] Rain and snowmelt flood damages.
[2] Data not available.
[3] Includes South flood area.

LAKE KAWEAH SEDIMENT STORAGE

The sedimentation rate in Lake Kaweah has exceeded that originally predicted prior to construction of Terminus Dam (1962). In 1977, a hydrographic survey of the reservoir indicated that about 7,000 acre-feet of sediment had deposited in the reservoir. The bulk of this sediment inflow is believed to have occurred during the 1966 flood event. Accordingly, at that time, only 1,000 acre-feet of the original 8,000 acre-feet sediment storage remained.

On the basis of soil conditions and expected storm runoff relationships in the watershed, it is estimated that the average annual equivalent sediment inflow to the reservoir is about 120 acre-feet. However, based on recorded runoff from storms since 1977, it is believed that the recent annual equivalent rate has averaged only about 100 acre-feet. On the basis of this rate, it is believed that by the year 2000 (basis for predicted project operations), only about 140,700 acre-feet of available storage space will be present in the reservoir. At that time, the

total accumulated sediment storage will be 9,300 acre-feet, which will exceed the allowable sediment storage by about 1,300 acre-feet. Over the remaining 100-year period of analysis, it is estimated that the total storage space will diminish by an additional 12,000 acre-feet, leaving only about 129,000 acre-feet of total storage space in the reservoir.

By the year 2000, and most certainly by the end of the 100-year period of analysis, because of the reduction in total storage space due to sediment inflow, the level of flood protection provided by Terminus Dam to downstream areas will diminish. Available irrigation water supplies will diminish. In addition, space for seasonal recreation use and fisheries resources will be severely impacted. Additional storage space in Lake Kaweah is needed to compensate the loss of space due to sediment accumulation.

WATER SUPPLY

The KDWCD and other members of the Kaweah and St. John Rivers Association need additional sources of water supply. An ever-changing cycle of wet and dry years causes the area to be susceptible to low-moisture seasons. The area experienced consecutive years of drought from the late 1980s to the early 1990s. During "dry" years, they depend heavily on ground-water pumping for most of their irrigation needs.

Additional surface water storage would increase the ability of irrigation water users to make beneficial use of the existing surface water in the study area. Increased storage capacity would 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. Without increased storage capacity, these waters would end up flowing into the Tulare lakebed and could cause flood damages. Provisions for additional upstream irrigation water storage would allow water to be beneficially used during the irrigation season so surface water use could be increased in lieu of pumping ground water for irrigation.

RECREATION

Recreation opportunities are available at Lake Kaweah, Pine Flat Lake, and Success Lake; Sequoia and Kings Canyon National Parks; Sierra and Sequoia National Forests; Kaweah, Tule, and Kings Rivers; and Mountain Home State Forest. All these areas provide a variety of choices to residents and visitors in the area. Boating opportunities abound at the three lakes described above and are all within a reasonable driving distance from each other. Most of the lakes, however,

are experiencing heavy visitation. There is a need for additional recreational facilities in the area. Although 50 new parking spaces for cars and 80 new car-trailer combination spaces have been added at Lemon Hill Recreation Area, additional parking areas are needed at Lake Kaweah. Parking along Highway 198, which is discouraged due to safety considerations, is common during peak use.

As mentioned, due to the continued accumulation of sediment in Lake Kaweah, there will be less water stored during the winter for water-based recreation activities, such as fishing and boating.

This study did not include recreational enhancement, since a non-Federal sponsor (public entity) willing to cost-share in recreation studies could not be initially identified. Should a non-Federal sponsor step forward in the future, the potential for adding recreation can be evaluated.

HYDROPOWER

The California Energy Commission (CEC) has adopted forecasts for sales and peak load electrical energy requirements for the study area. These forecasts are summarized in table 3-3. The CEC forecast is higher throughout the forecast period than predictions made in 1988, due largely to revised economic and demographic assumptions, new energy price projections, increased commercial floor space projections, and a revised calibration procedure. Many existing electrical plants use nonrenewable fossil fuels which are escalating in price and are in decreasing supply. Hence, any additional energy produced from hydropower would be beneficial as a nonpolluting energy source. However, with the drastic drop in electrical energy costs, the financial viability of hydroelectric power generation is decreasing.

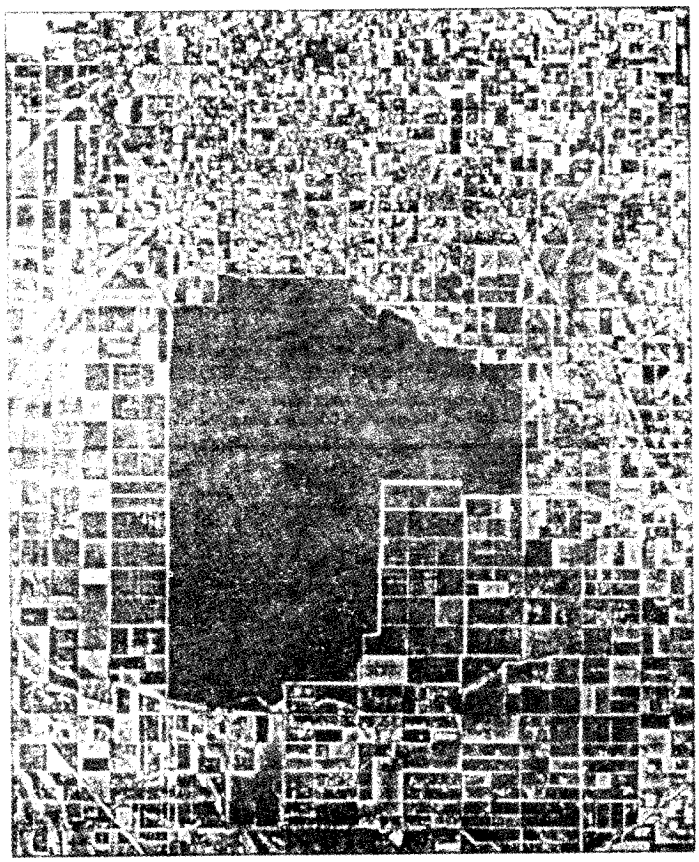
Table 3-3
Energy Projections
Southern California Edison Planning Area Results

	Energy (GWh)			Peak (MW)		
Year	1988 ER	Staff ER 7	CFM 8	1988 ER	Staff ER 7	CFM 8
1985	68337	68295	68368	14812	14837	14801
1987	71230	71476	73520	15001	14837	15062
1994	84470	81294	85388	18396	17569	18998
1999	93598	90657	95244	20528	19850	21429
2001	96732	93656	98788	21554	21131	22323
2007	108680	103071	110048	24339	23533	25205
2009	N/A	N/A	114125	N/A	N/A	26250

1988 ER = Adopted forecast from 1988 Electricity Report (ER 7)
STAFF ER 7 = CEC staff projections from 1988 Electricity Report (ER 7)
CFM 8 = Common Forecasting Methodology 8, used in this report

Data is from the California Energy Demand: 1989-2009, prepared for consideration in the 1990 Electricity Report Proceedings, Volume V: The Southern California Edison Planning Area Forms. June 1989 California Energy Commission.

Chapter 4
Technical Studies



Tulare lakebed flooding in July 1983. An inflow volume of 880,000 acre-feet from January through July 1983 flooded over 81,600 acres and some flooding lasted 2 years.

Chapter 4

TECHNICAL STUDIES

HYDROLOGY

The Kaweah River flows into Lake Kaweah, which is operated primarily for flood control and irrigation water supply. Three major tributaries to the Kaweah River below Terminus Dam are Dry, Mehrten, and Yokohl Creeks. Dry Creek, having considerable flood potential but no storage facilities, enters the Kaweah River above Mckays Point. Mckays Point is a control point for objective flow releases from Terminus Dam, and is also where the riverflows are divided between the St. Johns and Kaweah Rivers. Mehrten and Yokohl Creeks join the Kaweah River below this point.

The main river channel of the Kaweah River forms numerous distributary channels east of Visalia. These distributaries transport water for irrigation and spreading for ground-water recharge, and much of the water seeps into the sandy riverbeds. However, excess flow from these channels, as well as the Kings, Tule, and Kern Rivers and other sources, enters Tulare lakebed and floods valuable agricultural property.

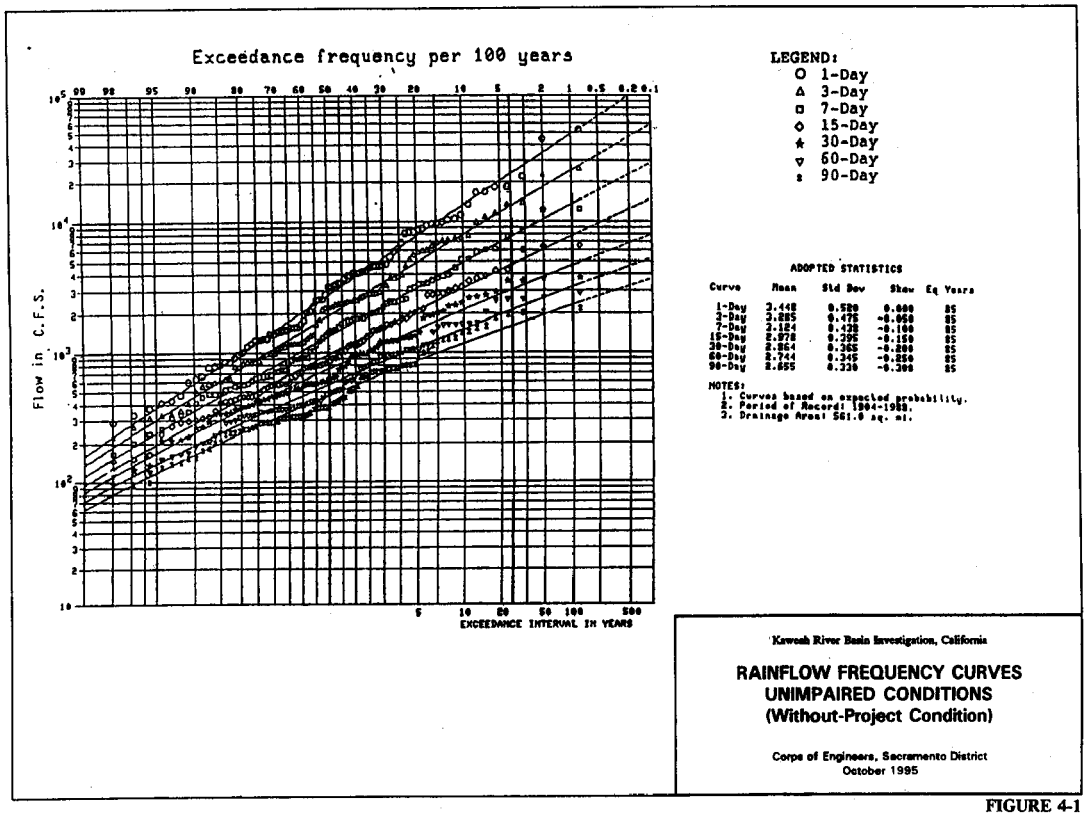
Lake Kaweah has not spilled during a rain flood since its completion in 1962. It filled in December of 1966 and nearly filled in 1969. It is expected to spill at about a 46-year flood event.

Channel Capacities

The objective flow on the Kaweah River at Mckays Point is not to exceed 5,500 cfs, above which control is lost at Mckays Point and flood damage occurs downstream. The flow is divided between the St. Johns and Kaweah Rivers at Mckays Point. The St. Johns River carries flows northwest, and the Kaweah River flows southwest from Mckays Point. The channel capacities within the system vary widely and in many cases are unknown. The Kaweah River and its distributaries terminate in Tulare lakebed and in percolation basins upstream from the lakebed.

Unimpaired Rain Flow Frequency Curves - Kaweah River

Flows from three gage locations were combined and adjusted to produce a continuous inflow record to the reservoir of 85 years, extending from 1904 through 1988. These data were used to develop unimpaired rain flow frequency curves shown in figure 4-1.



Kaweah River Basin Investigation, California

RAINFLOW FREQUENCY CURVES
UNIMPAIRED CONDITIONS
(Without-Project Condition)

Corps of Engineers, Sacramento District
October 1995

FIGURE 4-1

Unimpaired Snowmelt Flow Frequency Curves

No adjustment was made to the gage flows because it was assumed that all snowmelt flow originated above the gaging stations. The same period of record, 1904 through 1988, was used. Data for the unregulated snowmelt flow conditions are plotted in figure 4-2.

Unit Hydrograph, Loss Rates, and Base Flow

A 1971 hydrologic study of Dry Creek, the December 1966 and January 1969 floods were used as a basis for developing the 1-hour unit hydrograph for the Kaweah River.

An initial loss of zero and a constant loss rate of 0.38 inch per hour were used for the December 1966 flood on the Kaweah River. The initial base flow was assumed to be 400 cfs, and the recession flow was started at 10,000 cfs. For the January 1969 flood, the initial loss of 1.0 inch was used along with a constant loss rate of 0.285 inches per hour. The initial base flow was assumed to be 4,000 cfs, and the recession was started at 10,000 cfs.

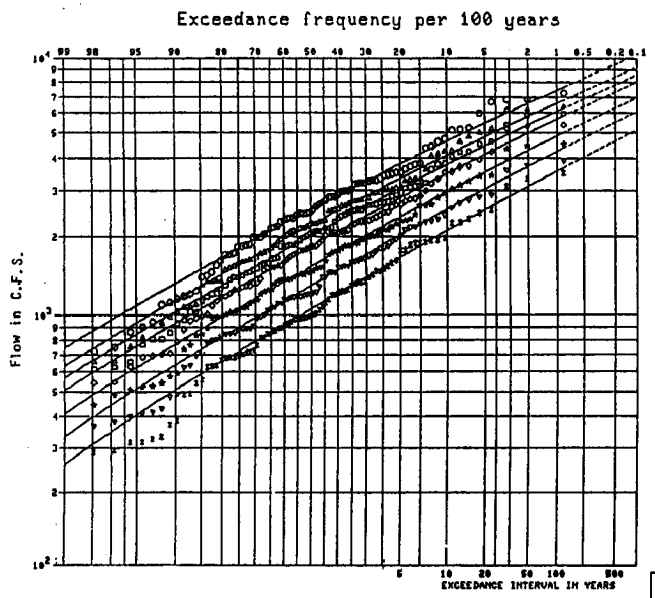
Standard Project Flood

The Standard Project Flood (SPF) is developed independently of the frequency analysis and is used to judge the reasonableness of the frequency curves. It is also used to pattern hypothetical floods. For the Kaweah River, the SPF volume is 245,500 acre-feet, and the peak flow is approximately 117,700 cfs. For a specific event over Dry Creek, the SPF peak flow is 23,000 cfs, and the volume is 33,000 acre-feet.

Regulated Peak Flow and Volume Flow Frequency Curves

Peak rain flows from the Kaweah River, Dry Creek, and Mehrten and Yokohl Creeks were used to evaluate the flood plain downstream from Terminus Dam along the Kaweah River distributaries. Snowmelt flows are lower than rain floodflows and are usually confined within the channels. The regulated rain flow-frequency curve for existing conditions is shown in figure 4-3.

Annual flow volume-frequency curves from the Kaweah River were used to evaluate the flood plain in the Tulare lakebed. A volume-frequency curve for flow to Tulare lakebed was developed by simulating Lake Kaweah daily operation over the 85-year period of available flow information. The frequency curve of annual volumetric flow from the Kaweah River to the Tulare lakebed is shown in figure 4-4.



LEGEND:
- ○ 1-Day
- △ 15-Day
- □ 30-Day
- ◇ 60-Day
- ★ 90-Day
- ▽ 120-Day

ADOPTED STATISTICS

Curve	Mean	Std Dev	Skew	Eq Years
1-Day	3.400	0.209	-.170	85
7-Day	3.340	0.213	-.180	85
15-Day	3.300	0.216	-.180	85
30-Day	3.260	0.220	-.180	85
60-Day	3.180	0.225	-.190	85
90-Day	3.110	0.231	-.190	85
120-Day	3.020	0.238	-.200	85

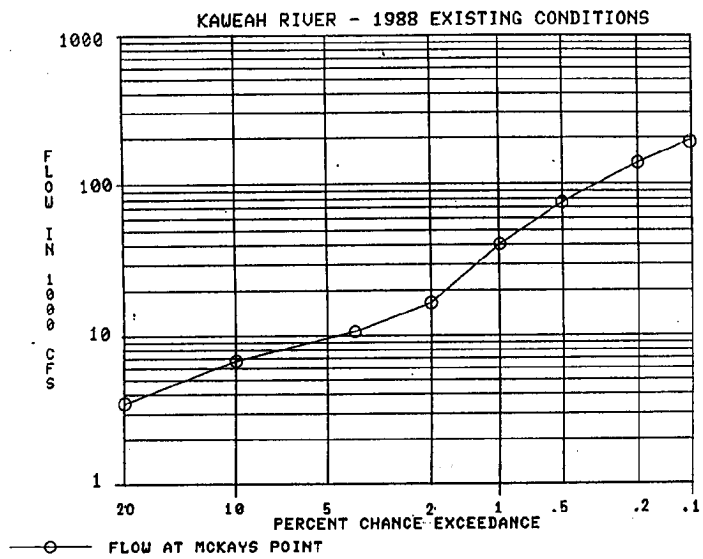
NOTES:
1. Curves based on expected probability.
2. Period of Record: 1904-1988.
3. Drainage Area: 561.0 sq. mi.

Kaweah River Basin Investigation, California

SNOWMELT FLOW FREQUENCY CURVES
UNIMPAIRED CONDITIONS
(Without-Project Condition)

Corps of Engineers, Sacramento District
October 1995

FIGURE 4-2

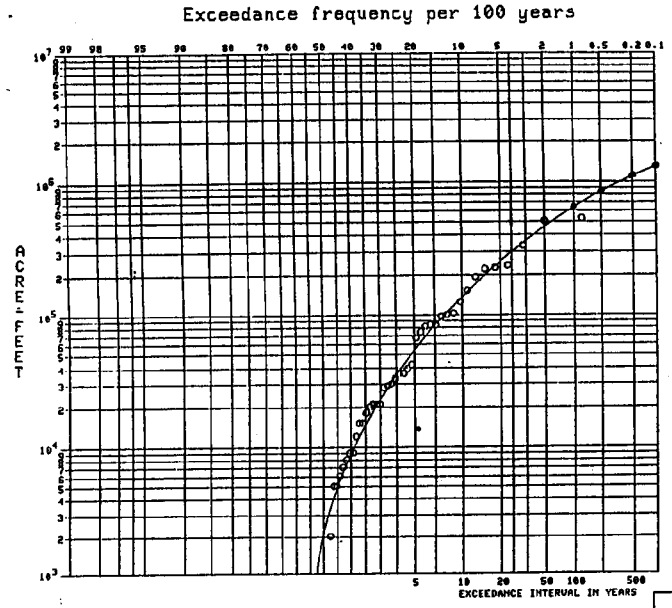


Kaweah River Basin Investigation, California

REGULATED PEAK RAINFLOW-FREQUENCY CURVE (Without-Project Condition)

Corps of Engineers, Sacramento District
October 1995

FIGURE 4-3



Kaweah River Basin Investigation, California

REGULATED VOLUMETRIC FLOW--FREQUENCY CURVE TULARE LAKEBED (Without-Project Condition)

Corps of Engineers, Sacramento District
October 1995

FIGURE 4-4

Flow to Tulare Lakebed from the Kings, Kaweah, Tule, Kern, and Local Streams

The annual floodflows to the Tulare lakebed from all sources—the Kings, Kaweah, Tule, and Kern Rivers and local— streams were used to determine the extent of flooding in the Tulare lakebed. To determine the annual floodflows to the Tulare lakebed, the floodwater from the Kaweah River was correlated with floodwater from other sources. The volume of floodwater from other river sources was combined with floodwater from the Kaweah River to determine the total volume of floodwater flowing to the Tulare lakebed from all sources. The curve correlating annual floodwater from the Kaweah River and other sources is shown in figure 4-5.

Variation of Reservoir Storage

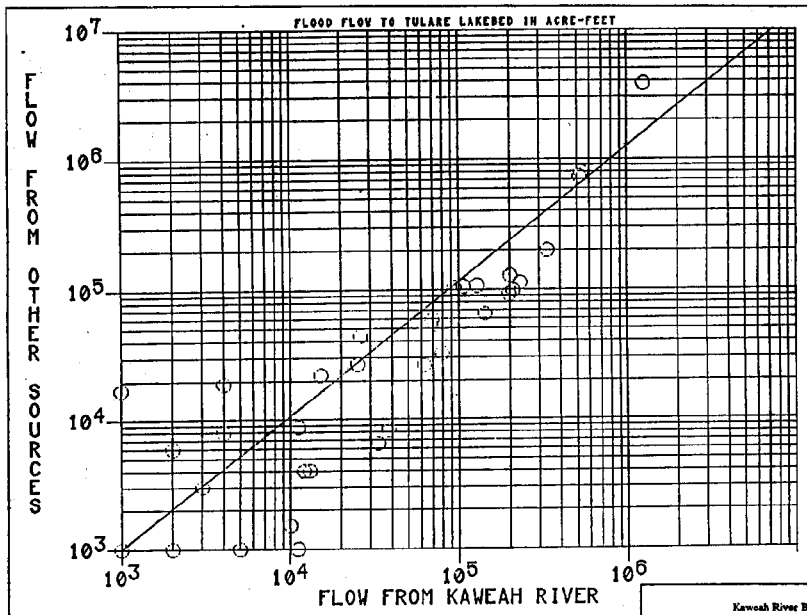
The likelihood of particular reservoir storages resulting from the simulated operations using the 85 years of data was analyzed and presented as a family of curves. This is shown in figure 4-6.

Sedimentation

As mentioned, when Terminus Dam was constructed, 8,000 acre-feet out of the total of 150,000 acre-feet was reserved for sediment accumulation. A 1977 hydrographic survey of Lake Kaweah indicated a capacity had decreased to about 143,000 acre-feet, or about 7,000 acre-feet of sediment accumulation. The large flood event in December 1966, estimated to be greater than a 100-year event, is believed to have transported much of the sediment into Lake Kaweah. Based on expected inflows to date, it is estimated that by the year 2000, the total storage is expected to be decreased to about 140,700 acre-feet. Over the sedimentation rate, considering the historical data, resulted in a reservoir life of the project, it is estimated that the sedimentation rate will be about 120 acre-feet per year. At this rate, the estimated sediment accumulation is 6,000 acre-feet over 50 years and 12,000 acre-feet over 100 years.

Reservoir Routings

For both with- and without-project conditions for rain and snowmelt flood events, flood routings through Terminus Dam were based on the mean average flood control storage space at Terminus Dam over a project life of 100 years. For both with- and without-project conditions, the sedimentation rate of 120 acre-feet per year was used. For without-project conditions, hypothetical floods were routed through the project simulating reservoir operation in conformance with the reservoir operation rules for Terminus Dam. The project was operated as



Kaweah River Basin Investigation, California

CORRELATED VOLUMETRIC FLOW FROM KAWEAH RIVER-FLOW FROM OTHER SOURCES TO TULARE LAKEBED (Without-Project Condition)

Corps of Engineers, Sacramento District
October 1995

FIGURE 4-5

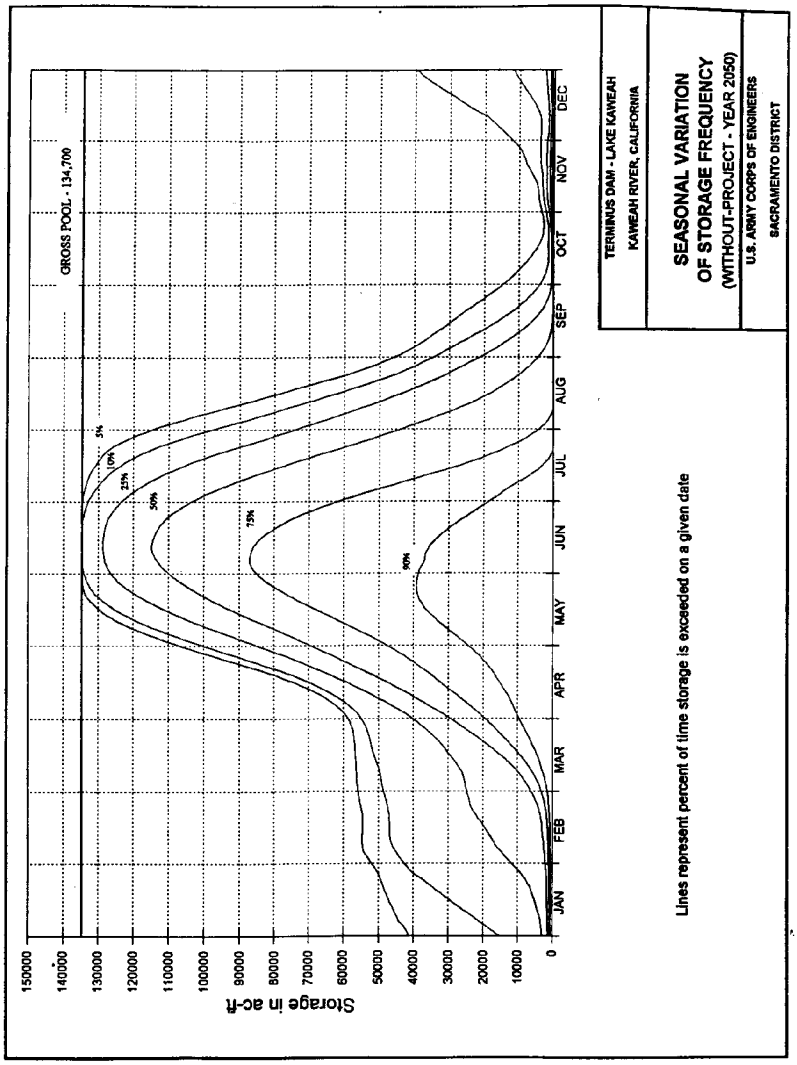

GROSS POOL - 134,700
5%
10%
25%
50%
75%
90%
Storage in ac-ft
150000
140000
130000
120000
110000
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
Lines represent percent of time storage is exceeded on a given date
TERMINUS DAM - LAKE KAWEAH
KAWEAH RIVER, CALIFORNIA
SEASONAL VARIATION
OF STORAGE FREQUENCY
(WITHOUT-PROJECT - YEAR 2050)
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

FIGURE 4-6

prescribed in the flood control diagram. Releases were not allowed to exceed 80 percent of downstream channel capacity to account for operational contingencies. In the base year or year 2000, the available flood control storage remaining in Lake Kaweah was estimated at 140,700 acre-feet. With sediment accumulating in the reservoir at an average rate of 120 acre-feet per year, in the year 2050 the available flood control storage would be 134,700 acre-feet, and in the year 2100 the available flood control storage space would be 128,700 acre-feet. The mean average reservoir storage over the project life, which is the storage space available in the year 2050, was estimated at 134,700 acre-feet and was used in the flood simulation.

Concurrent flows from Dry, Mehrten, and Yokohl Creeks were included in the routings below Terminus Dam. Maximum, mean, and minimum gross pool elevations were evaluated at Lake Kaweah to determine without-project conditions for recreation use and for fisheries, and to determine the frequency and magnitude of pool fluctuations.

Reservoir Operation

For without-project conditions in the year 2050, during the rain flood season between September and April, 65,000 acre-feet of storage capacity is designated "schedule 1" space, and 69,700 acre-feet is designated "schedule 2" space. During the rain flood season, when storage is within the schedule 1 space, objective releases are maintained at average irrigation and spreading demand. When storage is within the schedule 2 space, objective releases are maintained at maximum channel capacity or 5,500 cfs.

During the irrigation water storage season between March and August, reservoir releases are made to maximize beneficial use of the released water and during the snowmelt period between March and July storage is conditional on predicted snowmelt runoff.

Wave Runup

The longest fetch at Lake Kaweah is from the east-southeast, 2.46 miles. Overwater wind speeds of 50 miles per hour for 1 minute and 35 miles per hour for 60 minutes were adopted. The wave runup was calculated at 2.78 feet, with wind setup of 0.03 foot, for a total of 2.81 feet.

GEOTECHNICAL EXPLORATIONS

From July 1988 to April 1989, geotechnical explorations were conducted at Terminus Dam and potential Dry Creek Dam areas. Subsurface explorations were performed to ascertain the quality of the subsurface rock at the project sites. Two test holes were drilled adjacent to the existing spillway to obtain information for widening of the spillway. Sampling included two metamorphic rock type—a quartz-mica schist and a quartzite, and two meta-sedimentary rock types—meta-sandstone and a meta-siltstone. The meta-sediments make up less than 1 percent of the total recovered core. Information on explorations for the Dry Creek reservoir site are on file with the Corps.

SEISMIC STABILITY

The static stability of the embankment based on the raised gross pool was investigated as part of a post-earthquake slope stability evaluation of Terminus Dam performed in August 1995. A limit equilibrium slope stability analysis was performed using both pre-earthquake and post-earthquake material properties. The following conclusions were drawn based on the results of the analysis:

- Raising the pool level 21 feet from the gross pool elevation of 694 feet would not significantly affect the limit equilibrium slope stability of Terminus Dam.

- Current field test data without further testing do not sufficiently demonstrate whether liquefaction could occur in the alluvium foundation at Terminus Dam. If it is assumed that the alluvium foundation does not liquefy, then the integrity of the dam embankment for the raised 21 feet pool condition does not threaten the potential sliding surfaces determined in the dam stability analysis. However, if the assumption is made that the alluvium foundation liquefies in an earthquake, then the potential sliding exists for both raised pool and existing project conditions which could result in massive damage to the embankment and catastrophic loss of the reservoir.

Recent foundation testing, funded by the Dam Safety Assurance Program (DSAP), has been conducted to determine whether the alluvium foundation is susceptible to liquefaction. To date, the analysis from this testing has been inconclusive regarding the safety of the existing dam, its potential foundation problems, and the sliding threat. Further foundation testing will be required before a final determination can be made regarding the safety of the existing dam. New foundation testing has been tentatively scheduled in 1996.

In conclusion, the dam stability condition is the same for both the existing and raised gross pool elevations. Accordingly, dam safety is not affected by the raised pool condition. Should it later be determined that remediation is required, remediation of the dam will be funded under the DSAP program, separate from the proposed raised gross pool project.

FLOOD PLAIN DELINEATION

Alluvial Fan

The flood plains were delineated using historic floods as a guideline. Three flood plain studies were compared, the Corps of Engineers' Flood Plain Information (FPI) Report, the Federal Emergency Management Agency's (FEMA) Flood Insurance Study (FIS), and the State Department of Water Resources' (DWR) Designated Floodway Study of the St. Johns River. The floods of 1955 (pre-Terminus Dam) and 1969 (post-Terminus Dam) were also analyzed. The 1955 flood had a peak flow of 87,000 cfs at Mckays Point, and the 1969 flood had a peak flow of 35,600 cfs at Three Rivers and 6,750 at Mckays Point.

The flow patterns were estimated from maps of historic flooding. The flow distributions for a 100-year event are shown in figure 4-7. To account for storage behind major obstructions below Mckays Point, a Modified Puls routings of specific 100-year flood hydrograph was performed. The flood routings included concurrent flows from Dry, Mehrten, and Yokohl Creeks. The peak flows were compared to flow from previous flood plain studies. The flood plain analysis used available topographic data and channel ratings from the Visalia Flood Plain Information Report. The areas flooded by the Kaweah River are consistent with the 1955 flood after considering the impact of State Highway 198 and other land changes. The flow patterns were estimated from maps of historic flooding. It should be noted that numerous changes have occurred since the 1955 flood; levee systems, roadways, and canals have changed flow patterns. Estimates of depths and velocities of flooding along the Kaweah River system downstream from Highway 99 were based on the assumption that all flows exceeding channel capacity occur as overbank sheet flow. The amount of overbank flow was estimated by subtracting channel capacity from the total flow.

Tulare Lakebed

The flood plain in the Tulare lakebed was delineated using historic flood information, aerial photographs, and data from the Tulare lakebed land users. Flood plain information was also obtained from the "Report on Irrigation, Drainage

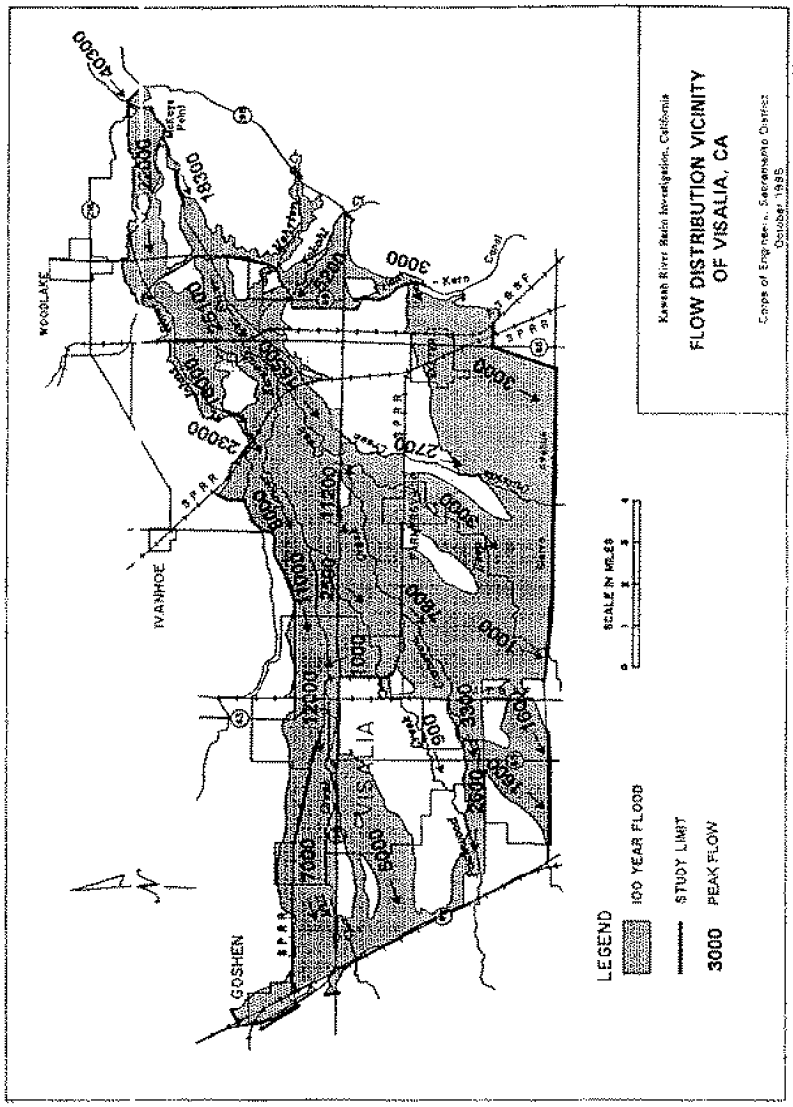

Kaweah River Basin Investigation, California
FLOW DISTRIBUTION VICINITY
OF VISALIA, CA
Corps of Engineers, Sacramento District
October 1995
LEGEND
100 YEAR FLOOD
STUDY LIMIT
3000 PEAK FLOW
SCALE IN MILES
WOODLAKE
IVANHOE
GOSHEN
VISALIA
40300
18300
23000
3000
2700
1000
7000
5000
2600
1600
900
3300
2500
11200
12000
11000
8000
7800
Kern Canal

FIGURE 4-7

and Flooding in the Tulare Lake Basin," September 1981, prepared by the Tulare Lake Basin Water Storage District.

Since the Tulare lakebed is a terminus for the Kings, Kaweah, Tule, and Kern Rivers, the volumetric flow for rain and snowmelt floods was used to determine the areal extent of flooding. Flows into the lakebed were reduced by 12 percent to account for evaporation and overland losses. Damaging floodflows for the economic studies were assumed to be split 50/50 between the main lakebed area and the south flood area, until the south area is completely filled. The 50/50 split is based upon the limitation of channel capacities and pumping facilities to move water upgradient to the south flood area. A flooded area versus flood volume (area-capacity) curve was developed and is shown in figure 4-8. This area-storage capacity curve was developed by the Corps, using information provided by the Tulare lakebed land users. Other information such as levee freeboard and flood sequencing was developed with information from Tulare lakebed land users.

Flooding in the main lakebed area is managed by reclamation districts and lakebed land users to minimize damages. The areas that are protected by levees in the Tulare lakebed are shown in figure 4-9. Based on historical flooding, it was concluded that the leveed areas generally flood in the following sequence. The Basin area (7,550 acres) is flooded first up to the 183 feet elevation. The levees surrounding the Basin area are maintained with 1 foot of freeboard. Once full, the Basin area is purposely breached by the lakebed land users, and the adjoining Brown (11,580 acres) and Cousins (13,260 acres) areas are flooded concurrently up to the 183-foot elevation. Thereafter, the Basin, Brown, and Cousins areas fill concurrently up to the 189-foot elevation. One foot of freeboard is maintained on the levee protecting the RD 749 area. The following areas are then filled to the 189-foot elevation in the following progressive order: RD 749 area (27,500 acres); Lovelace area (7,650 acres); Progressive and Stevenson areas (5,890 acres); and Helm area (6,530 acres). Thereafter, all areas fill concurrently to the 192-foot elevation. The outer perimeter levees, such as the El Rico levee, are at the 195 elevation and are provided with 3 feet of freeboard to account for wave runup and wind fetch. At the 142- foot elevation, up to 80,680 acres can flood in the main lakebed, which can store up to 931,100 acre-feet of floodwater.

As the main lakebed areas are filled, the south flood area (i.e., South Wilbur, West Hacienda, Mid-Hacienda, and East Hacienda) is also filled. The south flood area has a capacity of 99,826 acre-feet and an area of 19,680 acres. In all, up to 100,360 acres can flood in the main lakebed and south area with as much as 1,030,926 acre-feet of floodwater. Once the flood volume exceeds the 192-foot elevation in the main lakebed, then the outer perimeter levees were assumed to fail

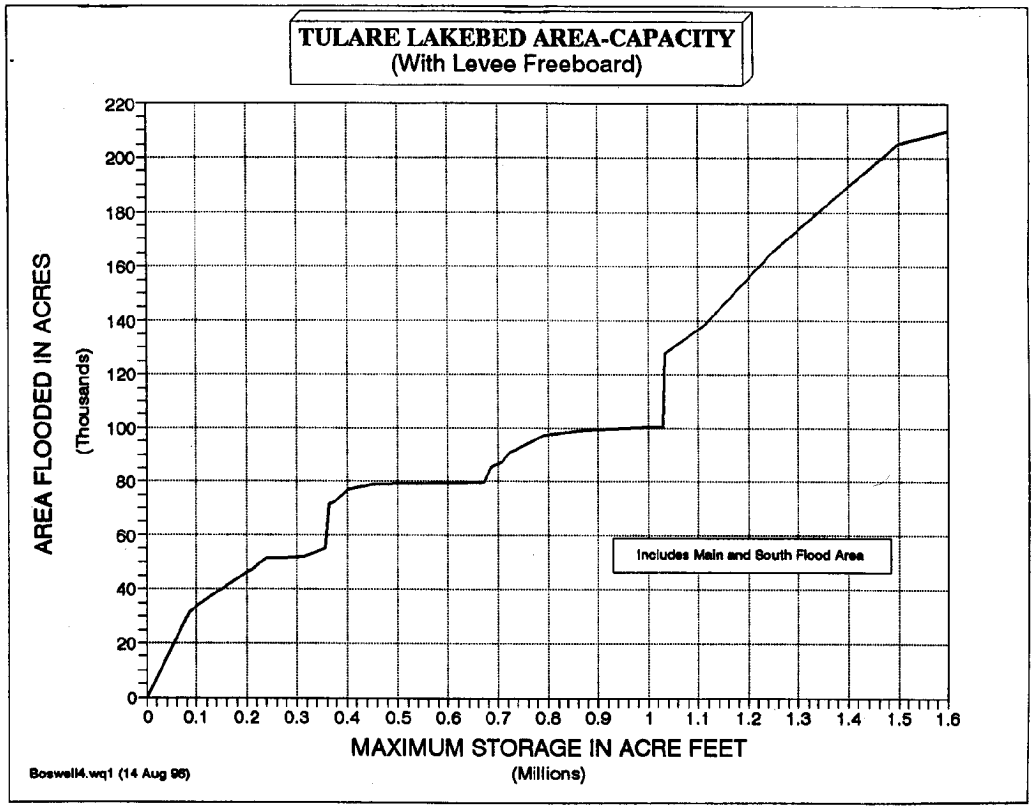

TULARE LAKEBED AREA-CAPACITY
(With Levee Freeboard)
AREA FLOODED IN ACRES
(Thousands)
0
20
40
60
80
100
120
140
160
180
200
220
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
MAXIMUM STORAGE IN ACRE FEET
(Millions)
Includes Main and South Flood Area
Boswell4.wq1 (14 Aug 95)

FIGURE 4-8

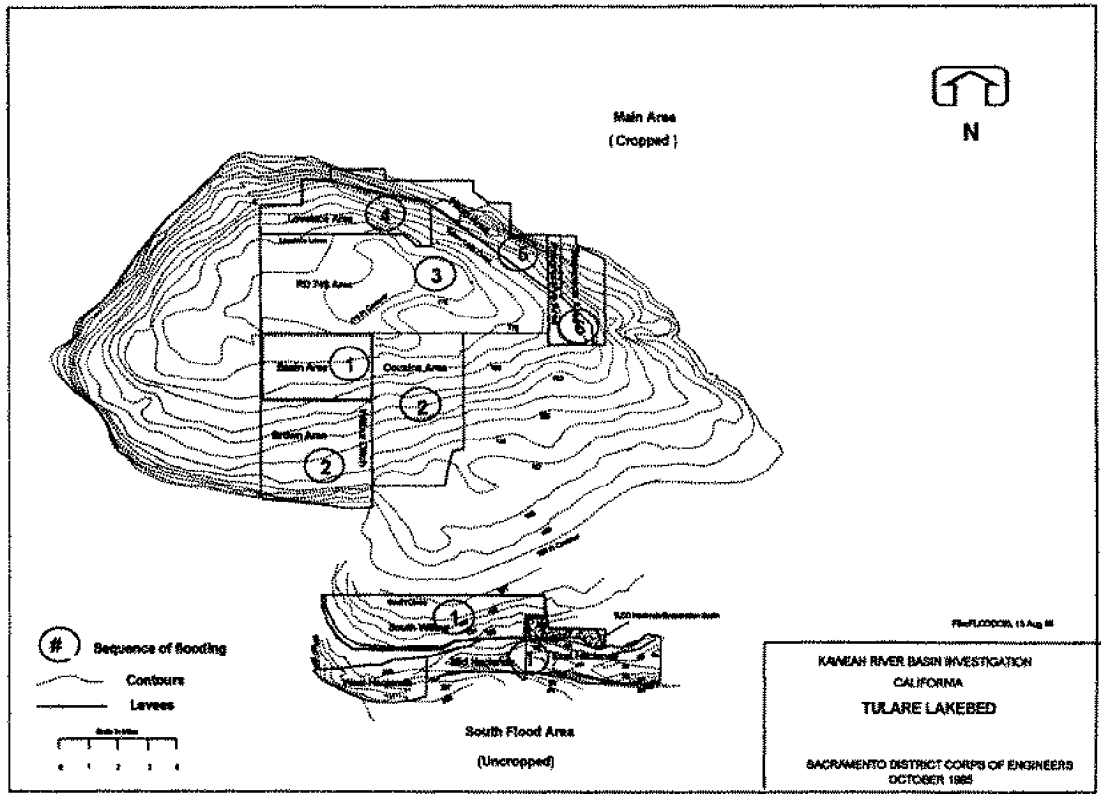

Main Area
(Cropped)
N
Sequence of flooding
Contours
Levees
South Flood Area
(Uncropped)
KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
TULARE LAKEBED
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1985

FIGURE 4-9

and the additional land in the lakebed would flood. All assumptions on levee freeboard and flood sequence were discussed with Tulare lakebed land users. The incremental storage for each cell and area flooded in the Tulare lakebed is shown in table 4-1.

Table 4-1
Area-Capacity of Tulare Lakebed Storage Areas

Main Area Flood Sequence	Elevation of Flood-water (ft, m.s.l.)	Main Area		South Flood Area		Main and South Flood Area	
		Area (acres)	Volume (acre-feet)	Area (acres)	Volume (acre-feet)	Cumulative Area (acres)	Cumulative Volume (acre-feet)
Basin	183 [1]	7,550	34,000	17,800	34,000	24,350	68,000
Basin Brown/[2] Cousins Subtotal	183	7,550 1,500 7,300 19,350	 67,700	19,680	67,700	36,270	135,400
Basin Brown/ Cousins[2] Subtotal	189 [3]	7,550 11,580 13,260 32,390	79,500 62,500 90,000 232,000	19,680	99,826	52,070	331,826
RD 749	189 [3]	27,500	339,000	19,680	99,826	79,570	670,826
Lovelace	189 [3]	7,650	37,500	19,680	99,826	87,220	708,326
Progressive Stevenson[4]	189 [3]	5,440	29,200	19,860	99,826	92,660	775,726
Helm	189[3]	4,900	18,500	19,860	99,826	97,560	794,226
Basin Brown Cousins RD 749 Lovelace Progressive Stevenson Helm	192[5]	80,680	931,100	19,860	99,826	100,360	1,030,926

[1] Basin levee has 1 foot of freeboard (top of levee is 184 ft, m.s.l.)
[2] Brown and Cousin cells fill concurrently to 183 ft, m.s.l., then Basin, Brown, and Cousins fill together to 189 ft, m.s.l.
[3] 1 foot of freeboard (top of levee is 190 ft, m.s.l.)
[4] Progressive and Stevenson cells fill concurrently
[5] Perimeter levee has 3 feet of freeboard (top of levee is 195 ft, m.s.l.)

ECONOMIC ANALYSIS

Eight reaches on the Kaweah River Delta and one reach for the Tulare lakebed were evaluated, which covered about 190,000 and 200,000-300,000 acres, respectively. The reaches are shown in figure 4-10.

Reach 1 - The urban area of Visalia.

Reach 2 - The urban area of Tulare.

Reach 3 - The urban area of Farmersville

Reach 4 - The urban area of Goshen.

Reach 5 - The urban area of Ivanhoe.

Reach 6 - The agricultural, nonurban areas above (east) Highway 99.

Reach 7 - The agricultural, nonurban areas below (west) Highway 99, extending to Tulare lakebed.

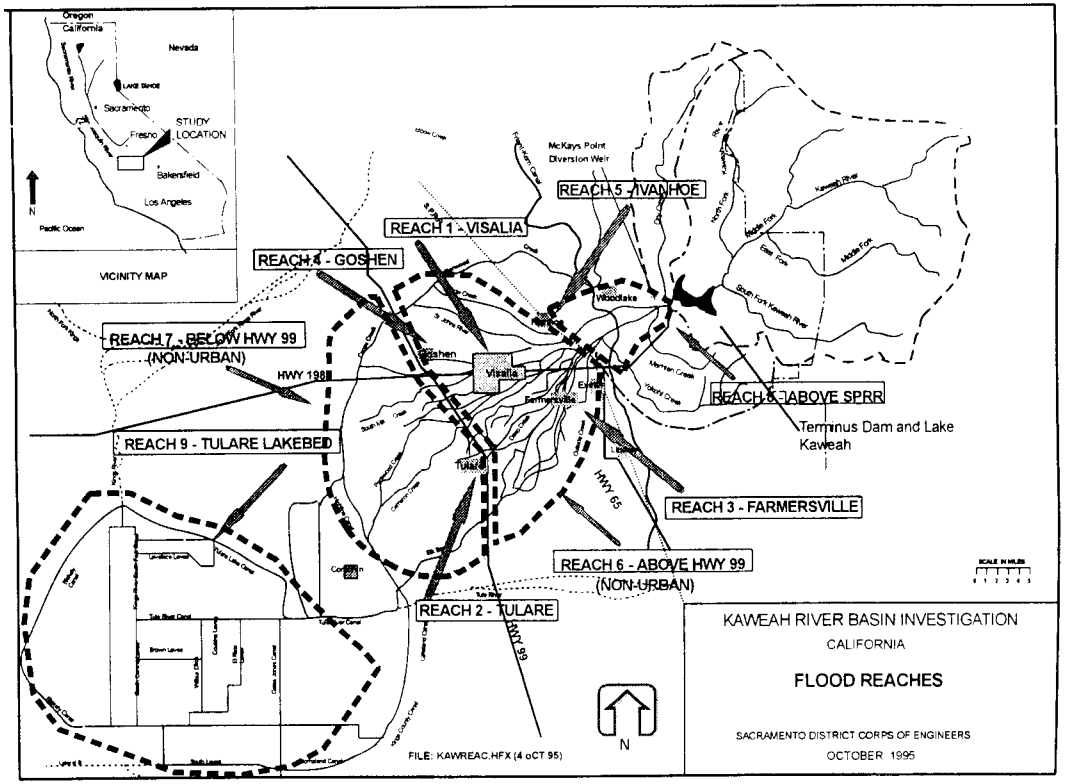
Reach 8 - The area upstream (east) from the Southern Pacific Railroad, which is between Terminus Dam and the railroad.

Reach 9 - Tulare lakebed.

Land Use in the Flood Plain

Damages are the result of inundation of both present and future land use characteristics and vulnerability of properties within the flood hazard area. The three flood plains that were analyzed for reaches 1 through 8 consist of the 500-year, 100-year, and 50-year flood plains. The 500-year flood plain contains 190,470 total acres: 145,340 of those acres are in agriculture, 29,430 are native vegetation and water, and 15,700 acres are urban areas. The 100-year flood plain contains 77,020 acres in agriculture, 13,700 acres in native vegetation and water, and 9,430 acres consisting of urban areas. The 50-year flood plain contains 11,160 acres of agriculture, 8,400 acres of native vegetation and water, and 420 acres of urban areas.

Ten flood plains were evaluated for reach 9, the Tulare lakebed, and consist of the 2.9-year, 4-year, 5.5-year, 9-year, 12-year, 51-year, 68.5-year, 112-year, 200-year, and 500-year flood plains. The flooded acres in the main area are



Oregon
California
Nevada
Sacramento
Fresno
STUDY LOCATION
Bakersfield
Los Angeles
Pacific Ocean
N
VICINITY MAP
REACH 1 - VISALIA
REACH 2 - TULARE
REACH 3 - FARMERSVILLE
REACH 4 - GOSHEN
REACH 5 - IVANHOE
REACH 6 - ABOVE HWY 99 (NON-URBAN)
REACH 7 - BELOW HWY 99 (NON-URBAN)
REACH 8 - ABOVE SPRR
REACH 9 - TULARE LAKEBED
McKays Point Diversion Weir
Terminus Dam and Lake Kaweah
HWY 198
HWY 65
HWY 99
Visalia
Goshen
Tulare
Woodlake
Exeter
Farmersville
Lindsay
Porterville
Corcoran
Kaweah River
Middle Fork
East Fork
South Fork Kaweah River
Mehrten Creek
Yokohl Creek
Cross Creek
Deep Creek
Lemon Cove Canal
Tule River Canal
Brown Lake
Water Lake Canal
Lindsay Canal
Porter Slough
Tule River
Kaweah River
SCALE IN MILES
0 1 2 3 4 5
N
FILE: KAWREAC.HFX (4 oCT 95)
KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
FLOOD REACHES
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995

FIGURE 4-10

2.9-year (non-damaging); 4-year (7,300 acres); 5.5-year (13,660 acres); 9-year (29,130 acres); 12-year (52,300 acres); 51-year (108,030 acres); 68.5-year (145,830 acres); 112-year (185,390 acres); 200-year (201,860 acres); and 500-year (230,010 acres). Land use in the Tulare lakebed is predominantly agriculture.

Present and future land use was determined by aerial photographs, visual inspection, agricultural land use maps, county assessor rolls, zoning maps, and city and county General Plans.

Damageable Structures

The total existing damageable structures in the flood plain are 22,986 structures in the 500-year, 12,593 structures in the 100-year, and 690 structures in the 50-year flood plain. There were no structures within the Tulare lakebed flood plain.

Value of Property

The value of structures was determined by using the Tulare and Kings County Assessors Rolls and discussions with local real estate professionals and County Assessor officials. The values were adjusted to reflect current market value by netting out the effects of "Proposition 13," then updating the values by using Marshall and Swifts Valuation Service to 1995 prices. Residential values were determined by discussions with local real estate brokers and sales personnel. Onsite inspections of all properties were made to determine foundation heights.

There are approximately $5.2 billion worth of damageable structures and contents in the 500-year flood plain, $2.4 billion in the 100-year flood plain, and about $114.5 million of structure and content value in the 50-year flood plain. This excludes lands, bridges, utilities, and roads.

For residential structures, content values are 50 percent of structure value, and are not projected to change. For commercial, industrial, and public and semi-public structures, the value of contents was based on information gathered from other district studies and interviews with business establishments and public entities.

Future Growth and Development

Estimates of future growth and development were obtained from the General Plans for the Cities of Visalia and Farmersville and the County of Tulare. Buildout for the flood plains would occur in 2020 for Visalia and Tulare. Buildout for Farmersville, Goshen, and reach 6 would occur by the year 2040. Agricultural

acreage and cropping were not projected to change over time for analysis of the Kaweah River flood plains or for the Tulare lakebed.

Types of Damages

The principal types of flood damages considered in this analysis are those physical damages and costs and losses that are caused by inundation. Physical losses include all structures and contents. The content damages include furnishings, equipment and fixtures, raw materials, goods in production, and finished goods. Other physical losses include damages to lot improvement, and damages to roads, bridges, and utilities. Damages in the Tulare lakebed were foregone crop profits, dewatering costs, levee repair costs, and cleanup costs.

Depth-Damage Relationships

Damages were determined by use of depth-damage relationships. Curves used for this part of the analysis were based primarily on the 1988 FEMA curves and study prepared for the Department of Housing and Urban Development. These were found to be the applicable area to the study.

Some land use categories, such as emergency costs, do not have depth-damage curves. These costs were based upon the amount of people affected by the flood and the estimated amount of time it would take before reentry into the home was possible.

The accuracy of observed foundation heights of residential structures, a survey of first floor foundation heights, was conducted in July 1995. The purpose of the survey was to compare and analyze the error between observed foundation heights and measured foundation heights. A random population of 41 residential structures was surveyed in Visalia. A regression analysis on this population showed the difference between observed and measured foundation heights within 2 percent. This small error would not significantly affect damages.

The results of this analysis are discussed in the Economics documentation.

Tulare Lakebed Damages

Flood damages in the Tulare lakebed were based on acreage flooded in the Tulare lakebed from the volumetric flow from the Kaweah, Kings, Tule, and Kern River systems; minor contributions are from Deer Creek and White River. The without-project damages were calculated by utilizing frequency-volumetric flow relationships from the Kaweah River and correlating flow from other sources, including the Kings, Tule, and Kern Rivers. The volumetric flow from the Kaweah

River was based on simulated releases from Terminus Dam, and the volumetric flow from other sources were based on simulations of flows on other river systems. Losses were estimated at 12 percent and deducted from the flood volumes. Based on the storage capacity of the conveyance channels in the lakebed, 5,700 acre-feet was assumed to be the nondamaging flow. Areas flooded in the lakebed were estimated using an area flooded-storage capacity curve for the Tulare lakebed.

Caution was exercised to distinguish flooded areas in the south flood area that are uncropped and the main lakebed area that are cropped. Only damages were claimed for the main lakebed area or cropped area. Based on historical flood data provided by the Tulare lakebed irrigators, flows into the lakebed were evenly split—50 percent to the south flood area and 50 percent to the main lakebed. The nondamaging frequency is approximately a 2.9-year event.

Damages in the Tulare lakebed consists of four categories—crop profit loss, pumping costs, levee repair costs, and cleanup costs of silt and debris. The crop loss, levee repair, and cleanup costs are based on the flooded area, and the pumping cost is based on flood volume. Crop losses are based on both area and flood duration. While no flood damage would occur to crops, damages are based on foregone profits and fixed cost losses incurred by growers from not being able to plant a crop or substituting a late lower-value crop (i.e., safflower) in the flooded areas. Safflower, if planted later to dewater saturated soils, will have a lower value than other crops such as cotton. There are five crops that are typically grown in the lakebed. An estimate of each of these crops gross return was determined by averaging the last 3 years of gross income from the Kings County Agricultural Commissioners Crop Report for each crop and then subtracting the variable cost of production. Costs of production were determined using the appropriate Crop Budget Report for each crop. These reports were generated by the University of California Agricultural Extension Service. The crop loss values were reviewed in 1995 by Tulare lakebed land users. Cropping patterns were as follows: cotton—49 percent, safflower—14 percent, seed alfalfa—9 percent, wheat—10 percent, barley—10 percent, and fallow (uncropped)—18 percent. These are the crops grown and are periodically rotated in the lakebed. These percentages are based upon an average from historical cropping patterns. No changes in cropping patterns were assumed for the future.

Pumping, levee repair, and cleanup costs were estimated from historical flood reports and from data from the Tulare lakebed lands users. Also discussed with growers were future flood operation procedures, sequence of flooding in the main lakebed storage cells, levee freeboard, dewatering sequences, and flood durations.

Average Annual Damages

Without-Project. Average annual equivalent damages for the without-project condition were estimated for the period (2000-2100) using standard discounting procedures, 7-3/4 percent interest rate, and October 1995 prices. Three flood plains (500-year, 100-year, and 50-year) were developed for the alluvial fan (i.e., reaches 1-8). The total monetary losses for all reaches due to a 500-year flood would be $1,582,000 while losses for a 100-year and 50-year flood would be $548 million and $127 million, respectively. Ten flood plains were evaluated for the Tulare lakebed (i.e., reach 9). Flood damages for the Tulare lakebed are shown in table 4-2. Average annual equivalent damages for reaches 1-8 and for the Tulare lakebed are shown in table 4-3.

Table 4-2
Without-Project Damages - Tulare Lakebed

Frequency Exceedence Interval (years)	Flood Volume Main Area (acre-feet)	Area Flooded Main Area (acres)	Flood Damages ($1,000)				
			Crop Loss	Pumping	Levee Repair	CleanUp	Total
2.9	0	0	0	0	0	0	0
4	13,450	7,300	1,037	269	475	365	2,146
5.5	41,850	13,655	1,939	837	888	683	4,347
9	140,170	29,130	7,778	2,803	1,894	1,457	13,932
12	265,470	52,300	20,711	5,309	3,400	2,615	32,035
51	933,550	108,030	73,785	18,671	7,022	5,402	104,880
68.5	1,150,170	145,830	99,602	23,003	9,479	7,292	139,376
112	1,400,170	185,390	140,896	28,003	12,050	9,270	190,219
200	1,786,470	201,860	153,414	35,729	13,121	10,093	212,357
500	2,446,470	230,010	174,808	48,929	14,951	11,501	250,189
Average Annual Equivalent Damages							9,114

Table 4-3
Without-Project Average Annual Equivalent Damages

Reach	Area	Without-Project Damages ($)
1	Visalia	6,633,000
2	Tulare	1,947,000
3	Farmersville	313,000
4	Goshen	222,000
5	Ivanhoe	24,000
6	Above HWY 99	1,314,000
7	Below HWY 99	307,000
8	Above SPRR	153,000
Total		10,913,000
9	Tulare Lakebed	9,114,000
TOTAL		20,027,000

With-Project Conditions. Flood damages under with-project conditions were evaluated using with-project peak flow-frequency relationships in reaches 1-8 (alluvial fan) and with-project volumetric flow-frequency relationships in reach 9 (Tulare lakebed). Flood damage reduction benefits are the difference between without- and with-project damages. Under with-project conditions, the peak flows on the alluvial flood plain and flood volumes reaching the Tulare lakebed are reduced by the increased storage capacity of the proposed project. Only the reduction of volumetric flow from the Kaweah River was used to assess the reduction of flow from all river sources into the lakebed. Flows from other sources, i.e., Kings, Tule, and Kern Rivers, were assumed to be the same for with-project conditions. With-project damages are presented in Chapter 5.

REAL ESTATE

Most of the land along the north shore of Lake Kaweah and along the Horse Creek area south of State Highway 198 is steep grazing land. Minimum parcel size is 80 to 160 acres.

Lands near Three Rivers, north of Highway 198, are used for single-family dwellings and motels. These pockets of high density land use are zoned

R-1-20 and C-2-SC. The former is a one-family zone with a minimum lot requirement of 20,000 square feet, and the latter is a general commercial scenic corridor designation.

Based on the above, the following highest and best uses are applicable to project lands proposed for acquisition:

- Foothill grazing
- Recreation homesite
- Scenic commercial
- Wildlife habitat.

According to knowledgeable local appraisers and real estate brokers, foothill grazing land values and other types of land suitable for agriculture have remained fairly static for the past couple of years. This trend is expected to continue for this type of land in the project area for the next 2 to 3 years. Values of recreational homesites, scenic commercial lands, and other types of land with potential for development have shown an increase of about 3 percent per year for the past 3 years. It is expected this will continue for the next several years.

ENVIRONMENTAL STUDIES

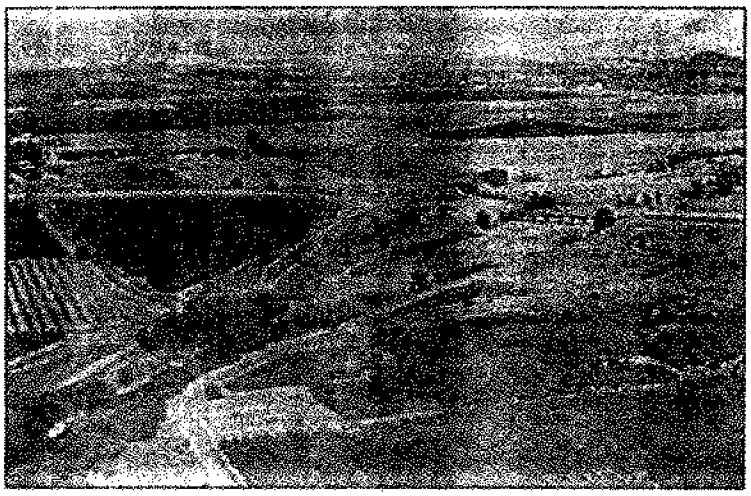
Environmental Impact Statement/Environmental Impact Report

An environmental impact statement/environmental impact report (EIS/EIR) was prepared and is attached to the feasibility report. An EIS/EIR, an FWS Coordination Act Report (CAR), Incremental Analysis, Biological Data Report, Cultural Resources Report, Land Use Study, and Recreational Analysis have been prepared.

Hazardous, Toxic, and Radioactive Waste

A confirmatory environmental site assessment was completed by DWR in 1995 and is attached as an appendix.

Chapter 5
Plan Formulation



The Friant-Kern Canal crossing the St. Johns River downstream of McKays Point.

Chapter 5

PLAN FORMULATION

Plan formulation is a creative and analytical process that involves establishing planning objectives, developing potential plans to accomplish objectives, screening out technically or socio-economically infeasible plans, and selecting candidate plans to evaluate in more detail.

PLANNING OBJECTIVES

On the basis of the flood problems, water resource needs and opportunities described in Chapter 3, the following planning objectives were developed and used in the formulation of alternatives.

- Provide increased flood protection to urban and agricultural areas.
- Enhance irrigation water supply storage incidental to the flood control objective.

PLANNING CRITERIA

Criteria applicable to development of alternatives and plan selection for all Federal water projects in accordance with the Federal Water Resources Council's Principles and Guidelines must be met. The most significant ones are:

- Completeness - Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure realization of planned effects.
- Effectiveness - Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified objectives.
- Efficiency - Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating the specified problems and realizing the specified opportunities, consistent with protecting the Nation's environment.
- Acceptability - Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local governments and the public and compatibility with existing laws, regulations, and public policies.

PLANNING CONSTRAINTS

Planning constraints include Congressional direction; current applicable laws, regulations, and policies; and existing water resource projects affecting the study area.

The following constraints were used in formulating alternative plans.

- Plans would be consistent with local city and county General Plans.
- Flood prevention measures should function without significantly aggravating flood hazards.
- Enhancement and relocation of recreation facilities at Lake Kaweah must be cost shared equally (50/50) by a willing non-Federal sponsor, unless they are considered basic minimum facilities.
- The Terminus Dam project meets conditions established under the Reclamation Reform Act of 1982 exempting it from Federal reclamation law.
- Plans will be compatible with provisions of the National Flood Insurance Program. The counties and cities are participants in the program.
- Consideration would be given to evaluating and preserving historical, archeological, and other cultural aspects.
- Plans should be formulated to preserve and enhance the quality of the natural environment, including fish and wildlife, vegetation, land, air, water, open space, recreation, and scenic and esthetic values.
- The national economic development (NED) plan will be identified. The NED plan has the highest net benefits, which are the difference between the average annual benefits of an alternative and the average annual costs of that alternative.
- Displacement of people should be minimized to the extent practicable.
- Consideration will be given to public health, safety, and social well being.
- A responsible and capable non-Federal sponsor must be identified for sharing project costs and assuming operation and maintenance costs.
- A selected plan, which could be a locally preferred plan which deviates from the NED plan, should have general public acceptance.

- Project benefits will be based upon analysis of with- and without-project conditions.

MEASURES CONSIDERED

Alternatives were developed and evaluated to conform with planning objectives. A summary of the measures and selection process that led to the development of alternatives described in the following paragraphs is summarized in table 5-1.

MEASURES

The following measures were evaluated during the initial screening. The plans that were not economically or technically feasible were not pursued in detailed analysis.

Nonstructural

As a participant in the National Flood Insurance Program, Tulare and Kings Counties have adopted ordinances or other controls to regulate land use and construction within the FEMA 100-year flood plain. The existing Emergency Warning System in the County of Tulare alerts the public in times of flooding. The system is operated by the Office of Emergency Services in Tulare, California, and the County Sheriff's Office. It also includes the Corps' Project Offices at Terminus and Success Dams. Plans include evacuating people where needed, establishing temporary shelter and food, flood fighting, providing police protection to private property, and blocking flooded roads and neighborhoods. This emergency system also includes the community of Three Rivers, upstream from Terminus Dam.

The feasibility of applying nonstructural measures of flood protection in the urban areas was evaluated using the Nonstructural Evaluation Computer Program developed by Corps for the State of California under the Planning Assistance to States (Section 22) Program. The evaluation was conducted for the major urban areas of Visalia and Farmersville. The other areas were not evaluated because they do not experience extensive damages during the 100-year flood event. The analysis uses various depth-damage curves for the different types of structures

Table 5-1
Measures

Measure Analyzed	Retained for Further Study	Remarks
Nonstructural	No	Not cost effective for existing structures.
Ground Water Recharge and Increased Spreading	No	Sufficient/appropriate land unavailable.
Levee and Channel Construction	No	Transfers damages to Tulare lakebed. Would also require extensive channelization due to distributary streams and have significant riparian environmental impacts.
Detention Basin Near Highway 99	No	Cost of lands and channelization is prohibitive. Extensive riparian impacts.
Detention Basin on Kaweah River above Visalia	No	Expense of lands and channelization is prohibitive. Extensive riparian impacts.
Pumping into Friant-Kern Canal	No	Unreliable.
Storage Upstream from Terminus Dam	No	Few benefits relative to costs and environmental impacts.
Removing sediment from Lake Kaweah	No	Not cost effective. Sluicing potentially aggravates flooding downstream by decreasing channel capacity below dam.
Storage on Other Kaweah Basin Streams	No	Flooding too localized to support costs involved and environmental impacts.
Increase Storage at Lake Kaweah	Yes	Compatible with study objectives and economically feasible. Does not provide 100-year protection to Visalia.
Dry Dam on Dry Creek and Increase Storage at Lake Kaweah	Yes	Compatible with most study objectives and economically feasible. Controls Dry Creek flows but does not provide 100-year protection to Visalia from Kaweah River. Extensive environmental and cultural impacts.
Dam on Dry Creek Reservoir, Increase Storage at Lake Kaweah, and Tunnel Connection to Lake Kaweah	Yes	Compatible with most study objectives and economically feasible. Controls Dry Creek flows and provides 100-year protection to Visalia. Extensive environmental impacts.
Limekiln Reservoir below Dry Creek and Terminus Dam	No	Provides 100-year protection to Visalia but is not economically feasible. Extensive environmental and cultural impacts.
Limekiln Dry Dam below Dry Creek and Terminus Dam	No	Costs greater than benefits. Extensive environmental and cultural impacts.

and their associated contents, structure and content value, structure size, garage size (if applicable), depth of flooding for the 50-year and 100-year flood, and nondamaging frequency information.

Six different nonstructural measures were evaluated for structures of average size and value in Visalia and Farmersville. These measures included temporary

closures, ring levees around structures, floodwalls around structures, raising existing structures above the 100-year flood elevation, relocating structures, and raising future construction above the 100-year flood elevation. Temporary closures include sealing doorways, windows, and vents; waterproofing walls, and installing check valves on sewers and sump systems. Ring levees consist of compacted earth berms with 12-foot wide crowns. Levee slopes consist of 1V:1.5H on the landside and 1V:2H for the waterside. Floodwalls consist of reinforced concrete walls that are 1 foot thick with appropriate footing foundations.

Estimates of the benefit-to-cost ratios of implementing various nonstructural measures are shown in table 5-2. As shown in the table, constructing new development on fill is the only measure that is cost effective. However, raising future construction above the 100-year flood elevation is being implemented by local governments as required through participation in the National Flood Insurance Program. Therefore, this measure is a future without-project condition and was not pursued further. The environmental impacts and mitigation costs of raising future construction were not evaluated; however, these were not expected to be substantial. Implementing nonstructural measures for existing structures is not feasible, and these measures are not pursued further.

Table 5-2
Benefit-to-Cost Ratios of Nonstructural Measures

Nonstructural Measure	Benefit-to-Cost Ratio
Temporary Closures	0.53
Levees	0.94
Floodwalls	0.37
Fill (Future Development)	1.46
Raising Existing Structures	0.29
Relocations	0.32

Ground-Water Recharge/Increased Spreading Basins

Ground-water recharge spreading basins have already been extensively developed in the area. Potential new spreading basin sites are extremely limited in the study area. Due to the large volumes of floodflows, numerous additional large spreading basins, and new and improved channels to convey floodwaters to the spreading basins would be required to significantly alleviate the flooding problem.

Therefore, development of ground-water recharge basins is not a feasible flood control measure and was not pursued further.

Levee and Channel Construction

Levee and channel improvement measures to transport floodwater to the Tulare lakebed area were not considered in detail in this study. Floodwater entering the Tulare lakebed has historically caused extensive crop damages. Although extensive flood control measures have been developed in Tulare lakebed, flooding continues to be a frequent and severe problem. Upstream levee and channel improvements would increase floodflows into Tulare lakebed and result in induced flood damage downstream at Tulare lakebed. A few miles downstream from Terminus Dam, the Kaweah River divides into numerous distributaries below Mckays Point. Many miles of major channelization would be required from Mckays Point to urban areas located 15 to 29 miles downstream from Mckays Point to provide comprehensive flood protection to the urban areas.

To develop a comprehensive downstream channel flood control project for the area, channelization of major distributaries from Mckays Point to Tulare lakebed would be required. Land costs in this intensively farmed area would be high for the channels and for a storage basin in the Tulare lakebed area that would be needed to mitigate for the additional floodwater from upstream channelization. In addition, channelization and levee construction would cause significant adverse environmental impacts. The loss of the remaining fragment of riparian habitat within the stream channels would be significant. The reconnaissance-level cost estimate for the channel improvement plan for the Kaweah and St. Johns Rivers was $200 million. This measure is not a feasible flood control measure and was not studied further.

Detention Basin Near Highway 99

Under this plan, channelization from the vicinity of Mckays Point to the vicinity of Highway 99 to provide increased flood protection to the urban and agricultural areas on the alluvial fan and a construction of detention basin to alleviate induced flood damages in Tulare lakebed was investigated. Under this plan, St. Johns River would be enlarged and a 28,000 acre-foot detention basin constructed in the vicinity of Highway 99. This plan included a new flow split structure at Mckays Point. Adverse environmental impacts to riparian habitat along the St. Johns River is a major concern associated with this alternative. The reconnaissance-level cost estimate for this measure was $180 million. The excessive cost of lands and channel work caused this alternative to be infeasible, and it was dropped from further consideration.

Detention Basin on Kaweah River Above Visalia

A new flow-split structure at Mckays Point with channelization and a 35,000 acre-feet detention basin above Visalia was considered. The reconnaissance-level cost estimate for this measure, exclusive of mitigation costs, was $430 million. Excessive costs dropped this alternative from further consideration. This alternative would also adversely affect remaining riparian habitat along the Kaweah River.

Pumping Into Friant-Kern Canal

This measure has been used on three occasions in the past during flooding; however, this plan is dependent upon the availability of capacity in the Friant-Kern Canal to transport floodwater; such availability and capacity is highly uncertain and unreliable. When the Friant-Kern Canal is carrying flows at or near its full capacity, it could not be used to transport floodwater from the Kaweah River. Consent from the U.S. Bureau of Reclamation (USBR) is required to use the Friant-Kern Canal for flood relief. The USBR approved this use only for event-specific situations based on the conditions at that time. Future increased demands on this system for water supply and the regularity at which the canal would be at full capacity would reduce any possibility of its use as a reliable flood control structure. This measure was not carried forward because it is not a reliable measure for providing flood control.

Storage Upstream from Terminus Dam

Potential dam and reservoir sites upstream from Terminus Dam were investigated but found to be of limited capacities and would not be cost effective in reducing flood damages in the study area. The available upstream sites would also require extensive environmental mitigation for loss of habitat associated with constructing dams in densely vegetated areas. Because new upstream reservoirs would be very costly in relation to flood control benefits, this alternative was not studied further.

Removing Sediment from Lake Kaweah

This measure calls for removing accumulated sediment from within the existing reservoir area. The two methods of removing sediment are sediment dredging and sediment sluicing. When water storage in Lake Kaweah began in 1962, the gross storage capacity was about 150,000 acre-feet. By the year 2000, sediment deposition in the reservoir is estimated to reduce the total capacity to about 140,700 acre-feet. To restore the original capacity of 150,000 acre-feet would require removing about 9,300 acre-feet of material in the year 2000.

Dredging to remove sediment would require high costs for mobilization, removal, demobilization, and disposal. Costs for excavation alone are estimated at $2.50 per

cubic yard. This compares to a cost of about 50 cents per cubic yard of additional storage to raise the spillway at Terminus Dam. Costs for excavation or dredging 9,300 acre-feet (15,004,000 cubic yards) of sediment would be about $37,510,000. Since nearly all sediment within the reservoir is deposited in the upstream reaches of the reservoir where the river meets the lake's water surface, access costs are high for transporting equipment to the site and in disposing of material. These costs would be in addition to the excavation costs. Other costs not accounted for would include acquisition of disposal sites and mitigation costs associated with adverse environmental impacts of transporting equipment to the site, establishment of disposal sites, and transport of the excavated materials.

The possibility of commercially selling dredged or excavated materials is limited. The gradation and quality of material would likely require the extensive processing of the material for any commercial use. The high costs and extensive processing make the feasibility of commercially mining this material uncertain.

The feasibility of sluicing sediments from the reservoir is also limited. Since sediments deposit at the upper end of the reservoir, extraordinary measures would be needed to transport these sediments down into the reservoir area near the outlet works where flow velocities would be sufficient to move the material out of the reservoir. This process would require nearly draining the reservoir, which would maintain the river channel and its higher water velocities farther downstream and transport material closer to the outlet works. However, draining the reservoir would have a serious adverse effect on the recreation, fishery, and water supply benefits of the existing facilities and operations. Sluicing sediments downstream from the dam could also cause serious flood control problems downstream when sediments deposit within the existing channel, thereby reducing its capacity.

Due to the high costs and potential adverse effects on existing resources and downstream channel capacity, this measure was not studied further.

Increase Storage at Lake Kaweah

Increasing storage capacity at Lake Kaweah would increase flood control storage and reduce urban flood damages to the downstream urban area, and reduce agricultural flooding along the Kaweah River and in the Tulare lakebed. Additional irrigation water supply storage would also be provided. This measure appeared compatible with the study criteria. It was retained for further study.

Flood Detention Dam on Dry Creek

A flood detention dam on Dry Creek just above the confluence with the Kaweah River was evaluated. This plan called for a dam on Dry Creek to temporarily impound floodwater for downstream flood protection. The dam would be located on Dry Creek

just above the confluence with the Kaweah River. This measure appeared compatible with the study criteria and was supported by local interests. It was retained for further analysis.

Dry Creek Reservoir

This measure included a flood control dam and reservoir on Dry Creek just above the confluence with the Kaweah River. This measure could include a connecting tunnel to Lake Kaweah which would allow floodwater to be moved from the Kaweah River to the Dry Creek Dam and improve the level of flood protection on the Kaweah River. It would also provide additional water supply benefits by storing Dry Creek flows. This measure was compatible with the formulation criteria and supported by local interests; therefore, it was retained for further analysis.

Limekiln Reservoir

Limekiln Reservoir site is located at the confluence of Dry Creek and the Kaweah River, about 1 mile downstream from Terminus Dam. This measure would provide flood detention storage downstream from Dry Creek and Kaweah River. This measure would provide 287,000 acre-feet of storage space for flood control, water supply, and hydropower. However, the 17-megawatt hydropower plant at Terminus Dam would be inundated. Loss of the powerplant and revenues would be part of the cost of developing a project at this particular site. The reconnaissance-level cost estimate for this measure was $441 million. This measure was eliminated from further consideration because of excessive costs, significant cultural and environmental impacts and mitigation, and lack of local support.

Limekiln Flood Detention Dam

A smaller flood detention dam was investigated at the Limekiln Reservoir site to provide 100-year level of flood protection to Visalia. This dam would also adversely affect the operation of the hydropower plant at Terminus Dam. The reconnaissance-level cost estimate for this measure was $131 million. The cost estimate does not include the cost for environmental mitigation, which includes alluvial sycamore trees along Dry Creek. Significant cultural resources in Dry Creek valley also would be affected. This measure was eliminated from further consideration because of high costs and significant impacts to cultural and environmental resources.

PRELIMINARY ALTERNATIVES

The following preliminary alternatives, developed from the measures, were initially evaluated to determine the most viable plans to be carried forward. This includes the No-Action Alternative. Flood detention and water supply storage

measures that satisfied the study criteria and were supported by local interests were developed into these preliminary alternatives for further analyses. The location of these preliminary alternatives are shown in figure 5-1. These preliminary alternatives included raising the spillway sill at Lake Kaweah to increase storage space, constructing a flood detention dam on Dry Creek, and constructing a flood control reservoir on Dry Creek with a tunnel connection to Terminus Dam.

No Action

Under this plan, the Federal Government would take no action toward implementing a flood control project. No additional flood control projects would be built in the area and the flood threat would increase to the city of Visalia, surrounding communities, and to the agricultural areas including the Tulare lakebed. It was assumed that future population trends, land use, and related urban growth in the study area would continue generally as described in current local plans. The cities and counties would continue to require developers to flood proof future developments within the FEMA 100-year flood plain.

The average annual equivalent flood damages are expected to reach about $20 million in the study area. Over time, the flood control storage space at Lake Kaweah would diminish as sediment accumulates in the reservoir, which would decrease the level of flood protection afforded to downstream areas. Also, the existing 7,000 acre-foot conditional rain flood storage space would diminish with sediment accumulation. The loss of the floodwater storage space would adversely affect the fisheries and recreation use at Lake Kaweah during winter and late summer. This preliminary alternative was retained for comparative purposes.

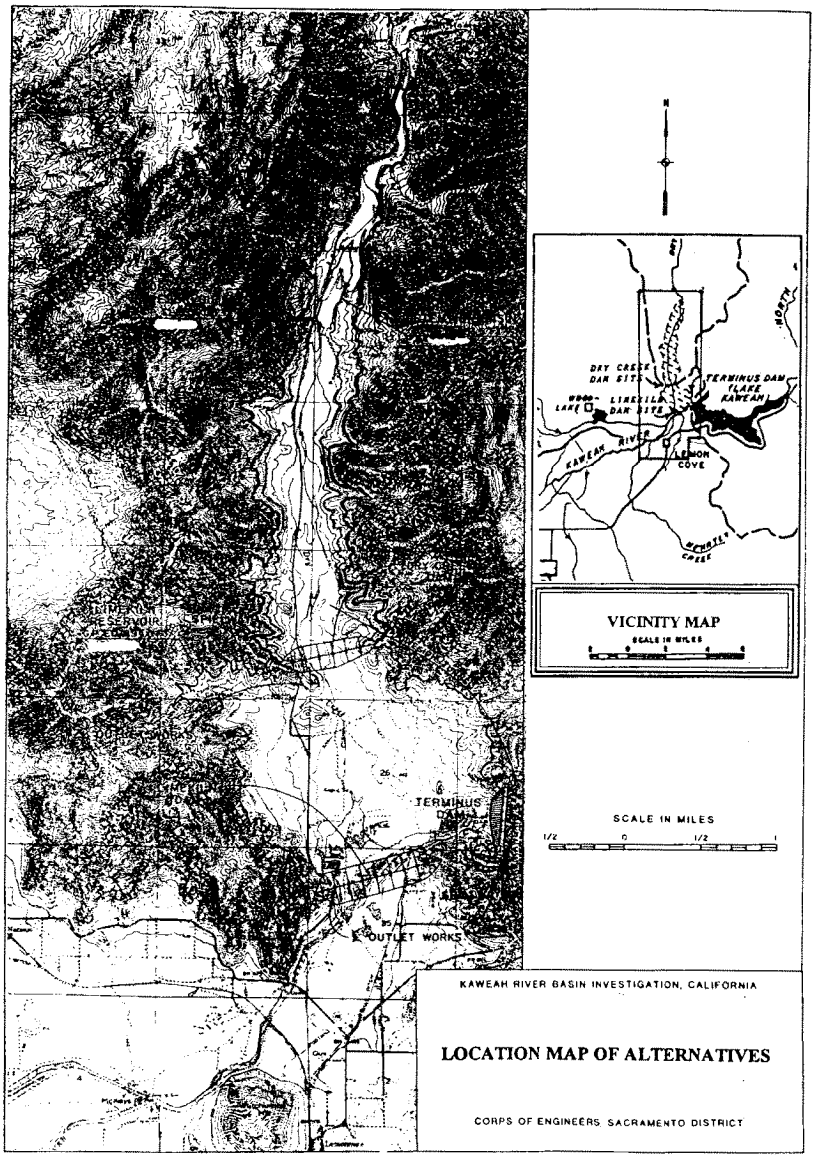

VICINITY MAP
SCALE IN MILES
TERMINUS DAM
OUTLET WORKS
SCALE IN MILES
1/2 0 1/2 1
KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA
LOCATION MAP OF ALTERNATIVES
CORPS OF ENGINEERS, SACRAMENTO DISTRICT

FIGURE 5-1

Increase Storage at Lake Kaweah (21-foot Spillway Raise)

There are a large number of potential options to increase storage at Lake Kaweah. Increased storage may be accomplished by raising the dam itself or by raising and widening the existing spillway to increase storage while still maintaining dam safety requirements to be able to pass the probable maximum flood without dam overtopping. Early in the formulation process, consideration was given to the option of raising Terminus Dam. This option was determined to be too costly, however, and so was eliminated from further consideration. A large array of options to increase spillway heights were also considered. A 21-foot spillway raise was identified as the maximum limit of height increase before extensive excavation and relocations were required. Consequently, for this preliminary alternative phase, this alternative was formulated as a 21-foot spillway raise. This plan to raise the spillway sill at Terminus Dam by 21 feet, from an elevation of 694 feet to 715 feet, requires constructing a 21-foot-high concrete ogee section across the spillway. The spillway would be widened from 307 feet to 455 feet to maintain the PMF maximum pool objective at an elevation of 747.4 feet and preclude raising the dam. Excavation would be required at the right and left abutments, with the majority of excavation taking place on the left abutment. Sideslopes on the spillway would be cut to 1.0V on 0.5H, the same as the existing slope. The spillway modification is shown on plate 2.

This plan would increase the reservoir capacity at Lake Kaweah by 42,600 acre-feet and decrease the frequency of Terminus Dam spillway overflows from about the 46-year event to about the 70-year event.

The surface area at gross pool would increase from 1,913 acres at 694 feet m.s.l. to 2,154 acres at 715 feet m.s.l., an increase of 241 acres. The 715-foot gross pool would be attained once every 3 years, on the average. It would periodically inundate the picnic area, parking lot, and boat launch ramp at the Kaweah Recreation Area, the boat launch ramp at the Lemon Hill Recreation Area, and 67 of 80 campsites at the Horse Creek Recreation Area. The boat launch ramp at the Lemon Hill Recreation Area would be extended to the 715-foot gross pool, and vault toilet facilities at the Kaweah and Horse Creek Recreation Areas would be resited above the 715 feet gross pool.

Real estate acquisition and relocation would be required for one motel and six dwellings located within the standard project flood gross pool of 726 feet.

An increase of the gross pool elevation would require the relocation of State Highway 198 Bridge (Horse Creek Bridge) farther upstream from Horse Creek. The lower chord on the Horse Creek Bridge is at elevation 711.5 feet. Increasing storage at the lake would increase the 100-year gross pool and require relocation of the bridge to an elevation of 718 feet. The roadway bridge approaches would also require

modification and relocation. The access road over the spillway would require lengthening and adding support columns. Utility lines to be relocated include 300-Kilovolt and 12-Kilovolt power and telephone lines that cross Horse Creek.

Mitigation of impacts at Lake Kaweah include 21 acres of riparian scrub, 14 acres of riparian forest, 320 acres of oak savannah, and 99 acres of oak woodland. Mitigation areas were identified in the Kaweah River corridor a few miles upstream from Visalia. Mitigation for impacts at the Tulare lakebed include 366 acres of wetland habitat in or adjacent to the lakebed. Modifications would be required to create shorebird habitat, such as islands and shallow ponded areas. Mitigation costs were estimated at $2,617,000 for structural work, planting, and equipment. An additional $1.7 million land acquisition cost was estimated for the two sites.

On the basis of feasibility designs and costs, the estimated first costs for this alternative is $33,842,000. The annual costs (7-5/8 percent discount rate and 100-year period of analysis) is $2,687,000. The estimated average annual benefit is $3,772,000. The benefit-to-cost ratio is 1.4:1; therefore, this alternative was pursued further.

Flood Detention Dam on Dry Creek (27,000 acre-feet) and Increase Storage at Lake Kaweah (42,600 acre-feet)

Dry Creek flows are the major unregulated contributor to floodwater reaching Visalia and Tulare lakebed. A small flood control detention basin, in conjunction with enlarging Lake Kaweah, was considered at a site on Dry Creek near the confluence with the Kaweah River.

This alternative consists of raising of the spillway at Terminus Dam by 21 feet and constructing a 27,000-acre-foot, ungated flood detention dam on Dry Creek. This alternative would provide about a 82-year level of flood protection to the city of Visalia.

A roller-compacted concrete dry dam on Dry Creek with the spillway located over the top of the dam and with an ungated outlet works was considered. It would have a capacity of 27,000 acre-feet and a gross pool elevation of 623 feet. This would allow for a run-of-the-river stream under normal circumstances. When inflow exceeds the maximum outflow of 500 cfs, the reservoir would start storing water. This alternative would include 2,000 acre-feet reserved for sedimentation space in the Dry Creek dam. The maximum height of the dam is 119.5 feet. The crest elevation is approximately 649.5 feet, length 2,400 feet, and crest width 25 feet. The upstream face is vertical and the downstream face has a slope of 1V to 0.65H.

The plan would provide additional irrigation water storage of 10,100 acre-feet per year, on an average annual basis. There would be an average annual loss of 7,400 megawatts of hydropower produced at Lake Kaweah due to head on the turbines when the pool level exceeds their operating capabilities at elevation 701. Also, an

incidental increase in the surface area of the recreation pool in Lake Kaweah during the recreation season would increase recreation usage.

This plan would require the relocation of Tulare County Road J-21, overhead transmission lines, and telephone lines. It would also require acquisition of approximately 1,002 acres in Dry Creek Valley. This includes two dwellings plus miscellaneous farm buildings and corrals. Nine ownerships would be acquired. This is in addition to the real estate required around Lake Kaweah.

The riparian/woodland complex at the Dry Creek site has a high component of alluvial sycamore trees. In fact, Dry Creek is one of the three significant alluvial sycamore sites remaining in the State of California. The largest site is located where the State of California is studying the Los Banos Grandes Reservoir. The other site, Orestimba Creek, has been chosen as one of the potential Los Banos Grandes mitigation sites.

The impacts to the Dry Creek watershed are estimated as follows:

Habitat	Area (acres)
Oak Woodland	285.5
Oak Savanna	21.4
Riparian/Woodland Complex Reservoir Area	216.2
Annual Grassland	597.6
Total	1,120.7

Based on investigations associated with sycamore trees in the Los Banos Grande study (near San Luis Reservoir), mitigation for impacts at Dry Creek are about $10 million. When added to the mitigation cost required around Lake Kaweah and for loss of seasonally flooded areas in Tulare lakebed for raising the spillway at Terminus Dam by 21 feet, mitigation would cost about $14.1 million.

The estimated first cost is $93,862,330 and the annual cost is $7,470,000. Average annual benefits are $5,200,000. The benefit-to-cost ratio is 0.7:1; therefore, this alternative was dropped from further analysis.

Dry Creek Reservoir with (70,000 acre-feet Dry Creek Dam) Increase Storage at Lake Kaweah and Tunnel Connection to Lake Kaweah

A large water storage reservoir was considered for Dry Creek with a connection tunnel to an enlarged Lake Kaweah. The tunnel would allow for offstream storage of Kaweah River waters for flood control and water supply storage as well as flood control storage for Dry Creek waters. This alternative would provide 100-year protection to the city of Visalia.

This alternative consists of raising the spillway at Terminus Dam by 21 feet and constructing a 70,000 acre-foot dam and reservoir on Dry Creek with gated outlet works. It includes a 12-foot-diameter, 7,600-foot-long concrete-lined tunnel connecting Lake Kaweah to the proposed Dry Creek reservoir. The tunnel invert elevation is 600 feet m.s.l. at Lake Kaweah. The tunnel slopes toward Dry Creek reservoir and, depending on the respective pool elevations, water could pass back and forth between the two reservoirs. It would have dual passages with one service and one emergency gate per passage. There is no bulkhead gate because reservoir operating criteria for both Lake Kaweah and proposed Dry Creek would require drawdown of the reservoir pool below the tunnel invert each year.

The Dry Creek dam would be a roller compacted concrete dam. The maximum height of the dam is 175 feet, roadway crest elevation is 705 feet plus 3 additional feet for parapet wall. Crest length is approximately 3,210 feet, 102 feet of which is the ungated, ogee crest weir spillway notched into the dam to a depth of 21 feet. The crest width is 25 feet. The upstream face of the dam is vertical; the downstream face is 1V on 0.65H. The outlet uses a fixed cone valve to regulate low level releases and is limited to 400 cfs at gross pool (elevation 684 feet).

The relocations and resitings at Lake Kaweah are identical to that discussed previously for raising the spillway at Lake Kaweah by 21 feet. The 70,000 acre-foot dam and reservoir in Dry Creek would require the relocation of Tulare County Road J-21, overhead transmission lines, and telephone lines.

The dam and reservoir would also require acquisition of approximately 1,658 acres, including two dwellings and miscellaneous farm buildings and corrals. Nine ownerships would be acquired in addition to the real estate to be acquired around Lake Kaweah.

Under this plan, additional 33,600 acre-feet of flood control space and 10,000 acre-feet for irrigation carryover would be provided in Lake Kaweah for a total of 185,600 acre-feet. In Dry Creek Reservoir, the space allocation would be 2,000 acre-feet for sedimentation space, 10,000 acre-feet for irrigation carryover, and 58,000 acre-feet for flood retention space, for a total of 70,000 acre-feet. With the combined operation of the two reservoirs, the average annual increase of irrigation water supply is 14,600 acre-feet. There would be an average annual loss of 13,900 megawatts of hydropower due to head on the turbines in excess of their operating capabilities. An incidental increase of 152 acres in the surface area of the recreation pool during the recreation season would provide for some incidental recreation.

Environmental impacts at Lake Kaweah, Dry Creek, and Tulare lakebed require mitigation. Based on investigations associated with sycamore trees in the Los Banos Grande Investigation, the cost to mitigate for impacts at Dry Creek is about $12 million.

When added to the mitigation cost for impacts at Lake Kaweah and in the Tulare lakebed, mitigation cost is about $16,100,100.

The estimated first cost for this alternative is $181,600,000. The annual cost is $14,590,000. Average annual benefits are estimated at $8,050,000. The benefit-to-cost ratio is 0.55:1; therefore, this alternative was dropped from further analysis.

REFORMULATION OF PRELIMINARY ALTERNATIVES

Based on the results of the initial screening of preliminary alternatives, the No-Action plan and the plan to raise the spillway on Terminus Dam 21 feet were carried forward for more analysis. The No-Action plan is carried forward in all cases as a baseline of comparison for all other alternatives. Federal policies mandate that alternatives be evaluated on four criteria—completeness, effectiveness, efficiency, and acceptability. The completeness criteria assures that any plan is functionally complete in meeting the purposes for which the plan is formulated. Effectiveness assesses how well a plan meets the project purposes. The efficiency criteria is used to optimize the economic viability of alternatives consistent with applicable laws and environmental goals of the Nation. The acceptability criteria assures that any plans formulated conform with all applicable laws, policies, and regulations. Based upon the preliminary screening, the "Increasing Lake Kaweah Storage (21-foot Spillway Raise)" alternative needed to be assessed using these four criteria to identify the most appropriate level of spillway raise to carry forward as a final alternative.

COMPLETENESS

The "Increase Lake Kaweah Storage (21-foot Spillway Raise)" alternative is functionally complete and is capable of providing benefits for the flood control and irrigation water supply purposes. The alternative is functionally complete in that it has considered real estate, relocation, mitigation, construction, and design costs in providing the water resource benefits. These costs were developed at an equal level of detail.

EFFECTIVENESS

Terminus Dam currently releases uncontrolled flows from the spillway at about a 46-year flood event. In addition, there are no flood detention measures on Dry, Mehrten, and Yokohl Creeks which makes the city of Visalia and other urban areas vulnerable to concurrent flows from these streams.

The 21-foot spillway raise would decrease the frequency of uncontrolled spills from the Terminus Dam spillway from about a 46-year event to about a 69-year event. There are no alternatives to increase the storage capacity of Terminus Dam that can viably provide a 100-year or more level of protection to downstream urban areas, unless flood detention storage is also provided on Dry Creek. As discussed previously, no such alternatives were economically feasible.

The 21-foot spillway raise alternative was formulated utilizing an operational criteria which provides for 7,000 acre-feet of conditional rain flood storage space (identified on the existing flood control diagram as conditional winter storage between November and March) over the life of the project. This operation is primarily effective in providing flood protection. The operation is not as effective, however, in protecting environmental resources, protecting existing recreation operations, or in developing additional water supplies. This limitation led to formulation of an additional alternative which provides a more balanced approach. This plan is described later in this section.

EFFICIENCY

The Federal objective in water and related land resources planning is to contribute to national economic development (NED) consistent with the Nation's environment, applicable executive orders, and other Federal planning guidelines. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. Under this Federal NED objective, policies mandate that an optimization analysis be carried out to maximize the benefits attained for each dollar invested in any water project. While the "Increase Lake Kaweah Storage" alternative was originally formulated as a 21-foot spillway raise, in order to optimize the alternative, an intermediate formulation process was required to optimize the height of the spillway raise. To optimize the spillway raise, four different height options were evaluated to determine which height of raise provided most benefits for each dollar invested. The four spillway height options considered for the NED optimization were 10, 15, 21, and 26.1 feet. In quantifying the benefits for the NED optimization, each of the four height options were compared to the without-project condition defined by the analysis of a No-Action plan. This NED optimization process is described in detail in Appendix C (Economics) and is summarized below.

Spillway Options

Four spillway sizes were used to identify the likely optimal combination of height and width. They are listed in table 5-3 and described below.

Table 5-3
Spillway Raise Alternatives at Terminus Dam

Option No.	Increase in Spillway Elevation (feet)	Gross Pool Elevation (msl, feet)	Spillway Base Width (feet)
Existing Condition	0	694	307
2A	10	704	291 [1]
2B	15	709	362
2C	21	715	455
2D	26.1	720.1	600.00

[1] The existing 307 foot wide spillway has a 195-foot concrete-lined notch (see appendix C, figure 5). Under this option, the spillway base width remains 307 feet wide, while the notch is widened to 291 feet.

Option 2A - Raise Spillway at Terminus Dam by 10 feet. This option consists of raising the spillway at Terminus Dam by 10 feet, from elevation 694 feet to 704 feet. This consists of constructing a 10-foot-high concrete ogee across the spillway and widening the spillway notch. The spillway notch widening is necessary to maintain the PMF pool at the current pool elevation of 747.4 feet.

Raising the gross pool by 10 feet would increase the gross pool capacity of Lake Kaweah by 20,000 acre-feet. The frequency of uncontrolled spills from the Terminus Dam spillway would decrease from about a 46-year event to about a 53-year event.

No modification of the access road over the spillway would be necessary. This alternative would require the relocation of the Horse Creek Bridge on Highway 198 to elevation 714 feet. Coordination was carried out with the California Department of Transportation for relocation and clearance criteria of the Highway 198 Bridge. CALTRANS requires low chord clearance of the 100-year pool elevation with no freeboard. The low chord of the bridge is currently at 711.5. The 100-year pool elevation for the existing conditions is 710.5. Therefore, any significant increase in gross pool elevation, greater than 1 foot, requires that the bridge and highway be relocated. This relocation would also require modification of both bridge approaches. Lands within the gross pool will be acquired in fee. Flood easements would be acquired for land within the SPF pool.

Option 2B - Raise Spillway at Terminus Dam by 15 feet. This option consists of raising the spillway at Terminus Dam by 15 feet, from elevation 694 feet to 709 feet.

This consists of constructing a 15-foot-high concrete ogee across the spillway and widening the spillway from 307 feet to 362 feet.

Raising the gross pool by 15 feet will increase the gross pool capacity of Lake Kaweah by 30,000 acre-feet. The frequency of uncontrolled spills from the Terminus Dam spillway decreases from about a 46-year event to about a 60-year event.

As with Option 2A, no modification of the access road over the spillway would be necessary. This plan would require the relocation of the Horse Creek Bridge on Highway 198 to elevation 716 feet. This relocation will require modification of both road approaches. Lands located within the gross pool will be taken in fee, and flood easements would be acquired for lands located within the SPF pool.

Option 2C - Raise Spillway at Terminus Dam by 21 feet. This option consists of raising the spillway sill at Terminus Dam by 21 feet, from elevation 694 feet to 715 feet. This consists of constructing a 21-foot concrete ogee section across the spillway and widening the spillway from 307 feet to 455 feet.

This option would increase the gross pool reservoir capacity of Lake Kaweah by 42,600 acre-feet. The frequency of uncontrolled spills from the Terminus Dam spillway decreases from about a 46-year event to about a 69-year event.

The access road over the spillway would require lengthening and relocating left column supports. This option would require the relocation of the Horse Creek Bridge on Highway 198 and the modification of both road approaches to the bridge.

Option 2D - Raise Spillway at Terminus Dam by 26.1 feet. This option consists of raising the spillway sill at Terminus Dam by 26.1 feet, from elevation 694 feet to 720.1 feet. This consists of constructing a concrete ogee across the spillway and widening the spillway from 307 feet to 600 feet.

This option will increase the gross pool capacity of Lake Kaweah by 53,800 acre-feet. The frequency of uncontrolled spills from the Terminus Dam spillway decreases from about a 46-year event to about a 78-year event.

As above, the access road over the spillway would require lengthening and relocation of the left column supports. Relocation of the Horse Creek Bridge on Highway 198 would be required. The 100-year flood pool for the 26.1-foot raise is 724.7. The relocation would also require the modification of both bridge approaches. Lands would be acquired in fee and permanent easements.

NED Optimization - Benefits

The NED optimization using the four height modification options is based primarily on two benefit categories—flood inundation reduction and increased irrigation water supply. Irrigation water supply benefits reflect increases in available storage of irrigation water obtained from within the basin. Employment benefits are also realized by the project options but are not included in NED benefit optimization. Hydropower and recreation were also considered in the NED optimization. Each of these benefit categories is considered below.

Benefits were based on a 100-year project life (2000-2100), 7-5/8 percent discount rate, and October 1995 price levels.

Flood Inundation Reduction Benefits. Flood inundation reduction benefits are the difference between the flood inundation damages that would occur under without-project and with-project conditions. Damage flow relationships were derived by estimating the probable flood damages for several hypothetical floods. The probable flood damages that may result from a particular flow were estimated by first describing the flood plain area associated with that flow, inventorying this area by damage category and depth of flooding, and applying the appropriate depth-damage relationship for each damage category. For the final alternatives, probable damages in reaches 1-8 were determined for three flood plains—16,000 cfs (50-year), 43,700 cfs (100-year), and 130,200 cfs (500-year). Damages in the Tulare lakebed were evaluated for 10 flood events: the 2.9-year, 4-year, 5.5-year, 9-year, 12-year, 51-year, 68.5-year, 112-year, 200-year, and 500-year.

Benefits reflect decreased damages as a result of the project to residential, commercial, industrial, and public properties, as well as Tulare lakebed farming production and agricultural development along the Kaweah and St. John Rivers. In addition, benefits were derived from savings in emergency flood costs and detours of traffic.

Three steps were used to estimate flood damages to existing facilities. First, the number and size of structures in the flood plain were estimated from aerial photographs and county land use maps. Second, assessments of the existing values and future number of structures were established by real estate professionals in the area and from an appraisal handbook published by Marshall and Swift Publication Service. Finally, the damage susceptibility of those structures was established as a function of the total value of each unit and the flood characteristics of the river. Intangible damages such as loss of life, impairment of health and living conditions, and other conditions that cannot be evaluated in monetary terms were not included.

Damage susceptibility of agricultural croplands varies with flood timing and depth of flooding. Flood damages in any given month are dependent on crop maturity,

field preparation, the severity of damage to the crop, replanting, and cleanup costs. No damages to crops were claimed in the Tulare lakebed; however, damages were claimed for loss of net profits due to not being able to farm inundated areas or the late planting of a lower value crop such as safflower, which can be used to dewater saturated soils.

The gross return of each of these crops was determined by averaging the last 3 years of gross income from the Kings County Agricultural Commissioners Crop Report for each crop and then subtracting the variable cost of production. Costs of production were determined using the appropriate Crop Budget Report for each crop. These reports were generated by the U.C. Agricultural Extension Service.

Pumping, levee repair, and cleanup costs were estimated from historical flood reports and from discussions with the Tulare lakebed growers. Also discussed with growers and considered were future flood operational procedures.

The study area consists of eight reaches in the alluvial flood plain covering about 190,470 acres and one reach in the Tulare lakebed covering between 200,000 and 300,000 acres.

Estimation of areas subject to major flooding were developed based on data gathered from previous flood events, state-of-the-art flood plain hydraulic analysis, review of three previous flood plain studies, and extensive field investigations. The three previous flood plain studies are the Visalia Flood Plain Investigation, conducted by the Corps of Engineers in 1972, the Flood Insurance Study for Tulare County, produced for the Federal Emergency Management Agency in 1982, and the State Designated Floodway for the St. Johns River, prepared by the California Department of Water Resources in 1986. The flood plain is on an alluvial fan, consisting of many distributaries with diminishing channel capacities as they flow toward Tulare lakebed. In addition, the distributary system is traversed by numerous structures that have a major influence on the distribution and redistribution of flows during large floods. This is covered in more detail in the Chapter 4, Appendix F - Flood Plain Determination, and a supplemental office report.

An example of how the damages in the Tulare lakebed are derived for without- and with-project conditions for Alternative 2C is shown in table 5-4.

Flooding in the Tulare lakebed will be reduced as a result of the increased storage capacity at Terminus Dam. For specific flood recurrence intervals, the 21-foot spillway raise plan would reduce flooded acreage by 2,600 acres for the 5.5-year event, 20,200 acres for the 12-year event, 27,760 acres for the 51-year event, and 7,980 acres for the 112-year event. The with- and without-project flood plains for the 5.5-year, 12-year, 51-year, and 112-year flood events are shown in figures 5-2, 5-3, 5-4, and 5-5, respectively.

Bridge Replacement Benefits. Bridge replacement benefits represent the portion of annual cost of a bridge replaced as a project feature from the end of the economic life of the existing bridge to the end of the life of the replaced bridge. The bridge that would be replaced is the Horse Creek Bridge on Highway 198. Annual bridge replacement benefits for each alternative are $17,000.

The average annual flood control benefits are the sum of the flood inundation reduction and bridge replacement benefits. The average annual without-project damages and with-project flood control damages for all reaches are shown in table 5-5 for the various spillway raising alternatives. The average annual flood control benefits are the difference in the average annual without- and with-project flood damages.

Table 5-4
With-Project Damages - Tulare Lakebed

Frequency (yrs)	Without- Project			With-Project		
				21 ft (Alt 2C)		
	Flood Volume (ac-ft)	Area Flood (acres)	Total Damages ($1,000)	Flood Volume (ac-ft)	Area Flood (acres)	Total Damages ($1,000)
3	0	0	0	0	0	0
4	13,450	7,300	2,146	8,900	6,600	1,874
5.5	41,850	13,655	4,347	33,000	11,000	3,487
9	140,170	29,130	13,932	105,170	25,460	9,690
12	265,470	52,300	32,035	220,170	32,100	16,666
51	933,550	108,030	104,880	873,170	80,270	76,783
68.5	1,150,170	145,830	139,376	1,070,170	130,100	125,223
112	1,400,170	185,390	190,219	1,350,170	177,480	182,298
200	1,786,470	201,860	212,357	1,724,870	199,235	208,828
500	2,446,470	230,010	250,189	2,358,470	226,254	245,142
Average Annual Equivalent Damage [1]			9,114			6,948

[1] Computed by integrating area under frequency-damage curve.

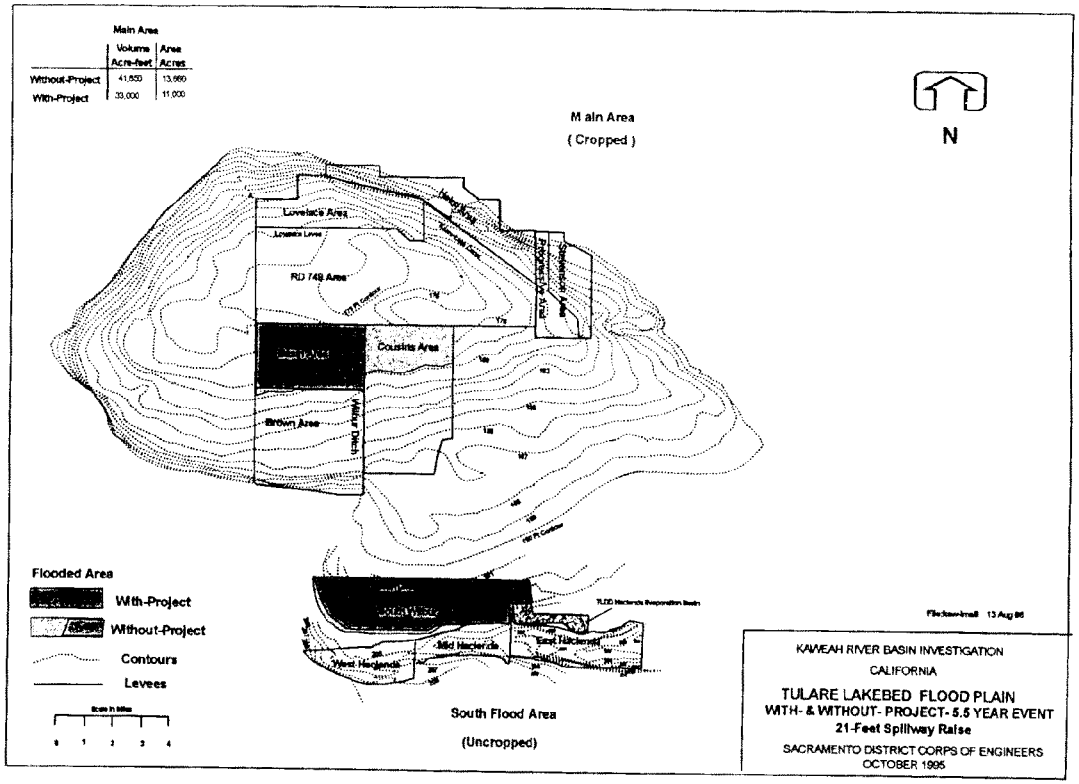

Main Area
Volume Acre-feet
Area Acres
Without-Project
With-Project
Main Area
(Cropped)
N
Lovelace Area
RD 749 Area
Cousins Area
Brown Area
Flooded Area
With-Project
Without-Project
Contours
Levees
South Flood Area
(Uncropped)
KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
TULARE LAKEBED FLOOD PLAIN
WITH- & WITHOUT- PROJECT- 5.5 YEAR EVENT
21-Feet Spillway Raise
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995

FIGURE 5-2

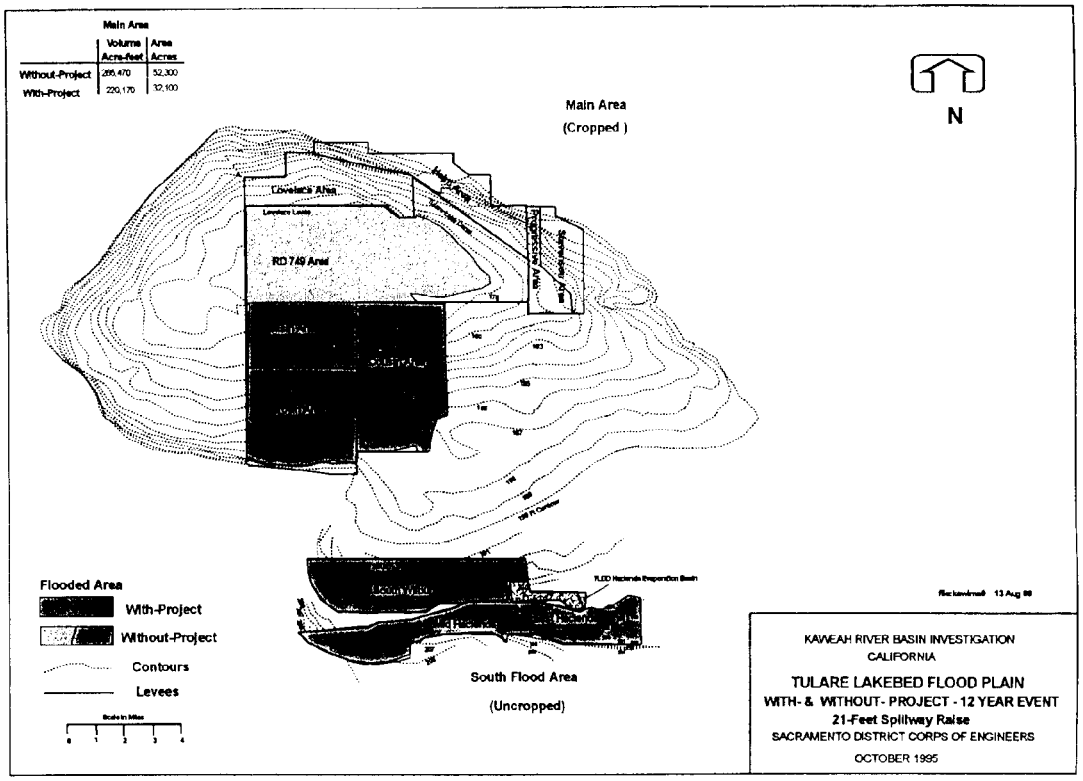

Main Area
Volume Acre-feet
Area Acres
Without-Project 288,470 52,300
With-Project 229,170 32,100
Main Area
(Cropped)
N
RD 749 Area
Flooded Area
With-Project
Without-Project
Contours
Levees
South Flood Area
(Uncropped)
KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
TULARE LAKEBED FLOOD PLAIN
WITH- & WITHOUT- PROJECT - 12 YEAR EVENT
21-Feet Spillway Raise
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995

FIGURE 5-3

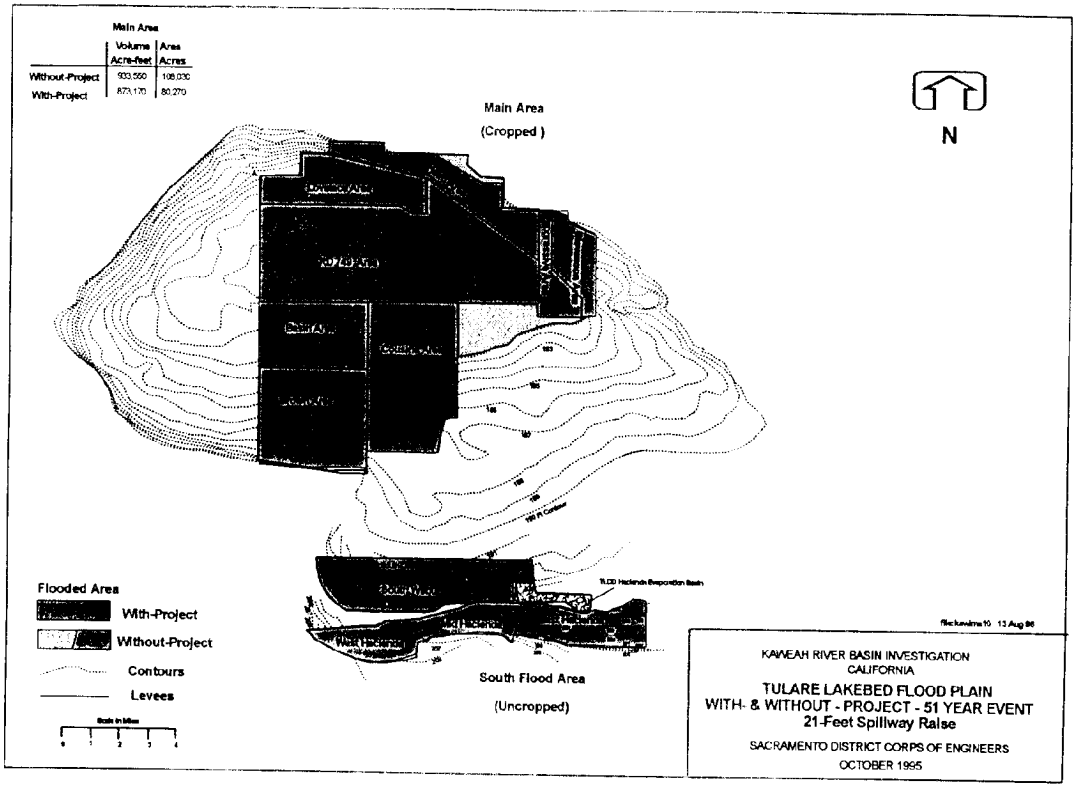

Main Area
Volume Acre-feet
Area Acres
Without-Project
With-Project
Main Area
(Cropped)
N
Flooded Area
With-Project
Without-Project
Contours
Levees
South Flood Area
(Uncropped)
KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
TULARE LAKEBED FLOOD PLAIN
WITH- & WITHOUT - PROJECT - 51 YEAR EVENT
21-Feet Spillway Raise
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995

FIGURE 5-4

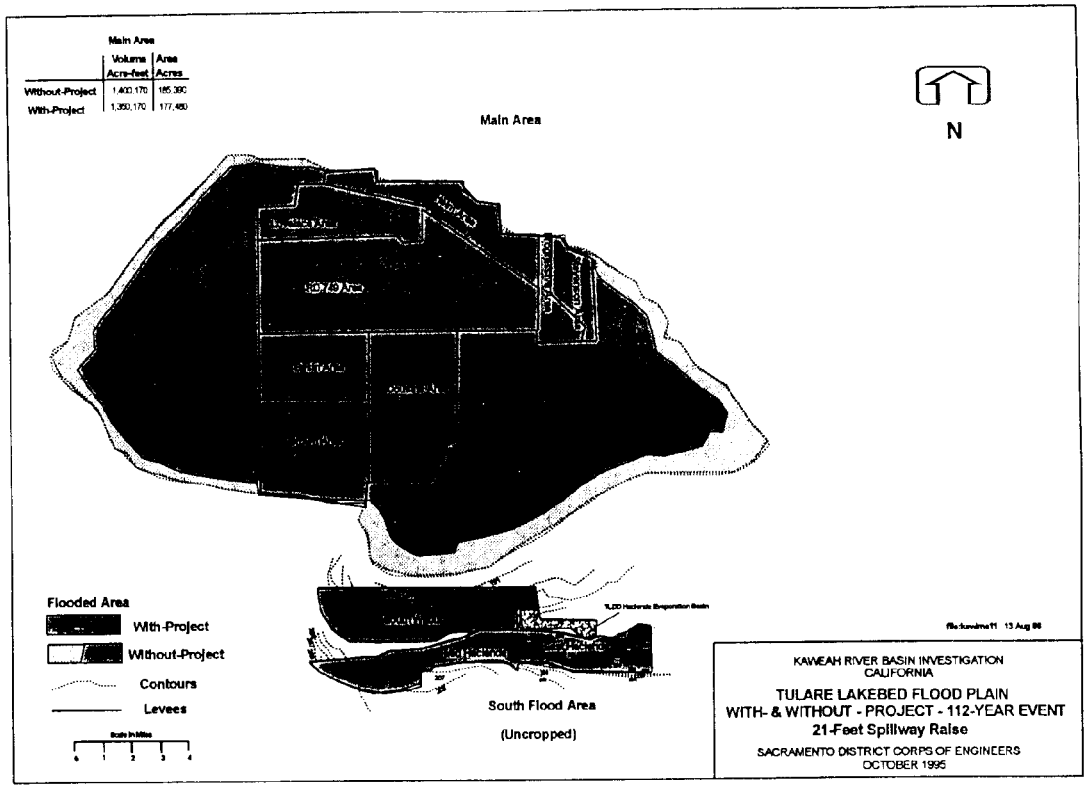

Main Area
Volume Acre-feet
Area Acres
Without-Project 1,400,170 185,390
With-Project 1,350,170 177,480
Main Area
N
Flooded Area
With-Project
Without-Project
Contours
Levees
South Flood Area
(Uncropped)
KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
TULARE LAKEBED FLOOD PLAIN
WITH- & WITHOUT - PROJECT - 112-YEAR EVENT
21-Feet Spillway Raise
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995

FIGURE 5-5

Table 5-5
FLOOD DAMAGES AND FLOOD REDUCTION BENEFITS OF ALTERNATIVES

REACH	NAME	Without-Project Damage ($)	With-Project Damages ($)							
			Alt 3A 10 ft Raise	Benefit	Alt 3B 15 ft Raise	Benefit	Alt 3C 21 ft Raise	Benefit	Alt 3D 26.1 ft Raise	Benefit
1	Visalia	6,632,000	6,787,000	(155,000)	6,216,000	416,000	5,551,000	1,081,000	4,939,000	1,693,000
2	Tulare	1,983,000	2,253,000	(270,000)	2,206,000	(223,000)	2,188,000	(205,000)	2,034,000	(51,000)
3	Farmersville	299,000	309,000	(10,000)	295,000	4,000	279,000	20,000	256,000	43,000
4	Goshen	235,000	241,000	(6,000)	215,000	20,000	180,000	55,000	164,000	71,000
5	Ivanhoe	24,000	27,000	(3,000)	26,000	(2,000)	26,000	(2,000)	24,000	0
6	Above Hwy 99	1,373,000	1,236,000	137,000	1,138,000	235,000	1,028,000	345,000	962,000	411,000
7	Below Hwy 99	317,000	315,000	2,000	290,000	27,000	260,000	57,000	241,000	76,000
8	Above SPRR	150,000	149,000	1,000	142,000	8,000	126,000	24,000	125,000	25,000
Total		11,013,000	11,317,003	(304,003)	10,528,003	484,997	9,638,003	1,374,997	8,745,003	2,267,997
9	Tulare Lakebed	9,114,000	7,168,000	1,946,000	7,104,000	2,010,000	6,948,000	2,166,000	6,895,000	2,219,000
TOTAL		20,127,000	18,485,000	1,642,000	17,632,000	2,495,000	16,586,000	3,541,000	15,640,000	4,487,000

Irrigation Water Supply Benefits. Increasing the storage capacity at Terminus Dam would provide opportunities to increase irrigation water from "in-basin" and "outside-basin" sources. The enlarged reservoir would increase the storage of in-basin water (i.e., surface water from the Kaweah River) and decrease flow releases that exceed irrigation and spreading demand. These flows would ordinarily reach the Tulare lakebed as floodwater. The enlarged storage of Lake Kaweah would also increase opportunities for irrigators to use outside-basin water when it is available. The increased storage at Lake Kaweah would allow storage of surface water from the Kaweah River that would be ordinarily released as irrigation water and substituting it with CVP water. However, benefits for CVP water are not claimed because it is intermittently available and is not a dependable source for water.

The reduction of the average volume of floodwater to Tulare lakebed under with-project and without-project conditions represents the amount of additional in-basin irrigation water supply. This water, which would cause flood damages to Tulare lakebed under without-project conditions, can be used beneficially upstream for irrigation under with-project storage conditions. A value of $32.27 per acre-foot was determined for the irrigation water supply benefits, which were computed using the DWR's ground-water pumping model. The DWR analysis was reviewed and approved by the USBR and determined to be an appropriate model. Energy costs were revised to 1995 prices using Southern California Edison Company energy rates. The value is based on the foregone cost of pumping ground water in the study area. Factors considered are length of pumping lifts, well yields, pumping plant size, power suppliers' power price schedules, and the percentage of total time that a pumping plant is running. The $32.27 per acre-foot does not include fixed costs for existing wells and represents the average energy cost (i.e., on-peak and off-peak rates) of pumping in the area.

The ground-water pumping model estimates irrigation water supply benefits based on a savings equal to the current cost of pumping ground water. An increase of storage capacity at Lake Kaweah would provide additional surface water for irrigation, which would reduce ground-water pumping for irrigation by an equal amount. The additional in-basin water supply provided by each alternative is provided in table 5-6.

Recreation Benefits. In the preliminary phases of plan formulation of these options used for the NED optimization, relocation of all recreation facilities was considered. However, no local sponsor was initially identified to cost share in the studying of relocation of these facilities and so, in the determination of recreation benefits for the NED optimization, the relocation of only minimum recreation facilities was considered. A detailed discussion of these issues is found in the NED optimization section of Appendix C - Economics Analysis. Should a potential

Table 5-6
Irrigation Water Supply Benefits

Option - Description		Average Annual In-Basin Irrigation Water Supply (acre-feet)	Water Supply Benefits (@ $32.27 per acre-foot)
2A	Raise Spillway 10 ft, increase storage at Lake Kaweah by 20,000 acre-feet	750	$24,200
2B	Raise Spillway 15 ft, increase storage at Lake Kaweah by 30,000 acre-feet	4,290	$138,400
2C	Raise Spillway 21 ft, increase storage at Lake Kaweah by 42,600 acre-feet	8,400	$271,000
2D	Raise Spillway 26.1 ft, increase storage at Lake Kaweah by 53,800 acre-feet	10,065	$324,800

sponsor for relocation of recreation facilities surface at a later date full relocation of campsite and other recreation facilities can be considered. Since raising the spillway allows more frequent inundation of campsites and trailer pads, a net decrease in recreation use is likely over the life of the project. The economic loss of this recreation has been valued at $288,000 on an average annual basis.

Hydropower Benefits. In consideration of hydropower facilities, it was determined that impacts to the efficiency of the operations of the existing hydropower facilities would be adverse as a result of raising the spillway. Hydropower interests are not objecting to these losses, since evaluations have shown that upgrading the hydropower facilities is a sound economic decision. Analysis of the upgraded hydropower facilities to handle the increased head indicates there would be incidental hydropower benefits ($12,000 average annual benefits for the 21-foot raise). Under current Federal policies, hydropower costs are a 100 percent non-Federal sponsor cost. The owners of the power facilities have indicated a willingness to upgrade the existing facilities to accommodate the increased head as a result of raising the spillway. These adverse economic costs do not influence the NED optimization.

Benefit Summary. The average annual flood control, irrigation water supply, and recreation benefits for the four alternatives are summarized in table 5-7. Incidental hydropower is not considered in the total benefits.

Table 5-7
Summary of Average Annual Equivalent Benefits
(@ October 1995 Price Levels)

Benefit	Option 2A (10 feet)	Option 2B (15 feet)	Option 2C (21 feet)	Option 2D (26.1 feet)
Inundation Reduction	$1,642,000	$2,495,000	$3,541,000	$4,487,000
Bridge Relocation	$17,000	$17,000	$17,000	$17,000
Water Supply	$24,200	$138,400	$271,000	$324,800
Recreation	($288,000)	($288,000)	($288,000)	($288,000)
Hydropower	($76,500)	($172,200)	($287,000)	($382,700)
Total	$1,318,700	$2,190,200	$3,254,000	$4,158,100

NED Optimization

Feasibility-level cost estimates were developed for the spillway height modifications used for the NED optimization. Costs include lands and damages; relocations; minimal resiting of existing recreational facilities; modification of the spillway; cultural resources preservation; engineering and design, supervision and administration, interest during construction, and operation and maintenance costs. Table 5-8 is a cost summary of the alternatives.

Table 5-9 presents the net benefits for the 2A, 2B, 2C, and 2D optimization points. The differences between the annualized benefits and costs for each option are the net benefits. Optimization occurs at the point where highest net benefits occur. Curves comparing annualized costs, benefits, and net benefits for Options 2A, 2B, 2C, and 2D are shown in figure 5-6. Polynomial regression techniques were used to generate these curves from the four spillway height data points. Flow-frequency relationships tended to drive the optimization of spillway height up from the 10-foot option. Cost jumps associated with additional relocation requirements beginning at about the 22-foot raise tended to provide an upper limit on the optimization. The development of the optimization curves, the factors influencing the optimization, and a sensitivity analysis are fully described in Appendix C - Economics Analysis.

Table 5-8
Cost Summary
(In $1,000, @ October 1995 Prices, 7-5/8% Interest Rates)

Code of Account Item	Raise Terminus Spillway 10 feet ($1,000)	Raise Terminus Spillway 15 feet ($1,000)	Raise Terminus Spillway 21 feet ($1,000)	Raise Terminus Spillway 26.1 feet ($1,000)
First Cost				
1. Lands and Damages	6,044	6,145	6,329	6,349
2. Relocations	2,634	2,718	2,836	4,698
3. Reservoirs	407	507	743	846
4. Dams	2,299	6,826	14,322	29,576
6. Mitigation	974	1,727	2,617	3,862
8. Roads	122	356	645	1,030
14. Recreation Facilities	118	118	291	291
18. Cultural Resources	0	0	0	0
20. Permanent Operating Equipment	0	0	0	0
30. Engineering and Design	3,061	3,194	3,688	4,109
31. Supervisor and Administration	1,074	1,567	2,371	3,822
Total First Cost	16,733	23,158	33,842	54,583
Interest During Construction	742	836	1,075	1,454
Total Investment Cost	17,475	23,994	34,917	56,037
Annual Costs				
Interest and Amortization	1,333	1,831	2,644	4,276
Operation, Maintenance, Repair	20	20	20	20
Total Annual Cost	1,353	1,851	2,664	4,296

Note: The cost estimates are of feasibility level and are used for project optimization. The M-CACES costs are presented in Chapter 6.

Table 5-9
Economic Summary of NED Optimization
(Costs and Benefits in $1,000's)

Annual Benefits	Alternatives			
	2A Raise Terminus Spillway (10 ft)	2B Raise Terminus Spillway (15 ft)	2C Raise Terminus Spillway (21 ft)	2D Raise Terminus Spillway (26 ft)
Flood Control [1]	1,659	2,512	3,558	4,504
Water Supply	24	138	271	325
Recreation	(288)	(288)	(288)	(288)
Hydropower	(76,500)	(172,200)	(287,000)	(382,700)
Total Annual Benefits	1318.7	2190.2	3254	4158.1
Total Annual Costs	1,353	1,851	2,644	4,276
Net Annual Benefits	(34.3)	339.2	610	(-117.9)

[1] Includes inundation reduction and advance bridge replacement benefits.

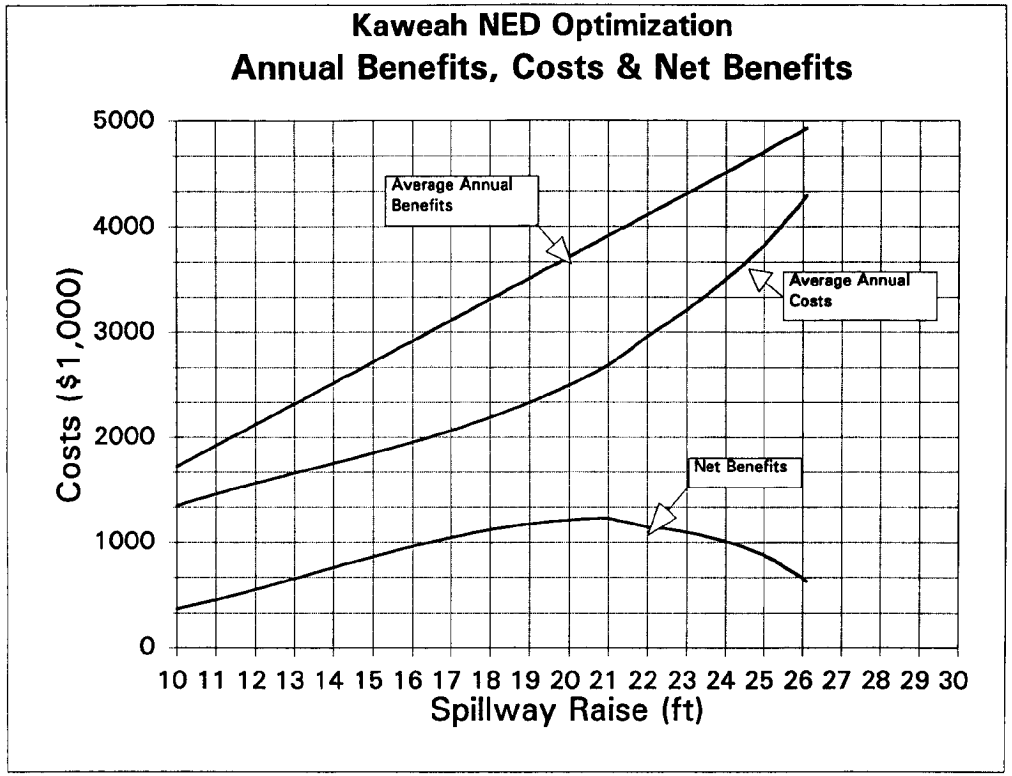

Kaweah NED Optimization
Annual Benefits, Costs & Net Benefits
Average Annual Benefits
Average Annual Costs
Net Benefits
Costs ($1,000)
5000
4000
3000
2000
1000
0
10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
Spillway Raise (ft)

Figure 5-6

Based upon the optimization process, the "Increase Lake Kaweah Storage (21-foot Spillway Raise)" alternative was identified as the NED plan.

ACCEPTABILITY

The "Increase Lake Kaweah Storage (21-foot Spillway Raise)" alternative complies with all applicable laws, regulations, and policies.

ADDITIONAL ALTERNATIVE FORMULATION

Raise Spillway at Terminus Dam by 21 Feet and Change Precipitation Parameter (Locally Preferred Plan)

The operational parameter of the 21-foot NED plan maintains a 7,000 acre-foot conditional storage space over the life of the project even as sediment accumulates. Consequently, a 21-foot spillway raise alternative was formulated which incorporated an alternative precipitation parameter and conditional storage space. This plan effectively optimizes flood control operations while maintaining a 7,000 acre-foot conditional storage space similar to that which existed under the original operating criteria of the reservoir. Other operational scenarios offer the ability to increase water supply benefits, improve fishery resources within the reservoir, and maintain existing recreation uses.

FINAL ALTERNATIVES

Based upon the evaluations done in the reformulation process, three alternatives were carried forward as final alternatives for detailed analysis and full environmental analysis. These are the No-Action Plan, the 21-foot NED Spillway Raise, and the 21-foot Locally Preferred Plan (LPP) Spillway Raise. Each of these plans are described below.

Alternative 1 - No Action

Under this plan, the Federal Government would take no action toward implementing a flood control project, and the flood threat would continue unchanged to the city of Visalia, surrounding communities, and to the agricultural areas including the Tulare lakebed. It was assumed that future population trends, land use, and related urban growth in the study area would continue generally as described in current local plans. The cities and counties would require developers to flood proof future developments.

The average annual equivalent flood damages are expected to reach about $20.1 million in the study area. Over time, the flood control storage space at Lake Kaweah would diminish as sediment accumulates in the reservoir, which would decrease the level of flood protection afforded to downstream areas and decrease the opportunities to store water at Lake Kaweah during winter months. The loss of storage capacity would adversely impact the fisheries and recreation use at Lake Kaweah during winter months.

Alternative 2 - 21-Foot NED Spillway Raise

Main features of this plan include:

- The spillway at Terminus Dam would be raised by 21 feet and widened by 148 feet.
- An ungated ogee section would be placed over the existing broadcrested sill.
- The total land required for construction would be 506 acres, including 370 acres that would be inundated in the reservoir area.
- The existing State Highway 198 Bridge over Horse Creek would be relocated immediately upstream from the existing bridge.
- Improvements to be purchased in fee and removed would include one motel and 6 dwellings, and 29 ownerships would be acquired in fee.
- To maintain basic minimum facilities, two vault toilets would be relocated, the boat ramp at Lemon Hill would be extended to remain above the new gross pool, and the county boat patrol building at Lemon Hill would also be relocated above the new gross pool.

Major accomplishments of this plan include:

- The plan would raise the gross pool by 21 feet and add 42,600 acre-feet of flood storage space in Lake Kaweah.
- The plan would increase the levels of flood protection to the 69-year event for downstream communities and the 3.2-year event for the Tulare lakebed.
- An additional average annual irrigation water supply of 8,400 acre-feet could be stored in the reservoir.

Primary operational features of the plan are:

- Timing of releases would not change.
- Reservoir storage during the rain flood and snowmelt season would increase, decreasing downstream flooding and increasing irrigation water supply.

This plan restores the conditional rain flood storage at Lake Kaweah. Under this plan, 7,000 acre-feet of conditional rain flood storage space is maintained over the life of the project even as sediment fills in the reservoir space.

Alternative 3 - 21-Foot LPP Spillway Raise

The primary features of this plan are:

- Structural features would be the same as Alternative 2.
- The water control diagram and basin wetness parameter for Lake Kaweah would be modified.

The major accomplishments are:

- Maximum conditional storage during the rain flood season would be increased from 7,000 to 12,000 acre-feet.

Operational considerations are:

- Timing of releases would be the same as Alternative 2.
- The plan would increase the levels of flood protection to the 66-year event for downstream communities and the 2.9-year event for the Tulare lakebed.
- An additional average annual irrigation water supply of 8,500 acre-feet could be stored in the reservoir.

This plan was developed similar to Alternative 1 only with a conditional rain flood storage space of 12,000 acre-feet which would be maintained over the 100-year project life. This alternative consists of raising the spillway sill at Terminus Dam by 21 feet, widening the spillway from 307 feet to 455 feet, and modifying the precipitation parameter. It is structurally identical to the NED plan, but the reservoir operation is different. Under this plan, the conditional rain flood space is maintained at 12,000 acre-feet during the winter season over the life of the project. Under this operating condition, up to 12,000 acre-feet can be stored during the winter flood season if water is available and antecedent rainfall conditions are favorable.

Annual flows to the Tulare lakebed above a 5-year event would be virtually identical for the NED and LPP. However, the LPP increases releases during rain flood events and provides a lower level of flood protection to the downstream area from rain floods as compared to the NED plan.

The increase of the conditional rain flood space from 7,000 acre-feet to a constant 12,000 acre-feet over the project life increases the maximum capacity of the conditional rain flood space by 5,000 acre-feet. This increase improves water supply benefits and provides additional security for the fishery resources of the lake and the existing recreational opportunities.

Comparison of Flood Damage Reduction Benefits

The flood damage reduction benefits decrease for the LPP due to the difference in reservoir operating criteria, but the LPP would help protect the fish and wildlife at the reservoir and recreational opportunities.

The average annual without-project damages and with-project flood control damages for the LPP and NED are shown in table 5-10. The average annual additional in-basin irrigation water supply, water supply, inundation reduction, and bridge relocation benefits are summarized in table 5-11.

Comparison of Costs and Benefits

Table 5-12 shows a comparison of average annual costs and benefits for the LPP and NED plan. As can be seen, the net economic benefits of the NED plan would be over double benefits of the LPP.

Comparison of Environmental Impacts and Mitigation

Table 5-13 summarizes the adverse environmental effects of the three alternatives on the significant resources. Those resources that would experience long-term impacts and require mitigation measures beyond best management practices include vegetation and wildlife and endangered species. Table 5-14 summarizes the mitigation measures to avoid, minimize, or compensate the adverse impacts of the NED plan and LPP.

Table 5-10
Flood Damages and Flood Reduction Benefits
($1,000 @ October 1995 Price Level, and 7-5/8 Percent Discount Rate)

Reach	Area	Without-Project Damage	LPP		NED Plan	
			With-Project Damages	Benefit	With-Project Damages	Benefit
1	Visalia	6,632	5,624	1,008	5,551	1,081
2	Tulare	1,983	2,202	(219)	2,188	(205)
3	Farmersville	299	282	17	279	20
4	Goshen	235	183	52	180	55
5	Ivanhoe	24	26	(2)	26	(2)
6	Above HWY 99	1,373	1,041	333	1,028	345
7	Below HWY 99	317	264	53	260	57
8	Above SPRR	150	128	22	126	24
Total		11,013	9,749	1,264	9,638	1,375
9	Tulare Lakebed	9,114	6,947	2,167	6,948	2,166
Total		20,127	16,696	3,431	16,586	3,541
	Bridge Replacement			17		17
Total				3,448		3,558

Table 5-11
Summary of Average Annual Equivalent Benefits
($1,000 @ October 1995 Price Levels, and 7-5/8 Percent Discount Rate)

Alternative-Description		Average Annual In-Basin Irrigation Water Supply 1,000 (acre-feet)	Water Supply Benefits (@ $32.27 per acre-feet)	Inundation Reduction Benefits	Bridge Relocation Benefits	Total Benefits
LPP	Raise Spillway 21 ft, increase storage at Lake Kaweah by 42,600 acre-feet, 12,000 acre-foot precipitation parameter	8.5	$274	$3,431	$17	$3,448
NED Plan	Raise Spillway 21 ft, increase storage at Lake Kaweah by 42,600 acre-feet, 7,000 acre-foot precipitation parameter	8.4	$271	$3,541	$17	$3,558

TABLE 5-12
Economic Comparison of Plans

Item	LPP	NED Plan
Annual Costs	2,664	2,664
Annual Benefits	3,448	3,558
Net Benefits	784	894

TABLE 5-13
Summary of Environmental NED Plan Effects

Affected Environment	No Action	NED Plan	Locally Preferred Plan
Land Use	Urban and agricultural development would continue as it does now.	No change from current trends is expected.	No change from current trends is expected.
Socioeconomics	Population would continue to increase.	No change from current trends is expected.	No change from current trends is expected.
Recreation	Fishery resources would likely decline. Use of all other recreation facilities would increase.	Some recreation facilities would be periodically inundated. Fishery conditions would likely decline.	Some recreation facilities would be periodically inundated. Fishery conditions would improve in the winter.
Hazardous, Toxic, and Radiological Waste	Current monitoring and remediation efforts at identified HTRW sites would continue.	The proposed project may accelerate the plume associated with the LUFT site at Kaweah Recreation Area and in Three Rivers.	The proposed project may accelerate the plume associated with the LUFT site at Kaweah Recreation Area and in Three Rivers.
Transportation	Traffic volumes and LOS on SR198 at the reservoir would not change. Traffic volumes and LOS on roads in the downstream area would change due to increasing congestion. Conditions at the lakebed would not change.	Effects would be temporary and of short duration. and would consist of mainly traffic delays due to construction equipment and work at Horse Creek Bridge.	Effects would be temporary and of short duration and would consist of mainly traffic delays due to construction equipment and work at Horse Creek Bridge.
Noise	Noise levels would be the same as existing conditions.	Adverse noise effects due to the project would be short-term construction effects. Increased noise would be generated from heavy equipment during construction at the reservoir.	Adverse noise effects due the project would be short-term construction effects. Increased noise would be generated from heavy equipment during construction at the reservoir.
Air Quality	Regional air pollution emission rates would not change and may improve over time with stricter standards.	Adverse air quality effects would be temporary and shortterm due to construction activities. Emissions would be due to construction equipment and other construction-related emissions.	Adverse air quality effects would be temporary and short-term due to construction activities. Emissions would be due to construction equipment and other construction-related emissions.
Water Quality	Surface and ground water quality would not change from existing conditions.	The proposed project would not have any adverse effects on water quality if best management practices are implemented.	The proposed project would not have any adverse effects on water quality if best management practices are implemented.

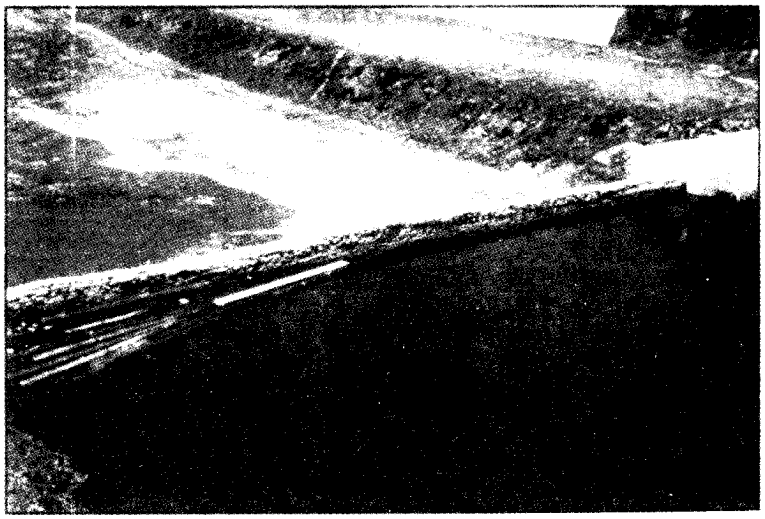
TABLE 5-13
Summary of Environmental NED Plan Effects

Affected Environment	No Action	NED Plan	Locally Preferred Plan
Vegetation and Wildlife	There would be no significant changes from existing conditions at the reservoir. No change is expected downstream or at the lakebed.	Construction and inundation would affect 93 acres of riparian scrub, 70 acres of riparian forest, 132 acres of oak savannah, and 38 acres of oak woodland. The downstream area would not be adversely affected and 1,412 average annual acres in the lakebed would be affected due to reduction in flooding.	Construction and inundation would affect 93 acres of riparian scrub, 70 acres of riparian forest, 132 acres of oak savannah, and 38 acres of oak woodland. The downstream area would not be adversely affected and 1,412 average annual acres in the lakebed would be affected due to reduction in flooding.
Fisheries	Fishery resources would decline due to the lack of sediment storage space to provide water during the winter.	Fishery conditions would decline as described for Alternative 1.	Fishery conditions in the winter would improve over conditions described for Alternative 1.
Endangered Species	Habitat conditions would likely continue to decline without further protection.	The valley elderberry longhorn beetle, a listed species, would be adversely affected. Foraging habitat for the bald eagle will remain the same as in without project. Two candidate plant species may also be affected.	Foraging habitat for the bald eagle would likely improve. The only listed species to be adversely affected would be the valley elderberry longhorn beetle. Two candidate plant species may also be affected.
Cultural Resources	On a regional basis, cultural resources sites would continue to be adversely affected due to urban expansion, agricultural practices, and natural processes.	No adverse effects to cultural resources would occur with the project.	No adverse effects to cultural resources would occur with the project.

TABLE 5-14
Summary of Mitigation

Affected Environment	NED Plan or LPP
Land Use	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.
Socioeconomics	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.
Recreation	A non-Federal cost-sharing partner has not been identified at this time; therefore; no recreation sites would be relocated.
Hazardous, Toxic, and Radiological Waste	HTRW sites affected by this alternative or project mitigation would be remediated according to applicable Federal, State, and local regulations.
Transportation	Temporary short-term construction effects would be mitigated through best management practices.
Noise	Temporary short-term construction effects would be mitigated through best management practices.
Air Quality	Temporary short-term construction effects would be mitigated through best management practices.
Water Quality	There would be no adverse effects due to this alternative if best management practices are implemented; therefore, no mitigation would be needed.
Vegetation and Wildlife	Mitigation includes 21 acres for riparian scrub, 14 acres for riparian forest, 320 acres for oak savannah, 99 acres for oak woodland, and 366 acres for wetland habitat.
Fisheries	Conditions for fisheries would not change from without-project conditions; therefore, no mitigation for fisheries would be needed.
Endangered Species	Mitigation for the valley elderberry longhorn beetle includes planting 276 elderberry seedlings/cuttings on 2.1 acres on project lands.
Cultural Resources	There would be no adverse effects to cultural resources; therefore, no mitigation would be needed.

Chapter 6
The Selected Plan



Temp rary sandbag barrier, 4 1/2 feet high, erected across the spillway at Terminus Dam n 1969.

Chapter 6

THE SELECTED PLAN

PLAN DESCRIPTION

This chapter describes the components, accomplishments, and impacts of the NED plan and locally preferred plan (LPP). The NED plan is described along with the LPP for comparison purposes. The NED plan is the selected plan. The non-Federal sponsors support the NED plan but strongly favors the LPP. The non-Federal sponsor has indicated that the No-Action plan is not acceptable. The selected plan maximizes flood control benefits compared to the LPP. The LPP has water supply, fish and wildlife, and recreational advantages. Cost allocations for both the NED and LPP are provided in Chapter 7.

Flood Control Features

Both the NED plan and LPP consist of constructing a 21-foot-high concrete ogee across the spillway and widening the spillway at Terminus Dam from 307 feet to 455 feet. This would raise the gross pool elevation by 21 feet from 694 feet to 715 feet and add 42,600 acre-feet of flood control storage space in Lake Kaweah. The gross pool will be jointly used for irrigation water supply. No additional space is reserved for sediment storage. Over the project life, the flood control storage space is expected diminish as sediment accumulates in the reservoir at a rate of 120 acre-feet per year, or 12,000 acre-feet over 100 years.

Accomplishments

The NED plan would decrease the frequency of uncontrolled spills from Terminus Dam from about a 46-year event to about a 69-year event. The NED plan would decrease flooding to Farmersvillle, Goshen, and agricultural areas along the Kaweah River and St. Johns River. The plan would reduce the volume, area, and duration of flooding in the Tulare lakebed. With the NED plan, the frequency of damages in the Tulare lakebed would decrease from about a 2.9-year event to a 3.1-year event.

The LPP would decrease the frequency of uncontrolled spills from Terminus Dam from about a 46-year event to about a 66-year event. Under the LPP, the frequency of damages in the Tulare lakebed would decrease from about a 2.9-year event to a 3.2-year event.

Benefits include flood damage reduction and irrigation water supply benefits. Incidental hydropower and employment benefits are attained by the project. The NED and LPP would reduce flood damages up to about the 225-year event. However, for rare events larger than the 225-year, the project would increase downstream flows

through the spillway due to the wider spillway crest. The overall flood damage reduction benefits far exceed the potential increase in damages for the rarer events.

Hydrology

Without- and with-project peak flow-frequency relationships and volumetric flow-frequency relationships below Terminus Dam are shown in figures 6-1 and 6-2, respectively.

Flood Plain Effects

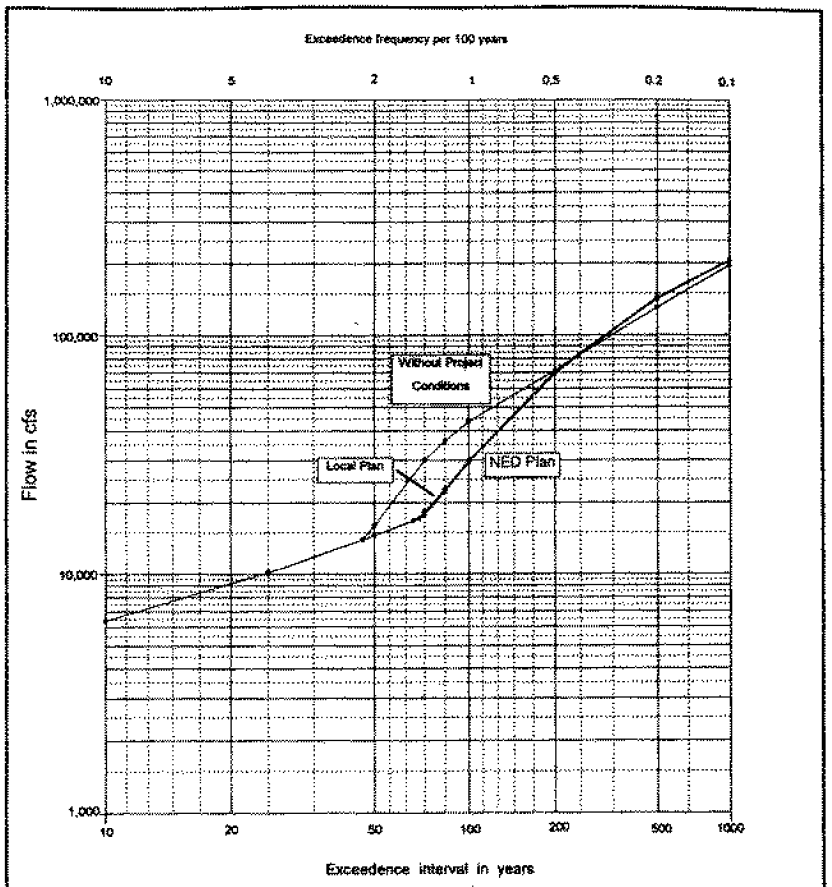
Flood damages along the Kaweah River, St. Johns River, and Cross Creek will be reduced. The alluvial fan flood plain is extensively developed for agricultural, grazing, and urban uses. Very little land remains in native historic condition. No change in land use is projected under the NED plan and LPP. Reducing flood depth is not expected to have a significant impact on land use.

Flood damages will be reduced in the flood plain with the increased storage effected by the raising of the spillway 21 feet for both the NED and LPP. The flood protection from rain floods would be greater for the NED plan than the LPP. For instance, the 100-year flood in the downstream area below Mckays Point for the NED plan is 29,400 cfs and for the LPP 29,900 cfs. The without-project 100-year flow is 43,700 cfs.

In the Tulare lakebed, the LPP would reduce flooded acreage by 2,660 acres for the 5.5-year event, 20,200 acres for the 12-year event, 27,760 acres for the 51-year event, and 7,910 acres for the 112-year event. The LPP would result in less volume of floodwater reaching Tulare lakebed than the NED plan for flood frequencies less than the 5-year event. For events greater than a 5-year event, the volumes reaching the lakebed are essentially the same.

Flood Control Storage

Sediment is estimated to accumulate in the reservoir at a constant 120 acre-feet per year for both the with- and without-project conditions. By the year 2000, it is estimated that there would be 140,700 acre-feet of storage space at the reservoir. At the end of a 100 years, it is estimated 12,000 acre-feet of sediment would accumulate in the reservoir. The average mean without-project storage over the 100-year period would be 134,700 acre-feet.



BASED ON 100-YR AVERAGE
Includes Dry, Mehrten, and Yokohl Creeks

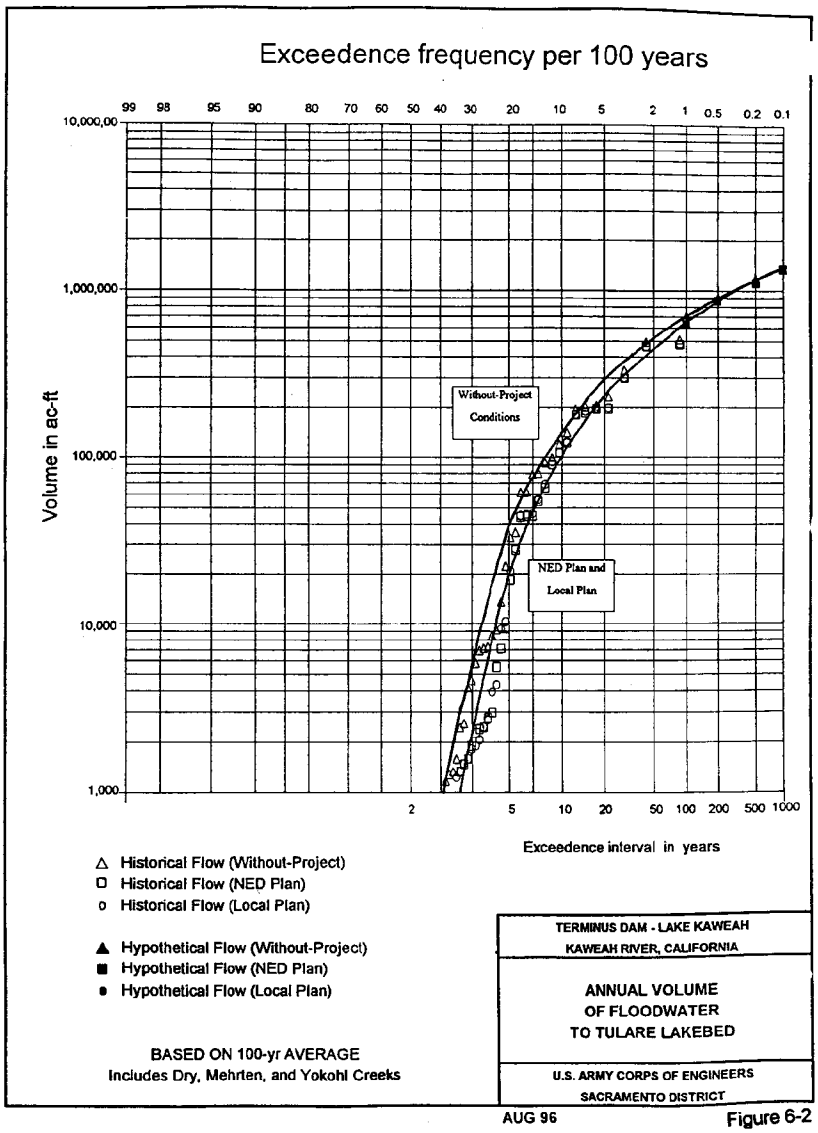
TERMINUS DAM - LAKE KAWEAH
KAWEAH RIVER, CALIFORNIA

REGULATED PEAK FLOW
BELOW
TERMINUS DAM

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

AUG 96

Figure 6-1



TERMINUS DAM - LAKE KAWEAH
KAWEAH RIVER, CALIFORNIA

ANNUAL VOLUME
OF FLOODWATER
TO TULARE LAKEBED

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

AUG 96

Figure 6-2

Both the NED plan and LPP would provide an additional 42,600 acre-feet of storage. The mean average storage over the 100-year life of the project would be 177,300 acre-feet. A higher level of flood protection is afforded at the beginning of the project, decreasing as sediment accumulates in the reservoir. Flood control benefits are calculated using the average mean flood control storage space of 177,300 acre-feet over 100 years. The reservoir storage for without- and with-project conditions is shown in table 6-1.

Table 6-1
Reservoir Storage

	Without-Project					With-Project (NED Plan)			With-Project (LPP)		
	1962	1977	2000	2050	2100	2000	2050	2100	2000	2050	2100
Additional Storage	-	-	-	-	-	42,600	42,600	42,600	42,600	42,600	42,600
Sediment Accumulation	0	7,000 [2]	9,300	15,300	21,300	9,300	15,300	21,300	9,300	15,300	21,300
Sediment Storage Space [3]	8,000	1,000	0	0	0	0	0	0	0	0	0
Flood Control Space	142,000	142,000	140,700	134,700	128,700	183,300	177,300	171,300	183,300	177,300	171,300
Total Storage Space[4]	150,000	143,000	140,700	134,700	128,700	183,300	177,300	171,300	183,300	177,300	171,300
Winter Conditional Storage	15,000	8,000	7,000	0	0	7,000	7,000	0	12,000	12,000	12,000

[1] Selected Plan.
[2] Based on hydrographic survey in 1977.
[3] Sediment accumulation rate estimated at 120 acre-feet per year.
[4] Includes conditional rain flood storage space of 7,000 acre-feet for NED plan and 12,000 acre-feet for LPP.

Reservoir Operation

Reservoir operations are generally governed by the water control diagram established for each alternative. From May to September, the reservoir is operated to control snowmelt runoff and to optimize irrigation water supply. Under the flood control plan, rain flood storage space in the reservoir is provided for between 1 September and 1 May. A portion of the rain flood storage space allocated for the rain flood season between September and May is also designated as conditional rain flood storage space. The primary purpose of this conditional storage space is flood control. However, criteria established governing the storage of water in this space during the winter allow reservoir releases to be deferred and runoff stored as potential irrigation water based upon a basin-wetness parameter. When substantial rainfall has occurred within the upper watershed, the operational criteria dictate that storage being held in the conditional rain flood storage space may be evacuated to assure enough empty

reservoir space during the rain flood season to assure flood protection. If upper watershed conditions are dry, this conditional space allows the early storage of floodwaters during the winter months for ultimate use during the summer months. This can be a very important source of water in drought years. This conditional storage space is very important in providing flexibility in water supply operations.

The additional storage space provided by the NED plan and LPP will allow greater storage of snowmelt during the spring and summer months, which will allow for water releases for a longer period during the irrigation season.

Under the NED plan, conditional rain flood storage would be up to 7,000 acre-feet. The 7,000 acre-feet of conditional rain flood storage would be maintained as sediment accumulates in the reservoir. Under the LPP, conditional rain flood storage would be 12,000 acre-feet. This 12,000 acre-feet of conditional rain flood storage would be maintained over the project life, regardless of the sediment accumulation in the reservoir. The flood control storage space over the project life would be less than the NED plan.

Conservation Storage

During the spring and summer, the reservoir is used for irrigation water storage. The NED plan would increase the average annual irrigation water supply of the Kaweah River service area by approximately 8,400 acre-feet. This is not new water to the system, but is water that currently occurs as floodwater in the spring and early summer and that cannot be used for irrigation and ends up in the Tulare lakebed. This floodwater would be captured in the enlarged reservoir space and released as irrigation water at a more appropriate (i.e., later) time for use by farmers.

The LPP would increase Kaweah River average annual irrigation water supply storage by 8,500 acre-feet in the Kaweah River service area, which is water that would otherwise flow into the Tulare lakebed as floodwater.

Recreation

Under the NED plan and LPP, on an average annual basis, the surface area of the reservoir pool during the recreation (summer) season would increase by 216 acres (from 1,142 to 1,358 acres). The average annual gross pool would be increased from elevation 634 feet m.s.l. to 649 feet m.s.l., an increase of 15 feet. The maximum surface area at gross pool would increase from 1,913 acres at 694 feet to 2,154 acres at 715 feet, an increase of 241 acres. The average increases in pool elevation are shown in figure 6-3.

Under the NED plan and LPP, overall recreation opportunities would decrease, resulting in a net loss of $288,000 average annual benefits; there is no storage space

dedicated to recreation. The existing recreation facilities sited between the existing gross pool and the new gross pool elevation would be subject to more frequent inundation, occur once every 3 years on the average. Basic minimum facilities will be resited, such as vault toilets at the Kaweah and Horse Creek Recreation Areas and boat launch ramp at the Lemon Hill Recreation Area. The boat launch ramp, picnic area, and parking area at Kaweah Recreation Area and campsites and trailer pads at Horse Creek Recreation Area which are not considered basic facilities required for health safety and operation of the facility will not be resited. Because access to the lake will be affected with one less usable boat ramp and reduced parking, day-use at the picnic and trailer areas would be reduced when the water surface in the lake exceeds the existing gross pool elevation of 694 feet. The impacts to recreational use are (1) reduced access to reservoir via lost boat launch ramp at Kaweah Recreation Area, (2) reduced parking at the Kaweah Recreation and Slick Rock Areas, and (3) reduced campground use in the summer when recreation usage is near peak levels.

The LPP would provide a larger conditional storage pool during the winter season and would provide a constant 12,000 acre-feet of winter conditional pool over the project life. This compares to the 7,000 acre-foot winter conditional pool with the NED plan. The LPP would lessen the probability of adversely affecting existing recreation opportunities compared to the without-project condition and the NED plan. With additional carryover water from the winter, the spring and summer storage pool would be attained earlier than under the NED plan. The size of the winter pool does not significantly affect winter lake recreational usage.

Hydropower

A 17-megawatt hydropower plant was retrofitted to Terminus Dam in 1990. Under existing conditions, it produces an estimated 42,619 megawatts of power. Under existing conditions, with an increase in the spillway height, the hydropower capacity would diminish because the turbines cannot produce power when the gross pool elevation exceeds 701 feet. Without improvements to the existing facilities, the NED plan and LPP are estimated to reduce hydropower to 34,924 megawatts— a loss of 7,695 megawatts. This is estimated to represent an economic loss of $287,000 annually. Because of these anticipated losses, the owners have examined the potential for making improvements to the power facilities independent of the proposed spillway raise. The owners have determined through preliminary studies that it would be economically feasible to make these improvements. The current owners have provided a letter dated March 25, 1996, indicating their intent to make the required modifications to eliminate this loss provided final feasibility studies continue to show favorable feasibility. The cost of upgrading hydropower facilities is not considered a project cost however. While the hydropower owners are expected to retrofit the existing hydro facilities at a cost of about $932,500 if the Federal spillway project is completed, resulting in an increase in poer generation beyond the loss, the retrofit is not part of the Federal project and the benefits of the non-Federal retrofit are not

AVERAGE MONTHLY INCREASE IN ELEVATION
DUE TO LAKE KAWEAH ENLARGEMENT

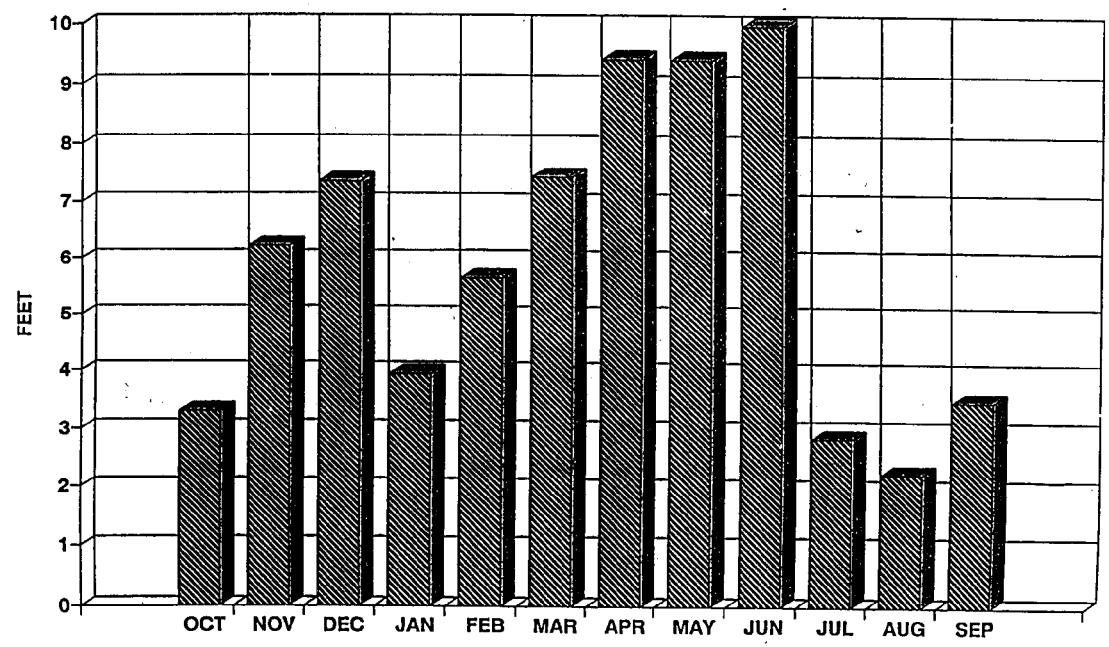


FIGURE 6-3

necessary to justify the Federal project. Since the estimated net profits of the hydropower upgrade would be minimal, there is no compelling need for the hydropwer owner to share in the costs of the spillway project modification.

Other Project Features

Several other existing features at Terminus Dam and around Lake Kaweah require reconstruction. The access road over the spillway would require lengthening and additional supporting columns. The boat launch ramp at Lemon Hill Recreation Area would be extended to the new gross pool elevation of 715 feet. The County of Tulare boat patrol office would be relocated to an area above 715 feet. Vault toilets at the Kaweah and Horse Creek Recreation Areas would be relocated above the new gross pool.

Relocations

Both the NED plan and LPP would increase of the gross pool elevation and would require the relocation of State Highway 198 Bridge (Horse Creek Bridge) farther upstream over Horse Creek. Presently, the lowest elevation on the Horse Creek Bridge is 711.4 feet. The bridge will be reconstructed to an elevation of 718 feet. The roadway approaches to the bridge would also require modification and relocation. The bridge would be designed to existing State highway design standards. No other existing roads will require relocation. The relocated bridge will be constructed adjacent to the existing bridge, which would remain open until the new bridge is constructed. The existing bridge cannot simply be raised for the double curvature bridge but must be reconstructed. Therefore, traffic should not be adversely affected. The old bridge would be demolished after the new bridge is completed. Utility lines to be relocated include 300-kilovolt and 12-kilovolt power and telephone lines that cross Horse Creek.

Real Estate

Real estate requirements and costs would be identical for the NED plan and LPP. Real estate acquisition and relocation would be required for one motel and six dwellings in the Slick Rock Area. Real estate costs are presented in table 6-2.

Table 6-2
Real Estate Requirements at Lake Kaweah

Type	Description	Total Cost ($)
Fee	Lake and Highway 198 lands (614.74 ac) 6 Dwellings 1 Motel	1,990,625 972,000 1,458,000
Mitigation Lands	825 acres appraised	2,228,600
Relocations	(1 Motel, 6 Dwellings)	175,000
Administrative Costs	Mitigation Lake Kaweah	82,300 1,008,500
Total		7,915,025

ENVIRONMENTAL IMPACTS

The environmental impact of the NED plan and LPP would be comparable. Under both plans, there would be the loss of habitat in two locations: (1) at Lake Kaweah in the inundated areas of the enlarged gross pool and (2) areas with reduced flooding downstream in the Tulare lakebed.

HEP Analysis

HEP Analysis - FWS together with Corps environmental staff performed a HEP analysis to assess adverse effects at the Kaweah Reservoir area and the Tulare lakebed. Tables 6-3 and 6-4 display the inundation impacts at Lake Kaweah.

Potentially Affected Species

Species of special concern may be adversely affected by the loss of habitat and disturbances associated with raising the spillway at Lake Kaweah by 21 feet. In addition, several habitats of potential value would be affected. These include riparian scrub, riparian forest, oak savannah and oak woodland.

Table 6-3
Inundation Impacts at Kaweah Reservoir

Cover Type	Inundation Impacts (acres)		Total Inundation Impacts (acres)
	< 694 feet	694-715 feet	
Riparian Scrub-shrub	91	1	92
Riparian Forest	60	10	70
Oak Woodland	2	36	38
Oak Savannah	7	125	132
Grassland	0	63	63
Riverine	7	0	7
Disturbed Area	0	8	8
Totals	167	243	410

Table 6-4
Project Mitigation

Habitat Type	Location and Acres	Compensation Increment [1]
Riparian Scrub	Site A - Existing project lands around Lake Kaweah, 21 acres.	Medium Intensity - including land acquisition, fencing, remove grazing, plant willow at 177 ft elevation, monitoring for 3 years.
Oak Woodland/Savannah Riparian Forest	Site D - LSID Southwest and Northwest sites, 440 acres. This includes 14 acres of riparian habitat, 320 acres of oak savannah, and 99 acres of oak woodland habitat.	Medium Intensity - including land acquisition, fencing, removing grazing, planting riparian at 144 plants per acre, oak woodland at 78 plants and acorns per acre, and oak savannah 33 plants and acorns per acre, grading for overland flooding, monitoring for 3 years.
Tulare Lakebed Wetlands	Site G - Kings County in or adjacent to Tulare lakebed.	Medium - High Intensity - including land acquisition, apply water from February to July, construct islands for shorebird habitat.

[1] The analysis is based on information available at the time. Mitigation locations are identified for comparative purposes. If additional information becomes available during final engineering and design phase, locations and features may change. Additional coordination with FWS would occur and appropriate environmental documentation will be prepared and circulated for public review.

Surveys were performed for the area around Lake Kaweah between the existing maximum inundation level and the proposed post-project maximum inundation level; the area around Terminus Dam where the spillway and bridge would be modified; areas associated with construction such as staging areas, the areas around Horse Creek Bridge, and the Tulare lakebed area, which would receive less floodwater in some years due to the increased storage capacity in Lake Kaweah. The incremental loss of floodwater would occur mainly in the flood detention areas in the southern portion of Tulare lakebed. The remainder of the lakebed is currently an intensive agricultural operation. The surveys indicated that three species would likely be affected by the project—valley elderberry longhorn beetle, spiny sepaled coyote thistle, and Kaweah brodiaea.

The EIS/EIR provides further analysis on impacts on potentially affected species.

Cultural Resources

Only one prehistoric archeological site, CA-Tul-1042, is located between the existing gross pool elevation of 694 feet and the proposed increased elevation of 715 feet. This site is a single bedrock mortar which was recorded in 1983 during an archeological survey of Corps land above gross pool at Lake Kaweah (Meighan, et al. 1988). The site is less than meter in diameter with four mortar holes in its surface and is not associated with a prehistoric midden or other habitation. The site was considered to be ineligible for the National Register of Historic Places in two previous survey reports (Meighan, et al. 1988; Jackson, et al 1989), although formal concurrence has not been requested from the State Historic Preservation Officer (SHPO). Assuming SHPO agreement with the eligibility status of the site, no mitigation would be required.

Mitigation Costs

Estimated costs for fish and wildlife mitigation for the Lake Kaweah/Reservoir and Tulare lakebed areas (excluding endangered species mitigation) are provided in table 6-5.

Table 6-5
Mitigation First Costs

Habitat Type	Acres	Cost
LAKE KAWEAH		
Lands	440	$880,000
Riparian Shrub and Forest, Oak Woodland	-	$1,295,000
TULARE LAKEBED		
Lands	366	$732,000
Wetlands	-	$1,070,000
Totals		$3,977,000

PROJECT COST

Because the NED plan and LPP are structurally identical and have the same project costs, the M-CACES cost estimate prepared for the NED plan also applies to the LPP. Costs include all lands and damages; relocations; resiting of existing recreation facilities; modification of the spillway; mitigation; engineering and design, and supervision and administration. The M-CACES cost estimate for the NED plan and LPP is presented in table 6-6.

Operation and maintenance costs represent the maintenance of mitigation sites. There are no additional significant operation and maintenance costs due to the spillway modification.

ECONOMIC ANALYSIS

A 100-year project life (2000 to 2100) was used to compare final costs and benefits and to analyze environmental and economic benefits for the selected plan. Project economics were based on a 7-5/8 percent interest rate, a 100-year life, and a 2.5-year construction period beginning in October 1998.

Table 6-6
Cost Summary (M-CACES)
(@ October 1995 Price Level and 7-5/8 Percent Interest Rate)

Summary of First Costs	($)
1. Lands	8,683,000
2. Relocations	3,863,000
3. Reservoirs	325,000
4. Dams	14,950,000
6. Mitigation	2,365,000
8. Roads and Bridges	715,000
14. Recreation Facilities	295,000
18. Cultural Resources	206,000
20. Permanent Operating Equipment	0
30. Engineering and Design	3,129,000
31. Supervision & Administration	1,319,000
Total First Cost	35,850,000
First Cost (less cultural resources)	35,644,000
Interest During Construction	4,088,000
Total Investment Cost	39,732,000
Summary of Annual Costs	
Interest & Amortization	3,032,000
Operation & Maintenance	60,000
Total Annual Cost	3,092,000

Benefits used in the benefit-to-cost ratios of final alternatives included two benefit types—flood damage reduction and irrigation water supply benefits. For the NED plan, flood inundation reduction benefits including bridge replacement benefits average $3,558,000 annually, and irrigation water supply benefits average $271,000 annually. Annual recreation losses are estimated at $288,000. Annual hydropower losses are estimated at $287,000 if retrofitting of the existing hydro facilities is not accomplished by the hydropower interests. The NED plan provides a total average benefit of $3,541,000 annually if hydropower interests retrofit existing facilities ($3,254,000 if facililities are not retrofitted). The annual costs are $3,092,000, net benefits are $449,000 annually ($162,000 if hydro retrofit is not completed), and the benefit-to-cost ratio is 1.15 to 1.

For the LPP, the flood inundation reduction benefits including bridge replacement benefits average $3,448,000 annually, and irrigation water supply benefits average $274,000 annually. Annual recreation losses are $288,000. Annual hydropower losses are $287,000. These benefits total an average of $3,434,000

annually ($3,147,000 if hydro retrofit is not completed). The annual costs are $3,092,000, net benefits are $342,000 annually ($55,000 if hydro retrofit is not completed), and the benefit-to-cost ratio is 1.11 to 1.

Other project benefits that were evaluated are employment benefits. Employment benefits for the selected plan are $214,000 annually. Including employment benefits, the benefit-to-cost ratio for the NED plan is 1.21 and for the LPP is 1.18.

Bridge Replacement Benefits

The replacement of the Horse Creek Bridge (Highway 198), with an expected life of 70 years, and date of construction of 1961, would provide an additional 69 years of service. The average annual advance bridge replacement benefits would amount to $17,000. These benefits were included in the flood control benefits.

Hydropower

A 17-megawatt hydropower generating plant was retrofitted to Terminus Dam and started producing power in 1990. Hydropower is generated whenever water releases are made for flood control or irrigation supply. This form of operation would not change under potential project conditions, and the increase in hydroelectric power cannot be realized (i.e., loss of 7,695 MWh) without modification to the existing powerplant. The losses are quantified at $287,000 annually. The owners of the hydropower plant, however, have indicated that modifying the hydropower plant would be economically viable, even given the recent trends in power prices. Consequently, the hydropower owners are not objecting to these losses. The current hydropower owners have indicated an interest to retrofit the existing hydro facilities if the proposed spillway modifications proceed. All required and appropriate coordination etween the Federal Energy Regulatory Commission and the hydropower owners will continue in its process.

Recreation

Both the NED plan and LPP which raise the gross pool level by 21 feet would periodically inundate 243 additional acres along the perimeter of the reservoir and add 216 surface acres of water.

Existing recreation facilities at the reservoir are located at four major recreational areas—Lemon Hill, Kaweah, Horse Creek, and Slick Rock. Many of the facilities would be inundated when the water surface reaches the new gross pool. Current Federal policy related to recreation developments at Federal water projects requires a non-Federal cost-sharing partner for construction and operation and maintenance of those facilities. During this investigation, no non-Federal sponsor was identified for

participation in the required recreation studies. Consequently, when assessing impacts to the existing recreation, operation policies dictated that only minimum facilities required for public health and safety would be relocated as mitigation for impacts to the existing recreation facilities as a result of the raised spillway. In both the NED plan and the LPP, the Corps would relocate vault restroom facilities to adjacent areas above 715 feet, m.s.l. since these restrooms are considered basic minimum facilities and relocation would be part of standard construction activity. The boat ramp at Lemon Hill would also be extended to remain above the new gross pool elevation, thus serving as a basic minimum facility to continue monitoring and patrolling of the reservoir. The remaining recreation facilities, including access roads, remaining launch ramps, parking areas, camping sites, and picnic areas, would be refurbished by the Corps after inundation.

A decrease in recreation use at Lake Kaweah is projected as a result of reduced access to the Slick Rock Area and Horse Creek Recreation Area with the inundation of existing camping areas and other facilities. An additional 50 car and 80 car-trailer parking spaces at Lemon Hill recently has been constructed above the existing gross pool provide recreational opportunities at Lake Kaweah under existing and raised-pool conditions.

Recreation benefits, which is a net reduction, were calculated for the recreation season from May through September. The 21-foot raise of the spillway at Terminus Dam relates to an average annual increase in the level of the recreation pool at Lake Kaweah of 15 feet. The Unit Day Value Method was used to estimate recreation use losses, which is based upon a combination of projected visitation, recreation criteria points, and assigned monetary values. The new recreation use, converted to average annual values, was multiplied by the dollar values to yield incidental recreation benefit losses. The values are presented in table 6-7.

Table 6-7
Average Annual Recreation Benefits Lost

Visitation (Maximum Practical Use)	Lost Visits	Value ($) per visitor day	Average Annual Benefits Lost ($)
700,000	61,451	4.69	288,000 (round)

Recreation use as a result of inundated facilities decreases under both the NED plan and the LPP. These losses are significant. However, a very significant recreation benefit will continue at the existing facilities. An important benefit remaining at the

Lake Kaweah facilities will center around boating and fishing activities. One component of boating and fishing recreation benefits occurs during the winter months. Analysis of winter recreation use indicates that winter use is relatively constant regardless of storage levels in the reservoir or water-surface area. This use centers around fishing activities on the lake which are highly dependent upon boat ramp access. The different operational schemes differentiating the NED plan and the LPP influence this winter recreation use.

The conditional rainfall storage space established under the alternative plans, while improving water supply operational efficiencies, potentially adversely affects winter recreational boat access. The existing boat ramps in Lake Kaweah become unusable when reservoir storage decreases to 6,000 acre-feet. The NED plan establishes a 7,000 acre-foot conditional rain flood storage space. Basin wetness parameter criteria identified under this plan dictate that when the basin precipitation is 4-1/2 inches or less, the full 7,000 acre-feet of conditional storage space may be filled. However, if the basin wetness increases to 5 inches of precipitation, the amount of water in the conditional storage space would be reduced by 1,000 acre-feet. This would leave 6,000 acre-feet in the conditional storage space. Consequently, strict adherence to this operational criteria would affect winter boat ramp access to the Reservoir.

In contrast, the LPP provides 12,000 acre-feet of conditional rain flood storage space. The basin wetness criteria under this plan varies from the criteria described for the NEP plan. With a conditional storage space of 12,000 acre-feet and the modified wetness criteria , winter conditions for boat ramp access would improve over the NED plan.

The winter recreational use of the lake would likely be the same with the NED or LPP plan. The number of dedicated fishermen willing to weather winter conditions on the lake is not likely to increase if the winter storage is 7,000 or 12,000 acre-feet. Recreation use would be severely affected, however, if the winter storage drawdown leaves the lake inaccessible.

The operation of the conditional storage space for the NED or LPP under the water control diagram is not dictated by recreational criteria, however. Water storage in this space under the water control diagram is governed solely by flood control and water supply considerations. Reservoir modeling indicates that storage levels under the LPP would dip below the allowable 12,000 acre-feet of storage well over 20 years out of 26 years modeled. Consequently, the establishment of the conditional storage space was not considered to be a recreation feature.

Employment Benefits

The NED plan and LPP would directly stimulate the economy of Tulare County through wages paid to local workers hired to fill construction jobs; these workers would otherwise likely be unemployed.

The wages expected to be paid to labor for onsite construction would be $7.027 million, based on similar construction projects in California. The construction jobs would consist of the following percentages of total labor costs: 30 percent skilled, 47 percent unskilled, and 35 percent other. Based on the construction labor force of 3,600 workers for Tulare County in 1995, there should be no problem fulfilling the local labor requirement. The total local labor cost during the 2-½-year construction period, including interest, is $2.389 million. The total employment benefits would be $2.710 million and average annual employment benefits would be $207,000. The local labor costs over the construction period are shown in table 6-8.

Table 6-8
Employment Benefits

Construction Year	Local Labor Cost	Compound Amount @ 7-5/8 %	Employment Benefits
1	$477,380	1.2017	$ 574,208
2	$959,659	1.1584	$1,107,035
3	$959,659	1.0763	$1,028,576
			$2,709,819

BENEFIT-TO-COST

The benefit-to-cost ratios of the NED plan and LPP with employment benefits included with flood control and irrigation water supply benefits are shown in table 6-9.

Table 6-9
Benefit-to-Cost Ratios

	NED Plan		LPP - Selected Plan	
	Flood Control/ Water Supply ($)	With Employment Benefits ($) Added	Flood Control/ Water Supply ($)	With Employment Benefits ($) Added
Flood Control	3,558,000	3,558,000	3,448,000	3,448,000
Irrigation Water Supply	271,000	271,000	274,000	274,000
Employment		207,000		207,000
Recreation Losses	(288,000)	(288,000)	(288,000)	(288,000)
Total Annual Benefits	3,541,000	3,748,000	3,434,000	3,641,000
Total Annual Costs	3,092,000	3,092,000	3,092,000	3,092,000
Benefit/Cost Ratio	1.15	1.21	1.11	1.18
Net Benefits	449,000	656,000	342,000	549,000

[1] Assumes non-Federal hydropower interests retrofit existing hydropower facilities. See Appendix C for Benefit-to-Cost Ratio analysis for if hydropower retrofit is not completed.

RISK AND UNCERTAINTY

The ability of the NED plan and LPP to provide the expected accomplishments is dependent of the validity of pertinent assumptions, base data, and analytical techniques used in this study; the successful completion of future studies, designs, and construction; and appropriate operation and maintenance after construction. Several significant study components and the estimated relative risk and/or uncertainty associated with them are described below.

Hydrology

The uncertainty in hydrologic analysis used to derive flow-frequency relationships is affected by assumptions on storm centering and period of record. Only the mean peak flow values were used in the study. Frequency curves were computed in accordance with the procedures recommended by the Water Resources Council Bulletin No. 17B. The mean, standard deviations, and skews for the maximum annual flows of various durations were computed with 85 years of record. The computed standard deviations and skews were adjusted for consistency between the different flow durations. The skews were further adjusted to be compatible with the historic record. The expected probability correction was applied and median plotting positions were used.

With the NED plan and LPP, there will be continued flood risks to the city of Visalia as a result of floodflows from Dry, Mehrten, and Yokohl Creeks, which are unregulated and not affected by improvements to Terminus Dam.

Problems still exist at the McKays Point control structure, which cannot control flows in excess of 5,500 cfs. The uncertainty of the division of flows down the St. Johns River and Kaweah River is high and adds uncertainty to the distribution and direction of flows on the flood plain. This uncertainty would affect the economic analysis of damages. The magnitude of the uncertainty and its effect on the economic analysis is unknown.

Sedimentation Rate

The average rate of sedimentation was estimated at 120 acre-feet per year. This rate was assumed in the plan formulation analysis of benefits. A mean average storage capacity was estimated over the project life and applied in the analysis of damages. The mean average storage was based on the area under the storage versus time curve. Although it is possible to have a large storm in year 1 of the project that would fill up the sediment pool, it is also possible that the sediment depositation rate would be less than 120 acre-feet per year. The mean average storage represents the balance between the two scenarios or other scenarios.

Seismic Stability

The NED plan and LPP are relatively simple structural modification of the Terminus Dam spillway. A static stability of the Terminus Dam embankment was investigated in a post-earthquake slope-stability evaluation in August 1995. The analysis indicated that raising the spillway would not in itself affect the slope stability and safety of Terminus Dam. However, data from recent foundation testing is inconclusive with regard to the potential of the foundation liquefying and embankment failure of the existing dam in an earthquake. Further foundation testing was scheduled in 1996 to determine the safety of the dam. If remediation is required, then it would be funded under the Dam Safety Assurance Program.

Environmental Mitigation

The uncertainty of adequately offsetting adverse impacts to environmental resources resulting from project construction will be low because (1) a detailed analysis of impacts and mitigation measures was developed and coordinated with USFWS and DFG for the study area; (2) conservative estimates of affected habitat and replacement needs are being used; and (3) the success of mitigation efforts will be monitored and enforced according to the required mitigation plan.

Project Cost

The confidence level in the cost estimates is fairly high, although there are always unknowns that cannot be identified in advance of construction. Cost estimates for the NED and LPP are based on Code-of-Accounts-Cost-Estimating-Procedures, and detailed Micro-Computer Assisted Cost Estimating System (M-CACES) cost estimates. Reasonable contingencies are included in the cost estimates for items where unknowns are expected.

Benefits

The level of confidence in achieving the estimated economic benefits is high. The flood damage data collected in Visalia and other urban areas on the alluvial flood plain have a high level of confidence. In July 1995, a survey of the height of the first floor elevations of a sample population of structures which showed less than a 2 percent error in foundation height assessments. For irrigation benefits, the extensive data on ground-water depths, well pumping logs, equipment costs, and electricity costs support least-cost irrigation water supply benefit values. The irrigation benefit analyses were coordinated with the U.S. Bureau of Reclamation and State of California Department of Water Resources.

PED AND CONSTRUCTION

Preconstruction, engineering and design (PED) for the NED and LPP are expected to take 3 years. Construction will take 2 years. The Highway 198 Bridge and approaches will be relocated. Construction will begin during the reservoir drawdown period, when pool elevations allow access to the recreation sites.

During design and construction of the project, the Corps will coordinate with the State Division of Safety of Dams. The Corps is solely responsible for the design of the project, but will provide State officials and any non-Federal technical review boards an opportunity to comment on feature design memoranda and plans and specifications. During construction, the Corps will be solely responsible for administering the construction contract, including inspection of the contractor's work. State representatives will be kept informed and allowed access to Corps files to review any construction-related documents. The State may arrange with the Corps to visit the site during construction. The Corps will not be required to pay any permit fees to the State during any phase of the project. No such fees have been included to the project cost.

OPERATION AND MAINTENANCE

The periodic maintenance of the project would be described in an Operation and Maintenance (O&M) Manual to be prepared by the Corps. Generally, all O&M activities

are to be paid for and accomplished by the non-Federal project sponsors. The non-Federal sponsors will be required to provide the Corps with a semiannual report describing operation and maintenance accomplishments.

The NED plan and LPP would modify the existing spillway at Terminus Dam, which the Corps presently operates and maintains with a contribution from the non-Federal interests for their share of the costs. The non-Federal share of these costs is based on the cost apportionment for the existing project. Consequently, an arrangement may be made whereby the non-Federal sponsor will pay the Corps the additional annual costs of operating and maintaining the portion of the new increment to the existing project. Recreation at Lake Kaweah would continue to be operated and maintained by the Corps.

Maintenance activities would consist of periodic inspection and repair of the spillway and inspection and repair/replacement of mitigation features. Cost increases to existing periodic inspection and repair of the spillway are not expected to increase with the NED plan and LPP.

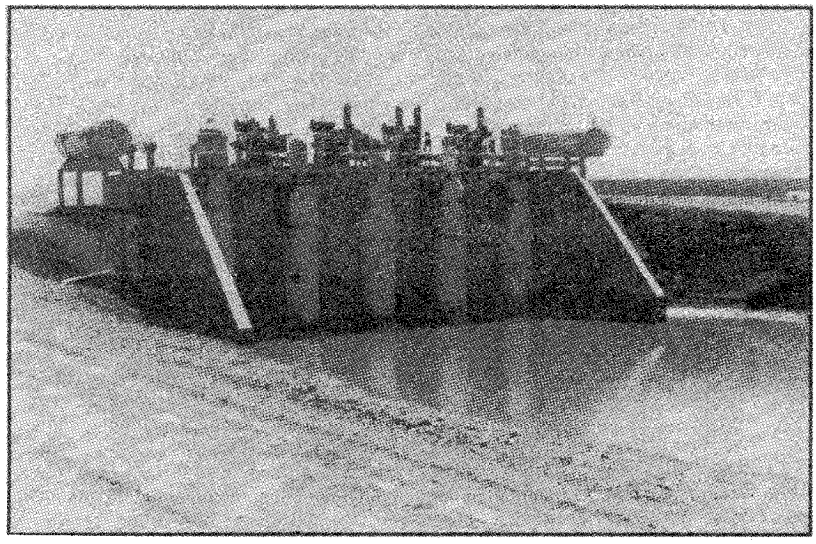
SELECTED PLAN (NED PLAN)

The NED plan is the selected plan in accordance with Section II, ER 1105-2-100. The NED project cost is identical to the LPP. The LPP rain flood operation criteria differ from the NED plan, which results in a reduction of the flood control benefits, but provides increased potential for water storage during the rain
flood season. This would also incidentally benefit fish and wildlife resources and recreational opportunities in the reservoir.

Both the LPP and the NED plan are developed in accordance with applicable rules and regulations. The non-Federal sponsors strongly favor the LPP but do support the NED plan. The No-Action plan is not acceptable to the non-Federal sponsor.

The total project investment cost for the NED plan is $39,732,000 and the annual cost is $3,092,000.

Chapter 7
Plan Implementation



A series of lift pumps at Tulare lakebed are needed to move irrigation and flood water from the interior of the lakebed to locations at higher elevation, including the south flood area.

Chapter 7

PLAN IMPLEMENTATION

PRELIMINARY COST ALLOCATION

General

Under current Federal policies, non-Federal sponsor cost-sharing requirements vary depending upon the project purpose. Flood control projects require a minimum contribution of 25 percent by the non-Federal sponsor with a maximum Federal contribution of 75 percent. For irrigation water supply projects, non-Federal sponsor contributions are 35 percent with a Federal contribution of the remaining 65 percent. For multipurpose projects, as in the proposed spillway raise at Terminus Dam, the objective of the cost allocation is to develop a preliminary distribution of project costs among the multiple project purposes to allow an equitable cost sharing with the non-Federal sponsor.

The separable costs-remaining benefits method of cost allocation was selected as the most appropriate method for the Kaweah River Basin Investigation. This method was recommended for use by Federal agencies by the Subcommittee on Benefits and Costs of the Federal Interagency River Committee and was favored by the Subcommittee to Study Civil Works of the Committee on Public Works, House of Representatives, in a report published as Committee Print No. 23, 83rd Congress, Second Session, dated December 5, 1952. The method was endorsed in the March 12, 1954, agreement cost allocation among the Department of the Interior, Department of the Army, and the Federal Power Commission. This method is also prescribed in ER 1105-2-100, Section XV, dated December 28, 1990 as the method to be used.

The objectives of the separable costs-remaining benefits method of cost allocation are:

- To allocate to each project purpose all costs associated with inclusion of that purpose in the project. This amount, referred to as the separable cost, is the minimum that would be allocated to the included purpose.

- To allocate costs in such a way that costs allocated to a specific purpose do not exceed the benefits associated with inclusion of that purpose or the costs of the most economical alternative way of providing equivalent benefits. This would be the maximum that would be allocated to the included purpose.

- To distribute joint or common costs among all project purposes in such a way that each purpose shares equitably in the advantage of multipurpose development as compared with alternative single-purpose development.

The costs of the Lake Kaweah enlargement project, which consists of enlarging the existing reservoir by 42,600 acre-feet, were allocated to flood control and irrigation water supply storage. The first and annual costs of the NED plan and LPP are identical. The total first and annual project costs for a multipurpose project that have been allocated are as follows:

First Cost (NED plan and LPP less cultural resources costs)	$35,644,000
IDC	$ 4,088,000
Investment Cost (NED plan and LPP)	$39,732,000
Annual Investment Cost (NED plan and LPP)	$ 3,032,000
O&M (NED plan and LPP)	$ 60,000
Annual Cost (NED plan and LPP)	$ 3,092,000

Alternative Single-Purpose Project Costs

While the separable costs-remaining benefits method procedure is complex, the principle is simple. All project costs are distributed among the purposes on the basis of the alternative costs that could justifiably be incurred to achieve equivalent benefits by alternative means. Consequently, alternative single-purpose project costs for flood control and irrigation water supply need to be determined.

An alternative project for flood control should provide the same degree of flood protection as the Lake Kaweah enlargement project and not interfere with existing water rights. The least costly alternative flood control project is considered to be the enlargement of Lake Kaweah by 42,600 acre-feet, with no new operation for water supply. The cost for the flood-control-only single-purpose alternative would be the raising the Terminus Dam spillway 21-feet. Studies have confirmed that a single-purpose reservoir elsewhere in the Kaweah River basin is either more expensive or not economically justified. The first cost of the flood-control only project would be the same as the multipurpose project. The single-purpose first cost for flood control would be:

$35,644,000 - $0 = $35,644,000

An alternative project for irrigation water supply in the absence of the multiple-purpose project should be one that provides the same annual yield of surface-water supply. Single-purpose reservoirs for irrigation water supply, either upstream from the existing Lake Kaweah or on one of several tributary streams

below Terminus Dam, were found to be more costly than enlarging the existing Lake Kaweah by raising the emergency spillway.

The least-costly alternative for the water supply purpose is an enlargement of Lake Kaweah by 42,600 acre-feet. The water supply project would incur the same first costs as the multipurpose project. The single-purpose first cost for water supply would be:

$35,644,000 - $0 = $35,644,000

First costs, interest during construction, investment costs, annual costs, and operation and maintenance (O&M) costs are shown in table 7-1. Interest during construction, although applied in the analysis of the NED plan and LPP, is not used in the cost apportionment analysis.

Table 7-1
Single-Purpose and Multipurpose Costs
NED Plan and LPP

Item	Flood Control Only	Water Supply Only	Multipurpose
First Cost	$35,644,000	$35,644,000	$35,644,000
IDC	$4,088,000	$4,088,000	$4,088,000
Total Investment Cost	$39,732,000	$39,732,000	$39,732,000
Annual Cost	$3,032,000	$3,032,000	$3,032,000
O&M	$60,000	$60,000	$60,000
Total	$3,092,000	$3,092,000	$3,092,000

Separable Costs

The separable cost of flood control is the difference between the cost of a multipurpose project and a single-purpose water supply project. The separable cost of water supply is the difference between the cost of a multipurpose project and a single-purpose flood control project.

The separable cost of flood control, separable cost of water supply, and multipurpose project costs are shown in table 7-2.

Table 7-2
Separable and Joint Use Costs

Item	Separable Cost			Joint-Use	Multipurpose
	Flood Control	Water Supply	Total		
First Cost	0	$0	$0	$35,644,000	$35,644,000
IDC	0	$0	$0	$4,088,000	$4,088,000
Total Investment Cost	0	$0	$0	$39,732,000	$39,732,000
Annual Cost	0	$0	$0	$3,032,000	$3,032,000
O&M	0	$0	$0	$60,000	$60,000
Total	0	$0	$0	$3,092,000	$3,092,000

The separable cost of providing flood control is zero. The separable annual cost of providing water supply is zero.

Joint Use Costs

Joint use cost is the cost for the combined use of all purposes and are not separable by purpose. Joint use cost is the difference between the cost of the multiple-purpose project and the sum of the separable costs. The joint use annual cost of the new project is also shown in table 7-2 and is:

$$\$3,092,000 - \$0 = \$3,092,000.$$

ALLOCATED COSTS - NED PLAN

A basic allocation of the project costs for the NED plan was estimated using the cost and benefit data presented in the preceding evaluation. A detailed allocation of costs based on the separable costs-remaining benefits method are shown in table 7-3. The allocated first costs are shown in table 7-4. The allocation of annual operation, maintenance, and replacement costs is shown in table 7-5.

Table 7-3
Detailed Cost Allocation [1] - NED Plan
(Separable Costs-Remaining Benefits Method)

Item	Flood Control ($)	Water Supply ($)	Total ($)
1. Allocation of Annual Costs			
a. Annual Benefits	3,558,000	271,000	3,829,000
b. Alternative Annual Costs	3,092,000	3,092,000	0
c. Annual Benefits limited by Annual Costs	3,092,000	271,000	3,363,000
d. Separable Annual Costs	0	0	0
e. Remaining Annual Benefits	3,092,000	271,000	3,363,000
f. Distribution Percentage	91.94	8.06	100
g. Allocated Joint Annual Costs	2,842,800	249,200	3,092,000
h. Total Allocated Annual Costs	2,842,800	249,200	3,092,000
2. Allocation of O&M			
a. Separable Annual Costs	0	0	0
b. Allocated Joint Costs	55,200	4,800	60,000
c. Total Allocation of O&M	55,200	4,800	60,000
d. Specific Costs	0	0	0
e. Allocated Joint Use Costs	55,200	4,800	60,000
f. Percent (%) of Joint Use Costs	91.94	8.06	100
3. Total Allocated OM&R			
a. Allocated Joint Use Costs	55,200	4,800	60,000
b. Percent (%) of Joint Use Costs	91.94	8.06	100
4. Allocation of Investment			
a. Annual Investment Cost (Interest & Amortization)	2,842,800	249,200	3,092,000
b. Allocated Investment	91.94	8.06	100
c. Allocated Investment	36,529,600	3,202,400	39,732,000
5. Allocation of First Costs			
a. Specific Investment	0	0	0
b. Investment in Joint-Use Facilities	36,529,600	3,202,400	39,732,000
c. Interest During Construction on Joint-Use Facilities	3,758,500	329,500	4,088,000
d. First Cost of Joint-Use Facilities	32,771,100	2,872,900	35,644,000
e. Percent of First Cost in Joint-Use Facilities	91.94	8.06	100
f. First Cost of Specific Facilities	0	0	0

[1] Preliminary.

Table 7-4
Allocation of First Costs [1] - NED Plan

Function	Flood Control	Water Supply	Total Cost
Separable Costs	$0	$0	$0
Joint-Use Costs	$32,771,000	$2,872,900	$35,644,000
Total Costs	$32,771,000	$2,872,900	$35,644,000

[1] Preliminary.

Table 7-5
Allocation of Maintenance and Operation Costs [1] - NED Plan

Function	Flood Control	Water Supply	Total Cost
Separable Costs	$0	$0	$0
Joint-Use Costs	$55,200	$4,800	$60,000
% Joint Use Costs	91.94%	8.06%	100%
Total Costs	$55,200	$4,800	$60,000
[1] Preliminary.			

COST APPORTIONMENT - NED PLAN

General

The cost apportionment for the NED plan is shown in table 706. In accordance with the Water Resources Development Act of 1986 (WRDA 86), non-Federal interests are required to pay a minimum of 25 percent of the cost allocated to the flood control purpose. Non-Federal interests are also required to furnish all lands, easements, rights-of-way, relocations, and disposal sites (LERRD) for flood control. The costs of LERRD may be applied to the non-Federal share for flood control. In addition, they are required to pay a 5 percent cash contribution during construction of the costs allocated to flood control. Should the cash contribution plus the LERRD be less than 25 percent, non-Federal interests shall pay an additional amount in cash during construction to bring their share to 25 percent.

Further, non-Federal interests are required to pay 35 percent of the costs allocated to agricultural (irrigation) water supply. Applicable laws governing cost sharing provisions for agricultural (irrigation) water supply include the Flood Control Act of 1944, the Reclamation Reform Act of 1982, and the Water Resources Development Act of 1986. Application of these statutes to Corps policy has led to the conclusion that a 65-35 (65 percent Federal) cost sharing is appropriate for this proposed project. The Reclamation Reform Act of 1982 States:

> Notwithstanding any other provision of law, neither the ownership or pricing limitation provisions nor the other provisions of Federal reclamation law, including this subchapter, shall be applicable to lands receiving benefits from

Federal water resources projects constructed by the United States Army Corps of Engineers, unless --

(1) the project has, by Federal statute, explicitly been designated, made a part of, or integrated with a Federal reclamation project; or

(2) the Secretary, pursuant to his authority under Federal reclamation law, has provided project works for the control or conveyance of an agricultural water supply for the lands involved.

There are no Federal purveyors of water at Lake Kaweah. The only Federal Government involvement with water rights arises by way of a contract between the Department of Interior/Bureau of Reclamation (DOI) and the Kaweah Delta Water Conservation District (KDWCD) for the operation and maintenance of irrigation storage space at Terminus Dam. The distribution of water stored for irrigation purposes, however, is not governed by any contract with the U.S. Government. In fact, the contract between KDWCD and DOI, expressly acknowledges that the U.S. will not acquire any interest in the stored water. The Kaweah River is a fully appropriated rive, i.e., the water rights to the river were established and are legally held by individual and ditch company irrigators in the Kaweah River basin. Therefore, since neither the Corps nor DOI is involved in the distribution of irrigation water in the Kaweah River Basin, the Terminus Dam Project is exempted from Reclamation Law. Consequently, provision in statute directing a 65-35 cost share on irrigation water supply as applicable. It must be noted that the proposed project does not include dedicated agricultural water supply storage space, the project is optimized and justified based solely on flood damage reduction benefits, and water supply benefits are only 8 percent of the total benefits.

ALLOCATED COSTS - LPP

The LPP has less benefits than the NED plan. This difference is the result of alternative operational criteria. The operational criteria of the NED plan resulted in higher benefits. For cost allocation and cost-sharing purposes, where a plan deviating from the NED plan is selected and it has less benefits than the NED plan, it is Federal policy to cost share only in the least costly plan which provides the same benefits. Consequently, to determine the applicable cost sharing for the LPP, a determination of the least costly plan providing the same benefits as the LPP was required. In this case, a 20.5-foot spillway raise plan using an

Table 7-6
Cost Apportionment Summary - NED Plan

Item	Federal ($)	Non-Federal ($)	Total ($)
FLOOD CONTROL Lands and Damages	0	7,983,200	7,983,200
Relocations	0	3,551,600	3,551,600
LERRD Flood Control Allocation [1]		11,534,800	11,534,800
Cash Contribution	19,597,700	1,638,600 [2]	21,236,300
TOTAL Flood Control	19,597,700 59.80%	13,173,400 40.20%	32,771,100
IRRIGATION WATER SUPPLY [3] Lands and Damages	454,900	244,900	699,800
Relocations	202,400	109,000	311,400
TOTAL LERRD Water Supply	657,300	353,900	1,011,200
(65% Fed and 35% Non-Fed (Cash Contribution	1,210,100	651,600	1,861,700
Total First Cost	21,465,100	14,178,900	35,644,000
Total Cash	20,807,800	2,290,200 [4]	23,098,000
Total LERRD	657,300	11,888,700	12,546,000
Total Share	21,465,100 60.22%	14,178,900 39.78%	35,644,000

[1] LERRD's allocation to flood control purpose are 91.94% of total LERRD. See Table 7-3 for deviation of allocation percentage. LERRD costs allocated to flood control 100% non-Federal sponsor responsibility.
[2] 5% cash contribution of the cost allocation to flood control.
[3] LERRD's allocated to water supply purpose are 8.06% of total LERRD. See Table 7-3. LERRD's allocated to water supply are cost shared on 65-35% basis.
[4] Non-Federal cash contribution.

operational criteria similar to the NED plan has the same benefits as the locally preferred plan. Consequently, the cost allocation for the LPP is based upon a 20.5-foot raise allocation with additional costs associated with constructing from the 20.5-foot to the 21-foot height being allocated as a 100 percent non-Federal sponsor cost share.

Table 7-7 shows a detailed cost allocation for the 20.5-foot plan. Tables 7-8 and 7-9 show allocations of first costs and operation and maintenance costs for the 20.5-foot plan.

COST APPORTIONMENT - LPP

The cost apportionment for the LPP is shown in table 7-10.

Table 7-7
Detailed Cost Allocation [1] - 20.5-Foot Plan
(Least Cost Equivalent Benefits Plan to LPP)
(Separable Costs-Remaining Benefits Method)

Item	Flood Control ($)	Water Supply ($)	Total ($)
1. Allocation of Annual Costs			
a. Annual Benefits	3,730,000	271,000	4,001,000
b. Alternative Annual Costs	2,982,000	2,982,000	
c. Annual Benefits limited by Annual Costs	2,982,000	271,000	3,253,000
d. Separable Annual Costs	0	0	0
e. Remaining Annual Benefits	2,982,000	271,000	3,253,000
f. Distribution Percentage	91.67	8.33	100
g. Allocated Joint Annual Costs	2,733,600	248,400	2,982,000
h. Total Allocated Annual Costs	2,733,600	248,400	2,982,000
2. Allocation of O&M			
a. Separable Annual Costs	0	0	0
b. Allocated Joint Costs	55,000	5,000	60,000
c. Total Allocation of O&M	55,000	5,000	60,000
d. Specific Costs	0	0	0
e. Allocated Joint Use Costs	55,000	5,000	60,000
f. Percent (%) of Joint Use Costs	91.67	8.33	100
3. Total Allocated OM&R			
a. Allocated Joint Use Costs	55,000	5,000	60,000
b. Percent (%) of Joint Use Costs	91.67	8.33	100
4. Allocation of Investment			
a. Annual Investment Cost (Interest & Amortization)	2,678,600	243,400	2,922,000
b. Allocated Investment	91.67	8.33	100
c. Allocated Investment	35,100,400	3,189,600	38,290,000
5. Allocation of First Costs			
a. Specific Investment	0	0	0
b. Investment in Joint-Use Facilities	35,100,400	3,189,600	38,290,000
c. IDC on Joint-Use Facilities	3,652,100	331,900	3,984,000
d. First Cost of Joint-Use Facilities	31,448,300	2,857,700	34,306,000
e. Percent of First Cost in Joint-Use Facilities	91.67	8.33	100
f. First Cost of Specific Facilities	0	0	0

[1] Preliminary.

Table 7-8
Allocation of First Costs [1] - 20.5-Foot Plan

Function	Flood Control	Water Supply	Total Cost
Separable Costs	$0	$0	$0
Joint-Use Costs	$31,448,300	$2,857,700	$34,306,000
Total Costs	$31,448,300	$2,857,700	$34,306,000

[1] Preliminary.

Table 7-9
Allocation of Maintenance and Operation Costs [1] - 20.5-Foot Plan

Function	Flood Control	Water Supply	Total Cost
Separable Costs	$0	$0	$0
Joint-Use Costs	$55,000	$5,000	$60,000
% Joint Use Costs	91.67%	8.33%	100%
Total Costs	$55,000	$5,000	$60,000

[1] Preliminary.

Table 7-10
Cost Apportionment Summary - LPP

Item	Federal ($)	Non-Federal ($)	Total ($)
FLOOD CONTROL Lands and Damages - 20.5 ft	0	7,945,000	7,945,000
Relocations - 20.5 ft	0	3,540,300	3,540,300
TOTAL LERRD - 20.5 ft	0	11,485,300	11,485,300
Cash Contribution - 20.5 ft	18,390,600	1,572,400 [1]	19,963,000
TOTAL Flood Control - 20.5 ft	18,390,600 58.48%	13,057,700 41.52%	31,448,300
IRRIGATION WATER SUPPLY - 20.5 ft Lands and Damages	469,300	252,700	722,000
Relocations	209,100	112,600	321,700
Total LERRD	678,400	365,300	1,043,700
(65% and 35% Non-Fed Cash Contribution	1,179,100	634,900	1,814,000
Total First Cost - 20.5 ft	20,248,100	14,057,900	34,306,000
Cash - 20.5 ft	19,569,700	2,207,300	21,777,000
LERRD - 20.5 ft	678,400	11,850,600	12,529,000
Cash Requirement 21-ft Upgrade	0	1,338,000	1,338,000
Total Share	20,248,100 56.81%	15,395,900 43.19%	35,644,000

[1] 5% cash contribution of the cost allocation to flood control.
[2] Non-Federal cash contribution.

SELECTED PLAN COST ALLOCATION

Allocation of costs for the selected plan is recommended in accordance with table 7-6.

FEDERAL RESPONSIBILITIES

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

NON-FEDERAL RESPONSIBILITIES

Current Federal regulations require non-Federal participation in the financing of projects. In accordance with the Water Resources Development Act of 1986, the non-Federal sponsor will:

- Provide all lands, easements, and rights-of-way necessary for construction and maintenance of the flood control and associated mitigation measures, including all necessary relocations and alterations of buildings, utilities, roads, bridges (except railroad bridges), sewers, irrigation diversions, and related special features.

- 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 of or negligence of the United States or its contractor;

- Obtain any water rights needed for use of water for construction, operation, maintenance, repair, replacement and rehabilitation of the project; and

- Provide for adjudication of all water rights claims resulting from construction, operation, maintenance, repair, replacement, and rehabilitation of the project and hold and save the United States free from damages due to such claims arising out of actions, inactions, representations, and agreements of the U.S. Department of the Interior and Claims asserted by the United States.

- 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.

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

- Pay during project construction such as additional amounts so that the total contribution of the non-Federal sponsor is not less than 25 percent of the total project first cots assigned to structural flood control.

- Enter a separate contract for payment of water supply in the amount of 35 percent of the total costs for agricultural water.

- Comply with the 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 concerned and provide this information to zoning and other regulatory agencies for their 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.

- 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 Lability Act (CERCLA), 42 U.S.C. 9601-9675 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; and

- 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.

Federal and non-Federal obligations and requirements will be defined in a Partnering Cooperation Agreement (PCA) signed prior to initiation of construction. The non-Federal funds will not have to be provided until after the Congress authorizes the project and appropriates construction funds and a PCA is signed. Payment of the funds will be made at intervals during construction.

PROCEDURES FOR IMPLEMENTATION

Once the feasibility report is approved and the project is authorized, preconstruction, engineering, and design funds and 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 its share of the project cost, and (6) budgetary constraints that may exist 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 Partnering 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.

NON-FEDERAL FINANCIAL CAPABILITIES

The lead non-Federal cost-sharing sponsor, the Kaweah Delta Water Conservation District, will be the non-Federal cost-sharing sponsor for the water supply storage. The Kaweah Delta Water Conservation District, acting in conjunction with Tulare County, Kings County, and the city of Visalia, has provided letters of intent to proportionately share in the non-Federal costs attributable to flood protection. Funding will be requested through the State's Flood Control Subventions Program. While this program is temporarily devoid of funds to finance items such as lands, easements, rights-of-way, and relocations of Federally authorized flood control projects, table 7-11 presents the 1988 cost-sharing percentages for local agencies cooperating in the construction of the Corps' flood control projects.

Table 7-11
Flood Control Subventions Program

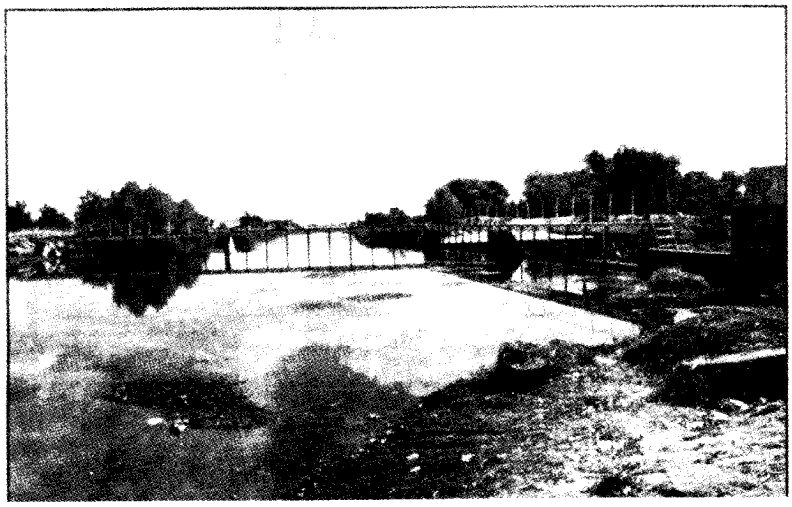
Non-Federal Cost Item	State of California Share of Non-Federal Costs (Flood protection only) [1]
Channel and levee project rights-of-way	0.7
Channel and levee project relocations	0.7
Reservoir project right-of-way relocations	0.7
Cash contributions toward construction costs	0.7
Capital costs of fish and wildlife mitigation	0.7
Capital costs of recreation and fish and wildlife enhancement	0.5
Reconnaissance and feasibility studies	Not Eligible
Planning and engineering studies	0.7
Design studies	0.7

[1] As of 1988.

VIEWS OF NON-FEDERAL INTERESTS

The non-Federal lead sponsor, Kaweah Delta Water Conservation District, has formed a partnership with Tulare County, Kings County, city of Visalia, and California Department of Water Resources in support of this project. There is strong support for construction of the project.

Chapter 8
Public Involvement



McKays Point flow division weir. Structure evenly divides flows from the Kaweah River into the St. Johns and Kaweah Rivers up to flows of 5,500 cfs.

Chapter 8

PUBLIC INVOLVEMENT

Throughout the conduct of the study, close coordination has been maintained with the non-Federal cost-sharing lead sponsor, Kaweah Delta Water Conservation District, and its cost-sharing partners. These partners are Tulare County, Kings County, city of Visalia, and the California Department of Water Resources. During the reconnaissance phase of the study, a study management team was formed, consisting of representatives of the cost-sharing partners. In addition, an Executive Committee, consisting of the responsible officers of the cost-sharing entities, was consulted on major management decisions. Informational meetings held throughout the timeframe of the study were mostly informal, but all were designed to keep study participants and affected people informed of progress of the study.

An initial public workshop in March 1986 was followed by a public meeting in March 1987 to inform people of the progress and results of the reconnaissance phase of the study and to assess the local perception of problems and opportunities in the study area. A notice of initiation of the feasibility study was circulated in March 1988 soliciting comments for consideration in the report.

It was generally acknowledged that additional storage is needed for flood control and irrigation water supply on the Kaweah River. The potential for recreation opportunities was also recognized. Problems foreseen by increasing storage at Lake Kaweah include loss of recreation facilities, reduced access to recreation areas, potential condemnation of lands and loss of property, reduced property values, dam safety, and adverse environmental impacts. Suggested solutions to increase the level of flood control protection and irrigation water supply included (1) building dams on Dry or Deer Creek and for the Middle Fork of the Kaweah River; Yokohl, Mehrten, and Horse Creeks and other tributaries; (2) flooding range lands instead of building new reservoirs; (3) dredging Lake Kaweah instead of building new reservoirs; and (4) creating beneficial additional ground-water recharge.

Opportunities afforded by additional flood detention dams or space include decreased flooding, reduced flood insurance participation, additional water storage beneficial to farmers, increased recreational opportunities, and added hydropower production.

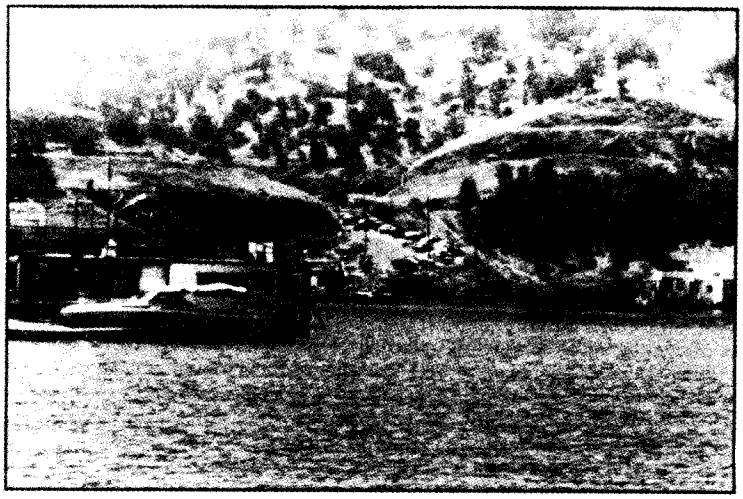
Tulare County and KDWCD asked the Corps to evaluate additional storage in the area, which led to the initiation of a reconnaissance study in December 1985. The sponsors strongly support maximizing the storage potential of Terminus Dam

and/or constructing a reservoir on Dry Creek to regulate flow on an unregulated stream. These actions would provide additional conservation storage and significantly increase the level of flood protection downstream in Visalia and outlying areas, as well as the Tulare lakebed. Any channelization and levee development downstream from Terminus Dam would increase floodflows to Tulare lakebed and increase damages to highly productive farmland. The non-Federal sponsors, therefore, oppose channelization and consider additional storage as the only viable solution to the flooding problem.

Throughout the study, the study management team met about once a month. When significant decisions were required, the Executive Committee was convened to render decisions on the conduct of the study in accordance with the agreement contained in the Feasibility Cost Sharing Agreement.

Two public workshops and one formal public hearing were held following circulation of the draft report for public comment. The two public workshops were held on July 22, 1996 (3:30 p.m. to 8 p.m.), and on July 23, 1996 (3:00 p.m. to 7:45 p.m.). The formal hearing was held on July 23, at 8 p.m. Comments received from these workshops and hearing as well as other comments received during the official review period are summarized in Appendix G of the environmental impact statement. During this review period, overwhelming support was expressed for the LPP.

Chapter 9
Conclusions



The Mehrten Marina at Lemon Hill. Note roadway leading down to boat launch ramp.

Chapter 9

CONCLUSIONS

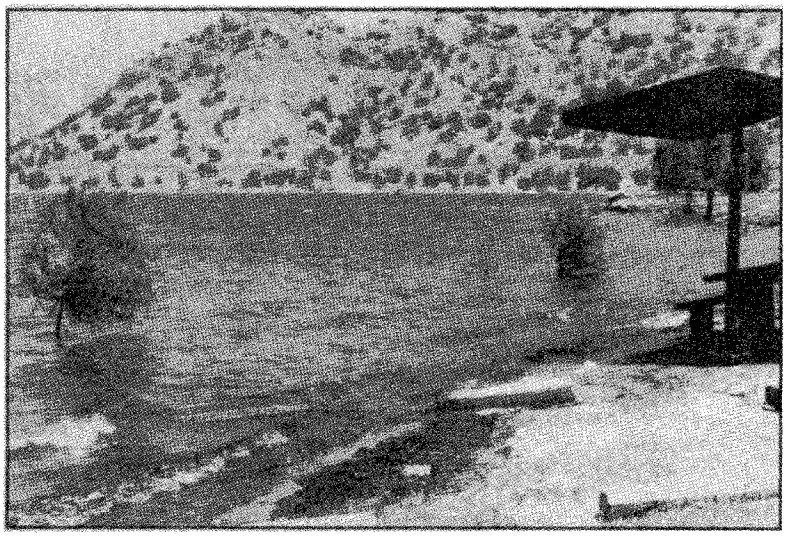
An array of alternatives have been considered. The NED plan consists of enlarging the existing Lake Kaweah by constructing a 21-foot-high concrete ogee across the spillway at Terminus Dam and widening the spillway by 148 feet. The NED plan produces the greatest net annual benefits by increasing flood protection to downstream areas, creating additional storage for irrigation water, and minimizing environmental impacts. The plan has a benefit-cost ratio of 1.21.

The locally preferred plan (LPP) is structurally identical and costs the same as the NED plan. The LPP consists of a different reservoir operation, which maintains a larger conditional rain flood space over the life of the project. This operation would maintain recreation year round, especially during the rain season, but would result in fewer flood control benefits than the NED plan. The LPP has a benefit-to-cost ratio of 1.18.

The non-Federal sponsor supports the NED plan but strongly favors the LPP. The No-Action plan is not acceptable to the non-Federal sponsor. The LPP provides a more balanced alternative in providing unquantified fishery and wildlife benefits above the NED plan and better allows the maintenance of existing recreation opportunities at the lake. The NED plan maximizes flood control benefits.

The NED plan is identified as the selected plan.

Chapter 10
Recommendation



Horse Creek Recreation Area. Many campsites and picnic areas are periodically inundated when Lake Kaweah is filled during summer months.

Chapter 10

RECOMMENDATIONS

The Administration has initiated the development of a new cost-sharing policy for flood damage reduction projects. I recommend that improvements for flood damage reduction in the Kaweah River basin be authorized subject to cost sharing that is consistent with Administration policy. This recommendation is also subject to the non-Federal sponsor agreeing to comply with applicable Federal laws and policies, including the following requirements:

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

- 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;

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

- Grant the 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;

- Hold and save the Government 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;

- 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;

- Perform, or cause to be performed, any investigations for hazardous substances that 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 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government;

- Assume complete financial responsibility 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 Government determines necessary for the construction, operation, or maintenance of the project;

- 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;

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

  (1) Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project;

  (2) Not less than once each year, inform affected interests of the limitations of the protection afforded by the project;

  (3) Publicize flood plain 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 flood plain, and in adopting such regulations as may be necessary to prevent

- 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 Commonwealth 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;

- The Corps should be authorized to turn the project over to a willing and capable non-Federal sponsor should one be found.

- The recommended plan is the NED plan.

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 Kaweah Delta Water Conservation District; interested Federal agencies; and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Dorothy F. Klasse
Colonel, Corps of Engineers
District Engineer

[First Endorsement]

CESPD-ET-P (September 1996) (1105) 1st End Conley/tjm/415-977-8162
SUBJECT: Feasibility Report for the Kaweah River Basin, California

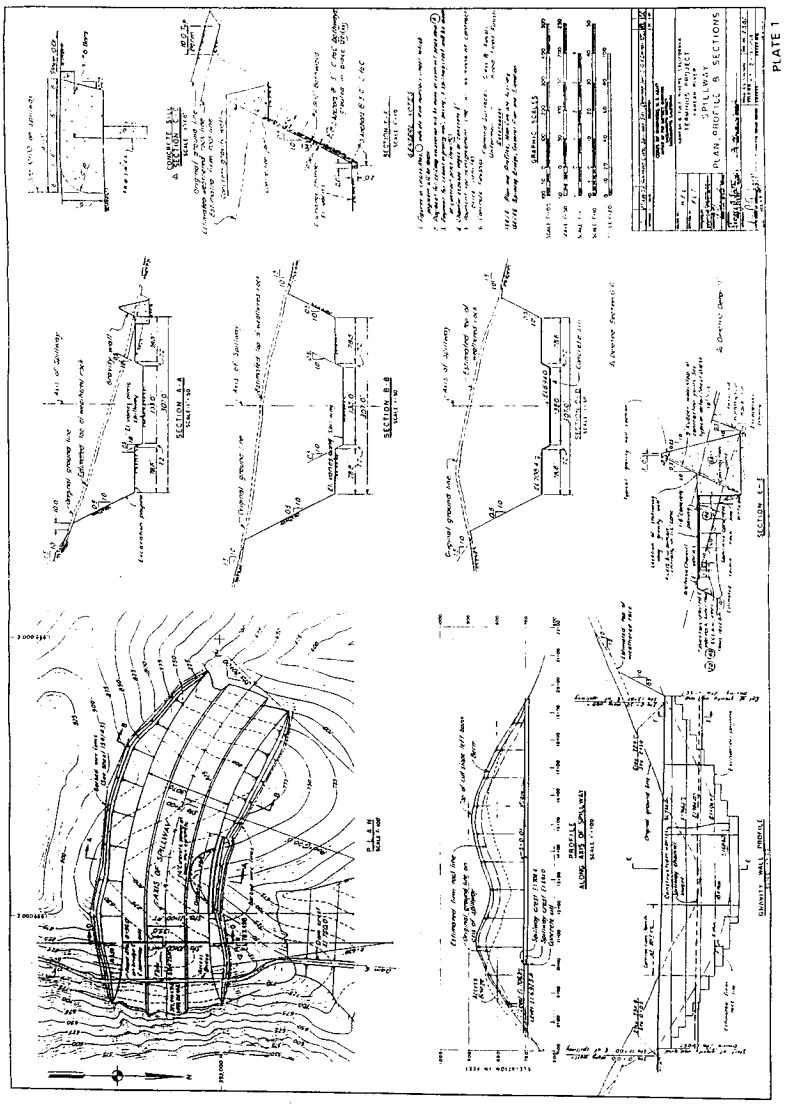
DA, South Pacific Division, Corps of Engineers, 333 Market Street, Room 923
San Francisco, CA 94105-2195 6 September 1996

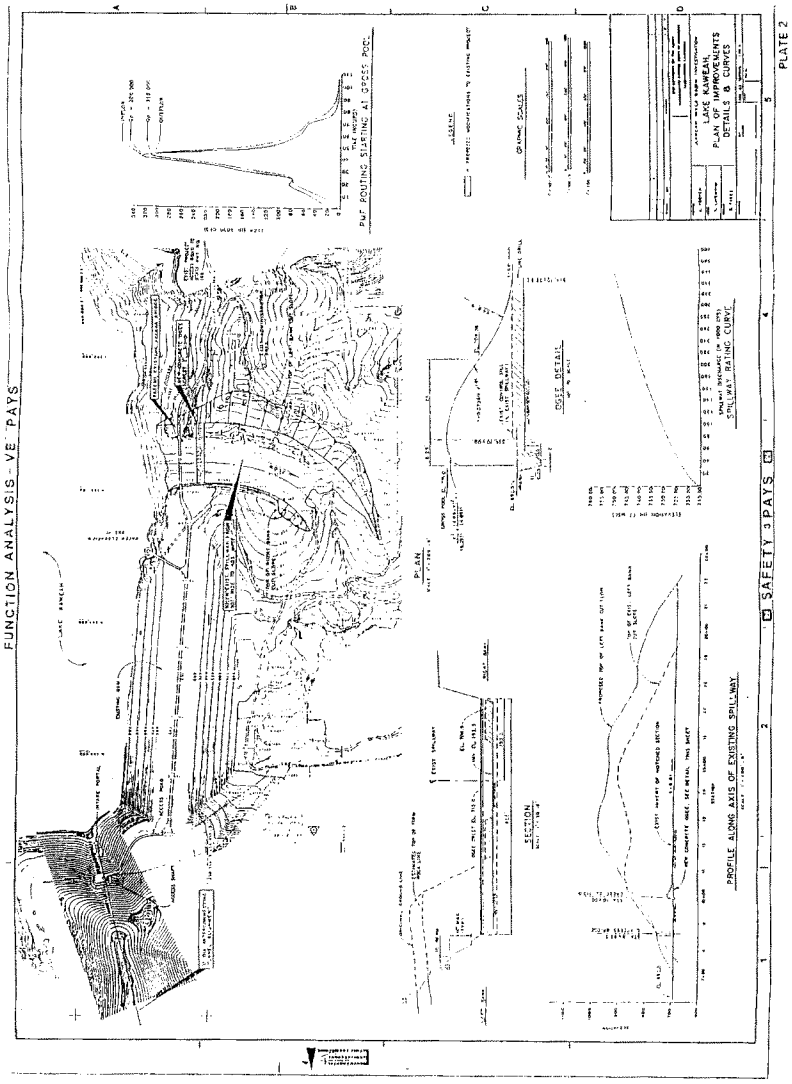
FOR CDR USACE (CECW-AR), Kingman Building, 7701 Telegraph Road,
Alexandria, VA 22315-3861

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

DAVID E. PEIXOTTO
COL, EN
Acting Commander

Plates

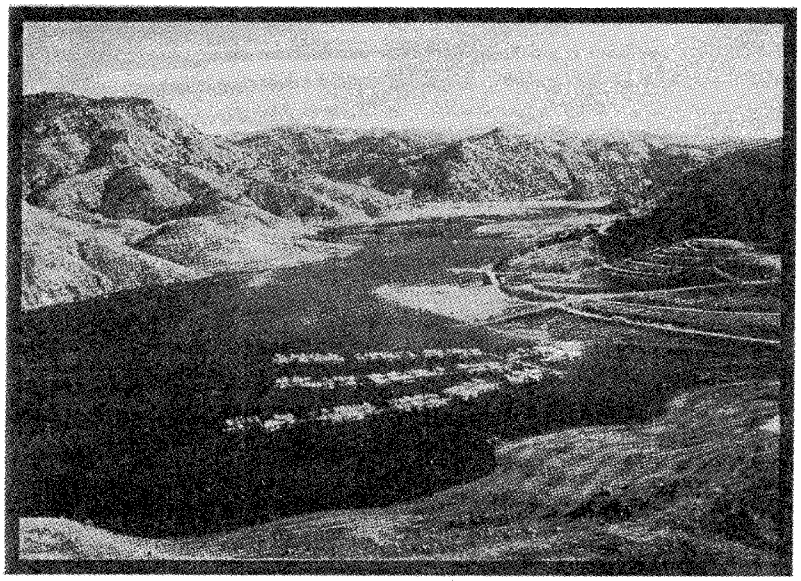



FUNCTION ANALYSIS - VE PAYS
PLATE 2
SAFETY 3 PAYS
PLAN
SECTION
DOSE DETAIL
PROFILE ALONG AXIS OF EXISTING SPILLWAY
SPILLWAY RATING CURVE
PMF ROUTING STARTING AT GROSS POOL
LAKE KAWEAH,
PLAN OF IMPROVEMENTS
DETAILS & CURVES

Final Environmental Impact Statement/Environmental Impact Report

September 1996

KAWEAH RIVER BASIN INVESTIGATION
FEASIBILITY STUDY, CALIFORNIA



US Army Corps of Engineers
Sacramento District

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

September 3, 1996

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

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

Non-Federal Sponsors. Kaweah Delta Water Conservation District.

Proposed Action. The U.S. Army Corps of Engineers and the non-Federal sponsors propose to increase flood protection downstream of Terminus Dam and increase the storage space in Lake Kaweah for irrigation water supply by making modifications to the dam and the operation of the reservoir.

Abstract. This FEIS/FEIR describes the affected environment at Lake Kaweah and downstream areas including the Tulare lakebed; evaluates the direct, indirect, and cumulative environmental effects and evaluates benefits of the selected plan and two alternative plans; and recommends mitigation measures. Most impacts would be either short term or would be avoided using best management practices. Adverse impacts 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
Attn: Jane Rinck
U.S. Army Engineer District, Sacramento
1325 J Street, Sacramento, California 95814-2922
(916) 557-6715
jrinck@usace.mil

KAWEAH RIVER BASIN INVESTIGATION FEASIBILITY STUDY
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 downstream of Terminus Dam and increasing the storage space in Lake Kaweah for irrigation water supply. The EIS/EIR describes the existing resources in the project 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 includes the Kaweah River Basin in the southeast part of the San Joaquin Valley (see Figure 1). The river flows naturally from the Sierra Nevada westward into the Tulare lakebed on the valley floor. The basin is located primarily in Tulare County although the western part of the basin extends into Kings County. The study area is divided into three reaches for descriptive and analytical purposes. These reaches are Terminus Dam and Lake Kaweah, the downstream area, and the Tulare lakebed.

NEED FOR ACTION

Terminus Dam was authorized by the 1944 Flood Control Act and was constructed by the Corps of Engineers in 1962. The project was designed to provide a 60-year level of flood protection downstream of the dam. However, revised hydrologic information shows that the existing project provides only about a 46-year level of protection due to unexpectedly high amounts of precipitation and sedimentation that have entered the reservoir.

Flooding downstream of the dam occurs when flows from individual creeks blend together and form sheet flow through urban and agricultural areas. Included in the flooded area are the communities of Visalia, Farmersville, Tulare, Ivanhoe, and Goshen. Since construction of Terminus Dam, damaging floods have occurred in 1966, 1978, 1983, and 1986. Downstream communities and areas adjacent to the flood plain are at risk of future flooding.

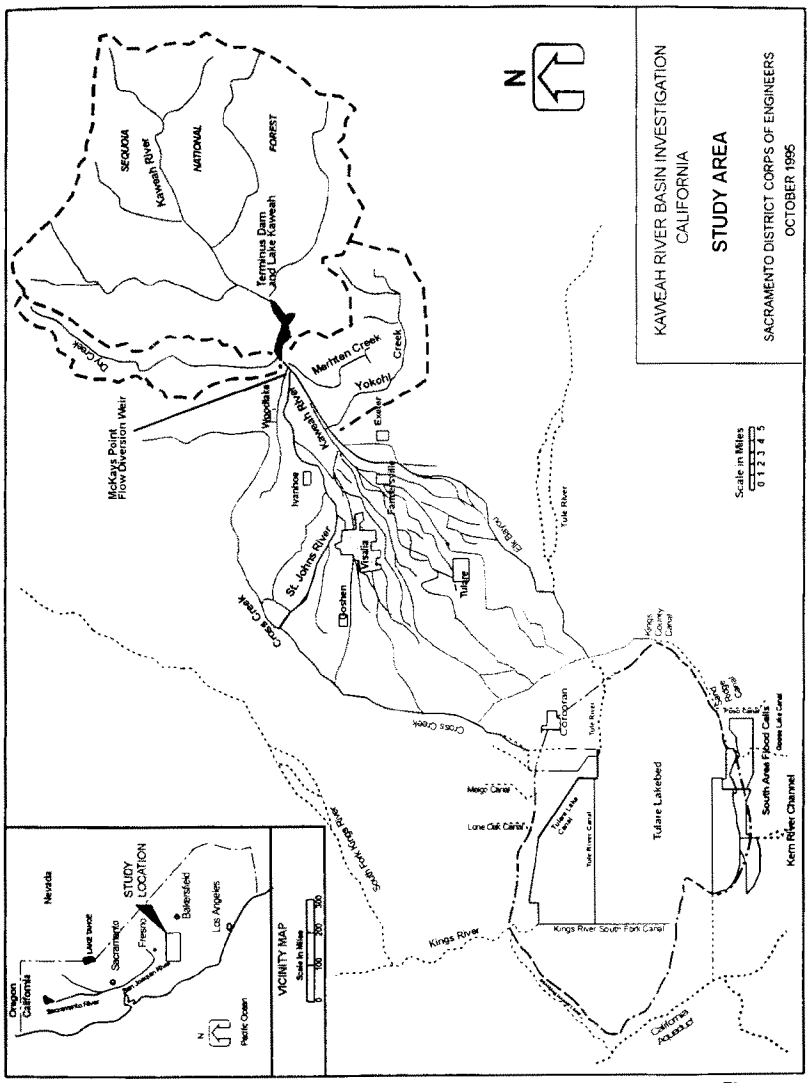

KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
STUDY AREA
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995
N
SEQUOIA
NATIONAL
FOREST
Kaweah River
Terminus Dam and Lake Kaweah
Dry Creek
Merhten Creek
Yokohl Creek
McKays Point Flow Diversion Weir
Woodlake
Kaweah River
Exeter
Ivanhoe
Farmersville
Elk Bayou
Tule River
St. Johns River
Visalia
Tulare
Cross Creek
Cross Creek
Kings County Canal
Corcoran
Tule River
Tulare Lakebed
Kings River
Kings River South Fork Canal
South Fork Kings River
Kern River Channel
South Area Flood Cells
Scale in Miles
0 1 2 3 4 5
VICINITY MAP
Scale in Miles
0 100 200 300
STUDY LOCATION
Nevada
Oregon
California
Sacramento
Fresno
Bakersfield
Los Angeles
Pacific Ocean

Figure 1

Flooding in the Tulare lakebed can occur from the Kings, Kaweah, Tule and Kern Rivers, plus local flooding. While floodwaters reaching the lakebed can benefit water supply and agriculture when received at the proper time and in the proper amount, excess floodwater can damage crops or interrupt cropping cycles. Since construction of Terminus Dam, crop cycles have been adversely affected seven times: December 1966 through 1967, January 1969 through August 1971, 1978, 1980, 1982, 1983-84, and 1986. Future flooding in the lakebed may continue to be a problem.

ALTERNATIVES

Initially, a variety of alternatives was evaluated, including alternative storage sites, detention basins, construction alternatives, and nonstructural measures. Based on technical, economic, and environmental criteria, the only feasible alternative was to raise the spillway 21 feet. All the other alternatives were eliminated because (1) they failed to meet the project flood control or water supply goals, (2) the costs exceeded the benefits, or (3) the associated environmental impacts were excessive. The non-Federal sponsor then requested that the Corps consider another similar alternative to raise the spillway. The main features, accomplishments, and operation of the three alternatives (including no action) are summarized below.

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 Federal action to increase the storage behind Terminus Dam. Flooding would continue in Visalia and other downstream communities and the Tulare lakebed, resulting in loss of agricultural production and damage to homes, businesses, and public facilities. Water supply for agriculture would remain at its current level.

Alternative 2 (NED Plan)

Features

- The spillway at Terminus Dam would be raised by 21 feet and widened by 148 feet.
- An ungated ogee section would be placed over the existing broadcrested sill.
- The total land required for construction would be 618 acres, including 370 acres that would be inundated in the reservoir area.

- The existing State Highway 198 bridge over Horse Creek would be relocated immediately upstream of the existing bridge.

- Improvements to be purchased in fee and removed would include one motel and 6 dwellings, and 29 ownerships would be acquired in fee.

- To maintain basic minimum facilities, two vault toilets would be relocated, the boat ramp at Lemon Hill would be extended to remain above the new gross pool, and the county boat patrol building at Lemon Hill would also be relocated above the new gross pool.

Accomplishments

- The plan would raise the gross pool by 21 feet and add 42,600 acre-feet of flood storage space in Lake Kaweah.

- The plan would increase the levels of flood protection to the 70-year event for downstream communities and the 3.2-year event for the Tulare lakebed.

- An additional average annual irrigation water supply of 8,400 acre-feet could be stored in the reservoir.

Operation

- Timing of releases would not change significantly.

- Reservoir storage during the snowmelt season would increase, decreasing downstream flooding and increasing irrigation water supply.

Alternative 3 (Locally Preferred Plan)

Features

- Structural features would be the same as Alternative 2.

- The water control diagram and basin wetness parameter for Lake Kaweah would be modified.

Accomplishments

- Maximum storage during the rainflood season would be increased from 7,000 to 12,000 acre-feet.

Operation

- Timing of releases would be the same as Alternative 2.
- Reservoir storage during the rainflood season could increase, increasing irrigation water supply.

AFFECTED ENVIRONMENT

Environmental resources not affected by the project alternatives include climate, topography, geology and seismicity, soils and agriculture, and prime and unique farmlands. Significant resources that may be affected by the project include land use, socioeconomics, recreation, hazardous, toxic, and radiological waste, transportation, noise, air quality, water quality, vegetation and wildlife, fisheries, endangered 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 long-term impacts and require mitigation measures beyond best management practices include vegetation and wildlife and endangered species. Table 2 summarizes the mitigation measures to avoid, minimize, or compensate the adverse impacts 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 Kaweah River 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 endangered species consultation and cultural resources requirements have been completed.

TABLE 1
Summary of Environmental Effects

Affected Environment	Alternative 1 (No Action)	Alternative 2 (NED Plan)	Alternative 3 (Locally Preferred Plan)
Land Use	Urban and agricultural development would continue as it does now.	No change from current trends is expected.	No change from current trends is expected.
Socioeconomics	Population would continue to increase.	No change from current trends is expected.	No change from current trends is expected.
Recreation	Fishery resources would likely decline. Use of all other recreation facilities would increase.	Some recreation facilities would be periodically inundated. Fishery conditions would likely decline.	Some recreation facilities would be periodically inundated. Fishery conditions would improve in the winter.
Hazardous, Toxic, and Radiological Waste	Current monitoring and remediation efforts at identified HTRW sites would continue.	The proposed project may accelerate the plume associated with the LUFT site at Kaweah Recreation Area and in Three Rivers.	The proposed project may accelerate the plume associated with the LUFT site at Kaweah Recreation Area and in Three Rivers.
Transportation	Traffic volumes and LOS on SR198 at the reservoir would not change. Traffic volumes and LOS on roads in the downstream area would change due to increasing congestion. Conditions at the lakebed would not change.	Effects would be temporary and of short duration. and would consist of mainly traffic delays due to construction equipment and work at Horse Creek Bridge.	Effects would be temporary and of short duration. and would consist of mainly traffic delays due to construction equipment and work at Horse Creek Bridge.
Noise	Noise levels would be the same as existing conditions.	Adverse noise effects due the project would be short-term construction effects. Increased noise would be generated from heavy equipment during construction at the reservoir.	Adverse noise effects due the project would be short-term construction effects. Increased noise would be generated from heavy equipment during construction at the reservoir.
Air Quality	Regional air pollution emission rates would not change and may improve over time with stricter standards.	Adverse air quality effects would be temporary and short-term due to construction activities. Emissions would be due to construction equipment and other construction-related emissions.	Adverse air quality effects would be temporary and short-term due to construction activities. Emissions would be due to construction equipment and other construction-related emissions.
Water Quality	Surface and ground water quality would not change from existing conditions.	The proposed project would not have any adverse effects on water quality if best management practices are implemented.	The proposed project would not have any adverse effects on water quality if best management practices are implemented.

TABLE 1
Summary of Environmental Effects

Affected Environment	Alternative 1 (No Action)	Alternative 2 (NED Plan)	Alternative 3 (Locally Preferred Plan)
Vegetation and Wildlife	There would be no significant changes from existing conditions at the reservoir. No change is expected downstream or at the lakebed.	Construction and inundation would affect 93 acres of riparian scrub, 70 acres of riparian forest, 132 acres of oak savannah, and 38 acres of oak woodland. The downstream area would not be adversely affected and 1,412 average annual acres in the lakebed would be affected due to reduction in flooding.	Construction and inundation would affect 93 acres of riparian scrub, 70 acres of riparian forest, 132 acres of oak savannah, and 38 acres of oak woodland. The downstream area would not be adversely affected and 1,412 average annual acres in the lakebed would be affected due to reduction in flooding.
Fisheries	Fishery resources would decline due to the lack of sediment storage space to provide water during the winter.	Fishery conditions would not significantly improve over conditons described for Alternative 1.	Fishery conditions in the winter would improve over conditions described for Alternative 1.
Endangered Species	Habitat conditions would likely continue to decline without further protection.	The valley elderberry longhorn beetle, a listed species, would be adversely affected. Foraging habitat for the bald eagle may improve in some years. Two candidate plant species may also be affected.	Foraging habitat for the bald eagle would likely improve. The only listed species to be adversely affected would be the valley elderberry longhorn beetle. Two candidate plant species may also be affected.
Cultural Resources	On a regional basis, cultural resources sites would continue to be adversely affected due to urban expansion, agricultural practices, and natural processes.	No adverse effects to cultural resources would occur with the project.	No adverse effects to cultural resources would occur with the project.

TABLE 2
Summary of Mitigation

Affected Environment	Alternative 2 (NED Plan)	Alternative 3 (Locally Preferred Plan)
Land Use	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.	There would be no significant adverse effects on land use due to this alternative therefore, no mitigation would be needed.
Socioeconomics	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.
Recreation	A non-Federal cost-sharing partner has not been identified at this time; therefore; no recreation sites would be relocated.	A non-Federal cost-sharing partner has not been identified at this time; therefore; no recreation sites would be relocated.
Hazardous, Toxic, and Radiological Waste	HTRW sites affected by this alternative or project mitigation would be remediated according to applicable Federal, State, and local regulations.	HTRW sites affected by this alternative or project mitigation would be remediated according to applicable Federal, State, and local regulations.
Transportation	Temporary short-term construction effects would be mitigated through best management practices.	Temporary short-term construction effects would be mitigated through best management practices.
Noise	Temporary short-term construction effects would be mitigated through best management practices.	Temporary short-term construction effects would be mitigated through best management practices.
Air Quality	Temporary short-term construction effects would be mitigated through best management practices.	Temporary short-term construction effects would be mitigated through best management practices.
Water Quality	There would be no adverse effects due to this alternative if best management practices are implemented; therefore, no mitigation would be needed.	There would be no adverse effects due to this alternative if best management practices are implemented; therefore, no mitigation would be needed.
Vegetation and Wildlife	Mitigation includes 21 acres for riparian scrub, 14 acres for riparian forest, 320 acres for oak savannah, and 99 acres for oak woodland, and 366 acres for wetland habitat.	Mitigation includes 21 acres for riparian scrub, 14 acres for riparian forest, 320 acres for oak savannah, and 99 acres for oak woodland, and 366 acres for wetland habitat.
Fisheries	Conditions for fisheries would not change from without-project conditions; therefore, no mitigation for fisheries would be needed.	Conditions for fisheries would improve in the winter; therefore, no mitigation for fisheries would be needed.
Endangered Species	Mitigation for the valley elderberry longhorn beetle includes planting 276 elderberry seedlings/cuttings on 2.1 acres on project lands.	Mitigation for the valley elderberry longhorn beetle includes planting 276 elderberry seedlings/cuttings on 2.1 acres on project lands.
Cultural Resources	There would be no adverse effects to cultural resources; therefore, no mitigation would be needed.	There would be no adverse effects to cultural resources; therefore, no mitigation would be needed.

TABLE 3
SUMMARY OF ENVIRONMENTAL COMMITMENTS

Affected Environment	Environmental Commitment
Recreation	Relocate vault toilets at Lemon Hill and Horse Creek Recreation Areas, extend boat ramp and replace boat patrol building at Lemon Hill Recreation Area.
Hazardous, Toxic, and Radiological Waste	Any affected HTRW sites will be remediated. Response actions must be acceptable to the U.S. Environmental Protection Agency and applicable State regulatory agencies. The non-Federal sponsor is responsible for the development and execution of HTRW response actions at 100 percent non-project cost. Further investigations will be conducted and remediation plans will be developed in the PED phase of the project.
Transportation	During the reconstruction of Horse Creek Bridge, temporary barriers and markings will be erected; existing speed limits will be drastically reduced in the area of construction; and flag-persons will control all vehicles.
Noise	During project construction, noise generating equipment will be limited to work during daytime hours only. Additionally, all mobile equipment will be fitted with mufflers consistent with the best noise reduction technology.
Air Quality	During project construction, specific best management practices for combustion emissions and PM_{10} emissions will be implemented. These measures comply with the local air district's regulations.
Water Quality	During project construction, specific best management practices will be implemented for work at Horse Creek Bridge and Terminus Dam. Implementation of these measures will avoid adverse effects to water quality resources.
Vegetation and Wildlife	Twenty-one acres of riparian scrub-shrub mitigation, 14 acres of riparian forest, 320 acres of oak savannah, 99 acres of oak woodland, and 366 acres of seasonal wetlands will be developed as described in the project mitigation plan.
Endangered Species	A total of 276 elderberry seedlings/cuttings will be planted at the Horse Creek area. If preconstruction, engineering, and design studies determine that the candidate plants Kaweah brodiaea and the spiny-sepaled coyote-thistle will be inundated due to the project, they will be relocated to similar habitat on project lands. Before construction begins in the Horse Creek area, the site will be examined by a biologist to determine if any southwestern pond turtles are present. If any turtles are found, a plan for avoidance will be developed with the FWS and DFG.

MAJOR CONCLUSIONS AND FINDINGS

The alternatives would have adverse impacts on environmental resources in the project area. However, most impacts would either be short term or would be avoided using best management practices. Adverse impacts on vegetation and wildlife and endangered species would be mitigated to a level of non-significance by developing new habitat areas and planting elderberry seedlings/cuttings. A mitigation and monitoring plan is included in the EIS/EIR.

PUBLIC INVOLVEMENT

Scoping comments received at the beginning of the feasibility study included the project's effects on riparian and wetland habitats, ground-water overdraft, irrigation water supply, recreation, and endangered species. These issues were identified and discussed with the non-Federal sponsor, other agencies, and local interests. The Corps used this information to evaluate these issues in the draft EIS/EIR.

In June 1996, the draft EIS/EIR was released for public and agency review. Two public workshops and one public hearing were held in July. Comments from the public review, workshops, and hearing were considered when the final environmental document was prepared. Copies of the comments and Corps responses are included in Appendix G (under separate cover).

UNRESOLVED ISSUES

There is one unresolved issue at this time. The Coordination Act Report (CAR) will be finalized in October 1996, the recommendations contained in the draft CAR (January 1996) are not expected to change. The CAR has not been finalized due to the lack of closure of Endangered Species Consultation. The consultation will be done in October and is expected to comply with the findings and mitigation proposed in the EIS/EIR. When the project is authorized, the mitigation and monitoring plan will be finalized during pre-construction engineering and design studies.

SELECTED PLAN

Based on the results of the feasibility studies, coordination with the non-Federal sponsor, and guidance from Corps Headquarters, Alternative 2 (NED Plan) has been identified as the Selected Plan.

KAWEAH RIVER BASIN INVESTIGATION

FINAL EIS/EIR

CONTENTS

Cover Sheet
Summary 190
Contents 200
Acronyms and Abbreviations 205

Chapter

1.0 Purpose and Need for the Action 209
1.1 Introduction 210
1.2 Study Authority 210
1.3 Study Area Location and Hydrology 210
1.4 Purpose and Need for the Action 213
1.5 Significant Issues 217
1.6 The Decisions to be Made Based on This Analysis 218
1.7 Organization of the EIS/EIR 218

2.0 Alternatives Including the Proposed Action 220
2.1 Introduction 220
2.2 Plan Formulation and Selection 220
2.3 Alternatives Considered but not Studied in Detail 220
2.3.1 Alternative Storage Sites 221
2.3.2 Detention Basins 222
2.3.3 Other Construction Alternatives 223
2.3.4 Nonstructural 224
2.4 Alternatives Considered in Detail 225
2.4.1 Alternative 1 (No Action) 225
2.4.2 Alternative 2 (Tentatively Selected Plan) 226
2.4.3 Alternative 3 (Locally Preferred Plan) 229
2.5 Comparative Impacts of the Alternatives 231
2.6 Environmental Commitments 232
2.7 Selected Plan 238

3.0 Affected Environment 239
3.1 Introduction 240
3.2 Environmental Setting 240
3.2.1 Climate 240

3.2.2 Topography 241
3.2.3 Geology 241
3.2.4 Soils 243
3.2.5 Agriculture, Prime and Unique Farmlands 245
3.3 Affected Environment 246
3.3.1 Land Use 246
3.3.2 Socioeconomics 250
3.3.3 Recreation 252
3.3.4 Hazardous, Toxic and Radiological Waste 255
3.3.5 Transportation 260
3.3.6 Noise 263
3.3.7 Air Quality 264
3.3.8 Water Quality 266
3.3.9 Vegetation and Wildlife 275
3.3.10 Fisheries 281
3.3.11 Endangered Species 286
3.3.12 Cultural Resources 296

4.0 Environmental Consequences 301
4.1 Introduction 301
4.2 Effects on Land Use 301
4.2.1 Alternative 1 303
4.2.2 Alternative 2 303
4.2.3 Alternative 3 307
4.2.4 Mitigation 307
4.3 Effects on Socioeconomics 308
4.3.1 Alternative 1 308
4.3.2 Alternative 2 308
4.3.3 Alternative 3 309
4.3.4 Mitigation 310
4.4 Effects on Recreation 310
4.4.1 Alternative 1 311
4.4.2 Alternative 2 311
4.4.3 Alternative 3 313
4.4.4 Mitigation 314
4.5 Effects on Hazardous, Toxic and Radiological Waste 314
4.5.1 Alternative 1 314
4.5.2 Alternative 2 315
4.5.3 Alternative 3 318
4.5.4 Mitigation 319
4.6 Effects on Transportation 319
4.6.1 Alternative 1 322
4.6.2 Alternative 2 322
4.6.3 Alternative 3 325

4.6.4 Mitigation 325
4.7 Effects on Noise 326
4.7.1 Alternative 1 327
4.7.2 Alternative 2 327
4.7.3 Alternative 3 328
4.7.4 Mitigation 331
4.8 Effects on Air Quality 332
4.8.1 Alternative 1 333
4.8.2 Alternative 2 333
4.8.3 Alternative 3 338
4.8.4 Mitigation 338
4.9 Effects on Water Quality 340
4.9.1 Alternative 1 340
4.9.2 Alternative 2 341
4.9.3 Alternative 3 343
4.9.4 Mitigation 343
4.10 Effects on Vegetation and Wildlife 345
4.10.1 Alternative 1 346
4.10.2 Alternative 2 349
4.10.3 Alternative 3 355
4.10.4 Mitigation 356
4.11 Effects on Fisheries 360
4.11.1 Alternative 1 360
4.11.2 Alternative 2 362
4.11.3 Alternative 3 363
4.11.4 Mitigation 364
4.12 Effects on Endangered Species 364
4.12.1 Alternative 1 365
4.12.2 Alternative 2 365
4.12.3 Alternative 3 369
4.13 Effects on Cultural Resources 369
4.13.1 Alternative 1 373
4.13.2 Alternative 2 374
4.13.3 Alternative 3 374
4.13.4 Mitigation 374

5.0 Other Required Disclosures 376
5.1 Introduction 376
5.2 Cumulative Impacts 376
5.2.1 Methodology 377
5.2.2 Related Water Resources Projects 377
5.2.3 Evaluation of Cumulative Impacts 379
5.2.4 Conclusions 381
5.3 Growth-Inducting Impacts 382

5.3.1 Existing Conditions/No Action 382
5.3.2 Alternatives 2 and 3 384
5.4 Significant Adverse Impacts Which Cannot Be Avoided if the Project is Implemented 386
5.5 Relationship Between Local Short-Term Uses of the Environment and Maintenance of Long-Term Productivity . . 387
5.6 Significant Irreversible Environmental Changes Associated with the Project 388
5.7 Mitigation and Environmental Monitoring 388
5.7.1 Mitigation 389
5.7.2 Monitoring 392
5.8 Compliance with Applicable Laws, Policies, and Plans 395
5.8.1 Federal Requirements 395
5.8.2 State Laws, Regulations, and Policies 401
5.8.3 Local Plans and Policies 405
5.9 FWS Recommendations 406
5.9.1 General Recommendations 407
5.10 Public Involvement 413
5.10.1 Scoping 413
5.10.2 Comments on the DEIS/EIR 414
5.10.3 Intended Uses of the Final EIS/EIR 414
5.10.4 Distribution List 416

6.0 List of Preparers 419
7.0 References 420
8.0 Index 426

TABLES

Table 2-1 Summary of Environmental Effects 233
Table 2-2 Summary of Mitigation 235
Table 3-1 Seismic Sources Affecting Terminus Dam 242
Table 3-2 Existing Land Use 248
Table 3-3 Existing Air Quality Data for General Pollutants 268
Table 3-4 Existing Air Quality for 10-Micron Particulate Matter 269
Table 3-5 Existing Air Quality Data for Suspended Particulate Matter 270
Table 3-6 Existing Water Quality Data for Kaweah River 271
Table 3-7 Existing Water Quality Data for Kaweah Reservoir 272
Table 3-8 Existing Water Quality for Trace Elements, Kaweah Reservoir 273
Table 4-1 Future Land Use With and Without Project 302
Table 4-2 Land Use in Existing and Post-Project 100-year

Flood Plains 304
Table 4-3 Relationship of Peak-Hour Traffic to Levels of Service for Surface Streets 320
Table 4-4 Level of Service on Critical Roadways in the Study Area . . 321
Table 4-5 Equipment to be Used During Construction 329
Table 4-6 Projected Equipment Emissions 334
Table 4-7 Criteria Pollutant Emission Thresholds and Proposed Project Equipment Emissions 336
Table 4-8 Summary Table of Effects on Vegetation 347
Table 4-9 Inundation Impacts at Kaweah Reservoir 351
Table 4-10 HEP Data for Project Effects at the Reservoir Area 353
Table 4-11 Project Mitigation 361
Table 5-1 Monitoring Activities for Mitigation 394

FIGURES

Figure 1-1 Kaweah Delta Water Conservation District Boundary 215
Figure 3-1 Recreation Facilities 254
Figure 3-2 Existing Daily Traffic Volumes for Roadways in the Study Area 262
Figure 3-3 Community Survey of Noise Levels 265
Figure 3-4 Wind Flow Entries and Exits 267
Figure 3-5 Oak Woodland/Savannah Vegetation at Lake Kaweah 277
Figure 3-6 Riparian Scrub-Shrub Vegetation in Lake Kaweah 278
Figure 3-7 Tulare Lakebed 283
Figure 4-1 Construction Equipment Noise Levels 330

PLATES

Plate 1 Study Area and Vicinity 428
Plate 2 Mitigation Site Locations 429

APPENDIXES

Appendix A Coordination Act Report 430
Appendix B Incremental Analysis 603
Appendix C Biological Data Report 630
Appendix D Cultural Resources Report 794
Appendix E Land Use Study 869
Appendix F Recreation Analysis 922
Appendix G Comments and Responses 933

ACRONYMS AND ABBREVIATIONS

AAHU	average annual habitat unit
BDR	biological data report
CAR	Fish and Wildlife Coordination Act Report
CEQ	California Environmental Quality
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	cubic feet per second
Corps	Corps of Engineers
dBA	decibel (unit of measure for sound)
DBCP	dibromochorobenzene
DDT	dichloro-diphenyl-trichlorethane
DFG	California Department of Fish and Game
DHS	California Department of Health Services
DTV	daily traffic volume
DWR	California Department of Water Resources
EIS	environmental impact statement
EIR	environmental impact report
EPA	U.S. Environmental Protection Agency
F°	farenheit
FWS	U.S. Fish and Wildlife Service
FEMA	Federal Emergency Management Agency
FESA	Federal Endangered Species Act
FC1	Federal category 1
FC2	Federal category 2
FGMP	foothill growth management plan
HEP	habitat evaluation procedures
HSI	habitat suitability index
HU's	habitat units
HTRW	hazardous, toxic, and radiological waste
KDWCD	Kaweah Delta Water Conservation District
L_{dn}	day-night average decibel levels
los	level of service
LSID	Lindsay Strathmore Irrigation District
LUFT	Leaking Underground Fuel Tank
MCL's	maximum contaminant levels
μg/L	micrograms per liter
mg/L	milligrams per liter
m.s.l.	mean sea level
mpn	most probable number

NDDB	California Natural Diversity Database
NED	National Economic Development
NEPA	National Environmental Policy Act
O&M	operation and maintenance
PCB	polychloronated biphenyl
PED	preconstruction engineering and design
PM_{10}	particulate matter, 10 microns in size
ppm	parts per million
ROG	reactive organic gases
RVLP	rural valley lands plan
SHPO	State Historic Preservation Officer
SJVUAPCD	San Joaquin Valley Unified Air Pollution Control District
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
SR	State route

ACRONYMS AND ABBREVIATIONS
Main Report

ASA(CW)	Assistant Secretary of the Army for Civil Works
BTX	benzene, toluene, xylene
CAR	coordination act report (USFWS)
CDMG	California Division of Mines and Geology
CEC	California Energy Commission
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Corps	Corps of Engineers
CVP	Central Valley Project
DWR	Department of Water Resources (State)
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FCSA	feasibility cost sharing agreement
FEMA	Federal Emergency Management Agency
FIRM	flood insurance rate map
FWS	U.S. Fish and Wildlife Service
H	horizontal
HEP	habitat evaluation procedure
HQUSACE	Headquarters, Corps of Engineers
HTRW	hazardous, toxic, and radioactive waste
KDWCD	Kaweah Delta Water Conservation District
LERRD	lands, easements, relocations, removal, and disposal
LSID	Lindsay Strathmore Irriigation District
M-CACES	military construction army cost estimating system
MCE	maximum credible earthquake
MCL	maximum concentration level
MPN	most probable number
NED	national economic development
NRCS	U.S. Natural Resources Conservation District
O&M	operation and maintenance
PCA	partnering cooperation agreement
PCB	polychlorolbiphenol
PED	preconstruction, engineering, and design
PL	Public Law
PMF	probable maximum flood
RD	Reclamation District
SHPO	State Historic Preservation Office
SPF	standard project flood
State	State of California

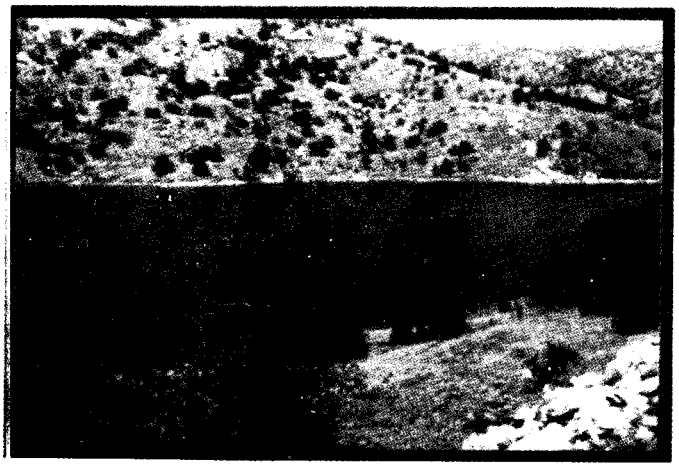
SWRCB	State Water Resources Control Board
UCLA	University of California at Los Angeles
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Service
V	vertical
WRDA	water resources development act

UNITS OF MEASUREMENT

g	acceleration of gravity
cfs	cubic feet per second
cu yd	cubic yard
dB	decibels
F	fahrenheit
ft	feet
feet, m.s.l	elevation in feet from mean sea level
GW/h	gigawatt hours
hp	horsepower
kW	kilowatts
kWh	kilowatt hours
mW	megawatts
mWh	megawatt hours
ug/L	micrograms/liter
mi	miles
mg/L	milligrams/liter
m.s.l.	mean sea level
pH	potential of hydrogen

CHAPTER 1.0

PURPOSE AND NEED FOR THE ACTION



Lake Kaweah near Horse Creek

CHAPTER 1.0

PURPOSE AND NEED FOR THE ACTION

1.1 INTRODUCTION

The Kaweah River Basin Investigation, California, addresses flooding problems downstream of Terminus Dam along the Kaweah River, St. John's River, Cross Creek, and Tulare lakebed and includes the city of Visalia (see Plate1). The study also investigates the feasibility of providing increased water storage space for irrigation at Lake Kaweah. This Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) summarizes the results of the feasibility phase of the Kaweah River Basin Investigation, California. Chapter 1 includes the study authority, an overview of the study area and hydrology, and the purpose and need for the action; briefly describes the proposed action; and identifies significant resources and issues in the study area. 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

The general authority for this investigation comes from the 1964 Congressional Resolution of the House Committee on Public Works presented below:

> Resolved by the committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on Sacramento-San Joaquin Basin Streams, California, published as House Document No. 367, 81st Session, and other reports...with a view to determining whether any modification of the recommendations contained therein are advisable at this time, with particular reference to further coordinated development of the water resources in the San Joaquin River Basin, California.

1.3 STUDY AREA LOCATION AND HYDROLOGY

The Kaweah River Basin is located in the southeast portion of the San Joaquin Valley and flows naturally from the Sierra Nevada westward toward the Tulare lakebed. Hydrologically, the Kaweah River Basin is a closed system with the river terminating in the Tulare lakebed. The Kaweah River Basin is located

primarily within Tulare County and is bounded on the north by the Kings River Basin and on the south by the Tule River Basin. The western portion of the Kaweah River Basin extends into Kings County. The study area is divided into three reaches for descriptive and analytical purposes. These reaches are Terminus Dam and Lake Kaweah, the downstream area, and the Tulare lakebed. A general description of each area is provided below.

Terminus Dam and Lake Kaweah

Lake Kaweah is located on the main branch of the Kaweah River about 20 miles east of Visalia. Terminus Dam, built in 1962 by the U.S. Army Corps of Engineers, provides flood protection and irrigation water to downstream interests. The earthfill dam is 250 feet high and has a gross pool elevation of 694 feet mean sea level (m.s.l.), providing 143,000 acre-feet of storage capacity. Lake Kaweah inundates approximately 1,945 acres at maximum pool, floods nearly 5 miles of river, and varies from 700 to 9,000 feet wide.

The Southern California Edison Company owns and operates three small hydroelectric plants upstream from Terminus Dam. In addition, the Kaweah River Power Authority operates a 17-megawatt hydroelectric powerplant which was retrofitted to Terminus Dam in 1990.

Downstream Area

Downstream of Terminus Dam, the St. John's River divides from the Kaweah River at McKays Point. There are many other major and minor distributaries such as Deep Creek, Outside Creek, Cameron Creek, and Packwood Creek that divide from the Kaweah River below McKays Point. The Kaweah River ceases to be an identifiable stream south of Highway 245, and the river branches into Mill Creek and other streams. The St. John's River turns into Cross Creek below the confluence with Cottonwood Creek. A few unregulated tributaries such as Dry Creek and Yokohl Creek enter the system below McKays Point. As this system extends to the San Joaquin Valley floor, many more distributaries branch from the main river, creating the effect of a delta. Only a few of the distributaries eventually reach the Tulare lakebed.

Tulare Lakebed

The Tulare lakebed is located in the southern part of the Central Valley about equally distant from the cities of Fresno and Bakersfield. Historically, the Tulare lakebed received runoff from the Kaweah, Kern, Kings, and Tule Rivers. Because the lakebed lacked an outlet to the sea, it acted as a sink in most years, and at one time it, together with Buena Vista and Kern Lakes and surrounding marshes, was

the largest body of water west of the Mississippi River. In 1862, the wettest year on record, historic Tulare Lake covered about 486,000 acres to depths of 40 feet. During these extremely wet periods of large-scale flooding, an outlet to the Sacramento-San Joaquin River Delta was created. The last time that water flowed through the outlet was in 1878.

In the late 1800's and early 1900's, reclamation districts were formed to prevent flooding in the lakebed and agriculture activities began. Currently, the lakebed covers about 200,000 to 300,000 acres. It is extensively farmed in crops such as cotton, barley, wheat, safflower, alfalfa seed, and other field crops. Flooding is controlled by dams and diversions upstream on the Kaweah, Kern, Kings, and Tule Rivers and by flood control features such as floodwater storage basins, levees, and pumps within the lakebed.

Hydrology

The Kaweah River originates in a series of glacial lakes in the Sierra Nevada near Triple Divide Peak at an elevation of 12,634 feet m.s.l. Much of the Kaweah River drainage basin is located within Sequoia National Park. Upstream from Terminus Dam, the Kaweah River watershed is a fanshaped area of approximately 560 square miles above Lake Kaweah. The upper watershed flows through steep, narrow canyons, eventually meandering onto the flatter slopes of the San Joaquin Valley. The main stem of the Kaweah River is formed by four main forks (North, Middle, East, and South) flowing in a southwestern or western direction to their confluence near the foothill line. Lake Kaweah is formed by Terminus Dam on the main branch of the Kaweah River about 20 miles east of Visalia.

Downstream from Terminus Dam, the Kaweah River Basin is a closed system terminating in the Tulare lakebed. Dry Creek enters the Kaweah River about 1 mile downstream of Terminus Dam. At McKays Point, about 3 miles below the dam, the flow of the Kaweah River is divided between the St. John's and Kaweah Rivers. Mehrten and Yokohl Creeks join the Kaweah River below McKays Point.

The main channel of the Kaweah River flows into numerous distributary channels east of Visalia, transporting water for irrigation, and spreading. Most of the water is diverted for agricultural use or ground-water recharge basins located throughout the Kaweah Delta Water Conservation District (KDWCD). Kaweah River flows in excess of irrigation and recharge demand enter the Tulare lakebed as floodwater. Many of the distributary channels are used during the early summer to convey irrigation water to nearby farms. A large quantity of this water eventually infiltrates to ground water, where it is pumped to the surface for irrigation during dry months.

The two types of floods which may occur on the Kaweah River are winter rain and spring snowmelt. Winter rain floods are characterized by sharp peaks, with most of the volume normally occurring within a few days. The winter rainflood season is November through March. Snowmelt floods, while not producing the sharp peak flows, have a much larger runoff volume and longer duration. Spring snowmelt floods occur between April and July.

Controlled flow releases from Terminus Dam are limited by the total capacity of distributary channels below McKays Point. These releases are a maximum of 5,500 cubic feet per second (cfs). Greater flows cannot be controlled at McKays Point and may flood developed portions of Visalia and downstream agricultural areas such as the Tulare lakebed.

1.4 PURPOSE AND NEED FOR THE ACTION

The U.S. Army Corps of Engineers and the non-Federal sponsors, are proposing to increase flood protection downstream of Terminus Dam and to increase storage space in the reservoir for agricultural water supply. The non-Federal sponsors include KDWCD, City of Visalia, Tulare County, and Kings County with assistance from the California Department of Water Resources. The California Department of Water Resources provided in-kind services including preparing portions of this report. The project objectives (flood control and irrigation water supply) would be accomplished by raising the existing spillway at Terminus Dam by 21 feet. Spillway modifications include placing a 21-foot-high concrete ogee weir over the spillway sill and widening the spillway from 307 to 455 feet. Construction is scheduled to begin in mid 1999.

Terminus Dam was authorized by the 1944 Flood Control Act and was constructed in 1962. The earthfill Terminus Dam is 250 feet high, and at maximum pool Lake Kaweah inundates approximately 1,945 acres. The total reservoir capacity at construction was 150,000 acre-feet with 142,000 acre-feet reserved for flood control and irrigation water supply and 8,000 acre-feet to store sediment. When constructed, the frequency of uncontrolled spills from Terminus Dam was at about a 60-year event. However, revised hydrologic information shows that the frequency of uncontrolled spills from the Dam is about a 46-year event.

Flooding problems downstream of Terminus Dam still exist due to unexpectedly high amounts of precipitation and sediment that have entered the reservoir and revised hydrologic information. Approximately 7,000 acre-feet of sediment has accumulated in the reservoir area, leaving about 1,000 acre-feet of available sediment space. In 1977, an aerial sediment survey showed that only

143,000 acre-feet of storage capacity remained in Lake Kaweah. Although this volume suggests a high rate of sediment accumulation, much of the added sediment was likely deposited during a December 1966 peak inflow of 105,000 cfs.

Flooding downstream of the dam occurs when flows from individual creeks blend together and form sheet flow through urban and agricultural areas. The sheet flow inundates approximately 119,214 acres in the existing 100-year flood plain. Included in the flood plain area are the communities of Visalia, Farmersville, Ivanhoe, and Goshen. The Kaweah River Basin has a history of flooding dating back to the mid-1800's. Since construction of Terminus Dam, damaging floods have occurred in 1966, 1969, 1978, 1983, and 1986. Downstream communities and areas adjacent to the flood plain are at risk of future flooding.

Flooding in the Tulare lakebed can occur from the Kings, Kaweah, Tule, and Kern Rivers, plus local flooding. The construction of Terminus Dam, Pine Flat Dam, Isabella Dam, and Success Dam has improved flooding conditions for the Tulare lakebed. Currently, the lakebed has about a 3-year level of protection from the Kaweah River. Floodwaters reaching the lakebed can be beneficial when received at the proper time and in the proper amount for water supply and agricultural activities. Floodwaters are pumped and stored in the south flood areas for later irrigation use. However, when the lakebed receives floodwater that the conveyance, pumping, and storage system cannot handle or when the flood detention basins are full, crop damages or an interruption in cropping cycles can occur. Cropping cycles are interrupted when floodwater delays crop planting or when floodwater remains on agricultural lands more than one season. Since the construction of Terminus Dam, crop cycles have been adversely affected 7 times: December 1966 through 1967, January 1969 through August 1971, 1978, 1980, 1982, 1983-84, and 1986. Future flooding in the lakebed may continue to be a problem.

The irrigation requirements and infiltration capability of the KDWCD service area are important in the flood control operation of Lake Kaweah. Since the Kaweah River has no outlet to the ocean, all floodflows not stored in the reservoir must be used or disposed of within the upper service area. Otherwise, they enter the Tulare lakebed as potentially damaging floodwaters.

The KDWCD coordinates with the Kaweah and St. John's Rivers Association to manage irrigation water supply within the district boundaries. They also work to improve the ground-water overdraft problems in the district. The California Department of Water Resources (DWR) has identified the Kaweah River alluvial fan area as a distinct ground-water basin called the Kaweah Basin. This basin generally follows the KDWCD service area boundaries which are shown in Figure 1-1.

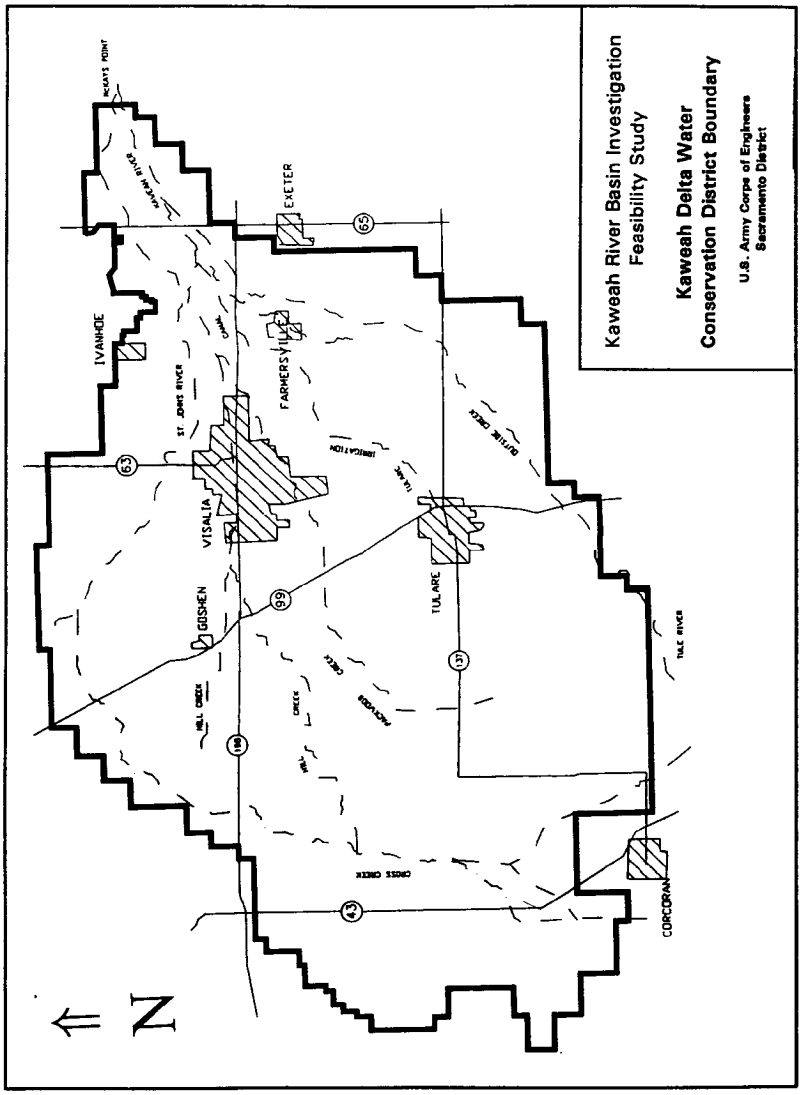

Kaweah River Basin Investigation
Feasibility Study
Kaweah Delta Water
Conservation District Boundary
U.S. Army Corps of Engineers
Sacramento District
N
IVANHOE
EXETER
FARMERSVILLE
VISALIA
GOSHEN
TULARE
CORCORAN
ST. JOHNS RIVER
KAWEAH RIVER
OUTSIDE CREEK
TULE RIVER
CROSS CREEK
HILL CREEK
63
65
99
137
43

Figure 1-1

When flood control releases must be made from Lake Kaweah, all possible diversions to agricultural irrigation systems are used. Additionally, extensive areas of permeable soils have been reserved for ponding and spreading to recharge the heavily pumped ground-water storage and prevent inundation of agricultural cropland in the Tulare lakebed.

Ground-water overdraft is a problem in the Kaweah Basin. Overdraft was estimated at 150,000 acre-feet in 1975. Water level declines throughout much of the basin are attributed to the development of irrigated agriculture in areas having an inadequate surface water supply. The conversion of agricultural lands to urban development and the removal of surface irrigation water from additional lands contribute to overdraft in the basin. Maximum ground-water level declines have exceeded 6 feet per year in the western part of the Kaweah Basin (Camp, Dresser and McKee, May, 1993).

KDWCD has expressed a need for increased irrigation supply storage at Lake Kaweah for water management within the basin. KDWCD was formed in 1927, under the provisions of the Water Conservation District Act of 1927. KDWCD's purpose is to conserve and store waters of the Kaweah River and to conserve and protect the underground water of the Kaweah River. Currently, the operation of the reservoir dictates providing flood control storage space starting the first part of September, and reaching the maximum drawdown by mid-November. Conditional storage of irrigation water begins April 1 and reaches maximum storage in May. From May through September the reservoir is operated to optimize irrigation water supply. This operation would not change with the project.

Additional irrigation water supply storage at Lake Kaweah would increase the ability to manage the water supply resources in the district. For example, increased storage capacity at the reservoir would allow irrigation water to be available longer in the irrigation season (May to September). Depending upon the water year, surface irrigation water supply from the reservoir is usually exhausted by August. At this time the farmers start ground-water pumping to finish the irrigation season. Additional storage space would allow irrigation deliveries longer in the season and reduce the amount of ground-water pumping. Increased storage space would also give more flexibility in using their ground-water recharge basins within the district.

Therefore, the purpose and need for the project, which are flood control and water supply, would be met by both of the alternative plans. The capacity of the reservoir would be increased by 42,600 from the existing capacity of 143,000 acre-feet. With the project, the frequency of flooding from floods overtopping the spillway at Terminus Dam, would be changed to about the 70-year event. The

Tulare lakebed would be protected from Kaweah River flooding to about the 3.2-year event.

1.5 SIGNIFICANT ISSUES

A public workshop was held in March 18, 1987, in Visalia at the end of the reconnaissance phase of the project. A number of environmental issues were raised. Additional non-environmental issues are addressed in the Feasibility Report. Many issues were related to potential alternatives that are no longer being considered The following environmental issues related to the current proposed project were retained for further review.

- Loss of riparian and wetland habitats
- Return of the Tulare lakebed to its natural conditions
- Overdraft of ground water in the study area
- Loss of existing natural areas and wildlife habitat

Because of recent contacts with the Kaweah Preservation Group, recreation concerns (inundation of recreation facilities and lack of a permanent minimum pool) have been added to the above list. Issues were eliminated that are not in the scope of the agency's proposed action. The issue concerning the return of the Tulare lakebed to its natural conditions was eliminated because it is not in the scope of this study. The remaining issues were considered significant issues to be evaluated in the EIS/EIR. Indicators, when possible, are used to quantify or measure the environmental consequences of the issues. The issues and indicators are discussed below.

- Loss of riparian and wetland habitats. Project construction and the resulting increased inundation at the reservoir may adversely affect some riparian and wetland habitats around the reservoir. Additionally, wetlands at the Tulare lakebed may be affected due to the reduction in floodflows. The indicator is acres of habitat lost and habitat units (HUs) lost.

- Overdraft of ground water in the study area. The proposed project would decrease the ground-water overdraft by providing surface irrigation water longer in the growing season. As a result, ground water pumping would be reduced. The increased storage space in the reservoir would also allow greater flexibility in filling its ground water recharge basins. There is no indicator for this issue because the benefits to ground water cannot be quantified for this study. Variations occur in surface water supply from year

to year, and without extensive ground water aquifer surveys and testing it would be impossible to quantify the study's benefits on the groundwater supply. Such surveys and studies are beyond the scope of this study.

- Loss of existing natural areas and wildlife habitat. Project construction and inundation and with the reduction in floodflows at the lakebed may adversely affect some natural areas and wildlife habitat. The indicator is acres of habitat lost and HUs.

- Project Affects on Recreation. The new reservoir gross pool for the proposed project would periodically inundate some of the existing recreation facilities (campgrounds and picnic areas). These facilities (except for basic minimum facilities) would not be relocated or replaced because there is no non-Federal sponsor to cost share in the relocation costs. The indicator is visitor-days lost.

  The existing Terminus Dam project does not include a permanent minimum pool in the project authorization. In the past, the sediment pool has served as a pool, providing fish and wildlife habitat and water for recreational uses. The sediment space is now almost full (about 1,000 acre-feet remaining). The project alternatives would not address the lack of a permanent minimum pool or a sediment pool at the reservoir. However, the locally preferred plan which increases the conditional rainflood space in the reservoir, allows up to 12,000 acre-feet of winter carryover water for the life of the project (100 years).

1.6 THE DECISIONS TO BE MADE BASED ON THIS ANALYSIS

The District Engineer, the commander of the Sacramento District of the Corps of Engineers, has decided to recommend the NED plan as the selected plan to be authorized for implementation as a Federal project, with modifications at the discretion of the Chief of Engineers. The final documents are being submitted to Corps Headquarters for review and subsequent action.

1.7 ORGANIZATION OF THE EIS/EIR

The EIS/EIR is organized into six chapters. Chapter 2.0 Alternatives Including the Proposed Action discusses the plan formulation and selection and all of the alternatives considered for this project. A detailed description of the selected plan is also included in the chapter. Chapter 3.0 Affected Environment discusses the environmental setting and baseline conditions for the affected environment in the study area. Chapter 4.0 Environmental Consequences discusses the impacts of the proposed project on the affected environment and mitigation. Chapter 5.0 Other Required Disclosures presents other chapters required in an EIS/EIR. Chapter 6.0 contains the List of Preparers while Chapter 7.0 contains References and Chapter 8.0 contains the Index.

CHAPTER 2.0

ALTERNATIVES INCLUDING THE PROPOSED ACTION

Kaweah River above reservoir

CHAPTER 2.0

ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 INTRODUCTION

This chapter describes project alternatives (potential actions) and summarizes their environmental impacts. 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.

As previously stated, the Kaweah River Basin Investigation is being conducted in response to requests from the non-Federal sponsors. A scoping meeting was held in 1987 to gather the public's ideas regarding problems and possible solutions in the study area. The public feedback from these meetings was used to identify planning objectives and generate conceptual plans. Formulation criteria were then developed, and these criteria and the planning objectives were used to screen preliminary alternatives for the project.

2.3 ALTERNATIVES CONSIDERED BUT NOT STUDIED IN DETAIL

The following alternatives were developed and analyzed during the reconnaissance phase of the study. These alternatives can be found in the "Kaweah River Basin Investigation, California Reconnaissance Report," July 1987. The following alternatives have been eliminated from further study. The alternatives discussed in this section were eliminated because (1) they failed to meet the project flood control or water supply goals, (2) the costs exceeded the

benefits, or (3) the associated environmental impacts were excessive. The alternatives have been grouped into the following categories: alternative storage sites, detention basins, other construction alternatives, and nonstructural alternatives.

2.3.1 Alternative Storage Sites

Storage Upstream of Terminus Dam

Potential reservoir sites upstream of Terminus Dam were eliminated from further study because the potential sites would capture runoff from only a portion of the drainage area. Therefore, the amount of water stored in these reservoirs would be small. The costs of dam construction and mitigation for environmental impacts would exceed the benefits received from such reservoirs.

Storage on Other Kaweah Basin Streams

Flood control storage on other streams in the Basin was not studied further due to excessive costs. A large number of reservoirs for small drainage areas would have to be constructed in order to provide effective flood protection. Additionally, flooding from streams in the Kaweah Basin is too localized to provide additional protection to the communities in the study area and the Tulare lakebed. Also, this alternative would not meet the water supply goal.

Limekiln Dam and Reservoir

This alternative proposed constructing a reservoir at the confluence of Dry Creek and the Kaweah River, about 1 mile downstream from the existing dam. Terminus Dam and the new Limekiln Dam would be operated together and would provide flood control, water supply, and hydropower. This alternative was eliminated from further consideration because of excessive costs, significant cultural and environmental effects and mitigation, and lack of local support.

Limekiln Dry Dam

A smaller dry dam was investigated at the Limekiln Reservoir site to provide a 100-year level of flood protection to Visalia. The hydropower plant at Terminus Dam would be inundated at gross pool, and flood proofing costs were infeasible. The reconnaissance-level cost estimate was about $131 million not including environmental and cultural resources mitigation. Therefore, this alternative was eliminated due to excessive costs.

Dry Creek Detention Basin in Conjunction with Enlarging Lake Kaweah

Dry Creek flows are the major unregulated contributor to floodwater reaching Visalia and the Tulare lakebed. Constructing a small flood control detention basin, in conjunction with enlarging Lake Kaweah, was considered at a site on Dry Creek near the confluence with the Kaweah River. This Dry Creek alternative was eliminated from further study due to high construction costs and extensive environmental and cultural resource effects and mitigation.

Dry Creek Reservoir with Tunnel Connection to Enlarged Lake Kaweah

This alternative proposed constructing a large reservoir on Dry Creek with a connecting tunnel to an enlarged Lake Kaweah. The tunnel would allow off-stream storage of Kaweah River and Dry Creek waters for flood control and water supply. This alternative was also eliminated from further study due to high construction costs and extensive environmental and cultural resource effects and mitigation.

2.3.2 Detention Basins

Ground-Water Recharge/Increased Spreading Areas

Due to the large flows in the Kaweah system during the past 15 years, large spreading areas for ground-water recharge would have to be reserved to solve the flooding problem. Since ground-water recharge is already used extensively in the study area, however, additional potential sites are limited due to agricultural and urban development. Therefore, this was not considered to be a viable alternative.

Detention Basin near Highway 99

This alternative proposed constructing a 28,000-acre-foot detention basin and channel work along the St. Johns River near Highway 99. A new weir would be included at McKays Point. The high cost of the channel work and land requirements and the loss of riparian vegetation eliminated this alternative from further consideration.

Detention Basin on Kaweah River above Visalia

A new control structure at McKays Point and a 35,000 acre-foot detention basin above Visalia were considered as an alternative during the reconnaissance phase of the study. The high cost of the channel work and land requirements and the loss or riparian vegetation eliminated this alternative from further consideration.

2.3.3 Other Construction Alternatives

Levee and Channel Construction

Levee and channel improvement alternatives to facilitate the transport of floodwater to the Tulare lakebed were not considered in detail in this study. Because flooding causes crop damage in the lakebed, an extensive flood control system has been developed. Construction of levees and other upstream flood control alternatives would worsen the existing flooding conditions in the area. Additionally, the nature of the Kaweah River system with its numerous distributaries would make any channelization project extremely expensive.

Any levee and channel construction alternative would not meet the planning objective of providing additional water supply for agriculture and would likely adversely affect the remaining riparian vegetation along the Kaweah River.

Pumping into Friant-Kern Canal

In 1978, 1981, and 1983, floodwater was pumped into the Friant-Kern Canal to alleviate flood problems. However, pumping into the canal depends on obtaining permission from the U.S. Bureau of Reclamation (USBR) and the availability of channel capacity. When permission to pump has been granted, the USBR has emphasized that it was an event-specific situation based on conditions at the that time and would not be precedent setting. Future increased demands on this system for water supply also reduce any possibility of the Friant-Kern Canal's use for flood control. Because of the uncertainty of permission and available channel capacity, this alternative was dropped from further consideration.

Dredging Lake Kaweah

When Terminus Dam started storing water in 1962, the gross storage capacity was 150,000 acre-feet. Since then, sediment from the drainage area has reduced the capacity of the reservoir to about 143,000 acre-feet. The storage capacity could be increased by about 6,000 acre-feet by removing the 9,680,000 cubic yards of sediment. However, the costs of removing this sediment are high. The cost of dredging alone was estimated at $24 million, not including the high costs of mobilization, demobilization, drawing down the reservoir, disposal, or mitigation. Therefore, this alternative would not be cost effective, and it was not considered further.

2.3.4 Nonstructural Alternatives

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 means other than controlling floodwaters by changing the use of the flood plain or by accommodating existing uses to the flood hazard. Most nonstructural alternatives are directed at flood damage reduction of individual property through the use of land use restrictions and other actions. Nonstructural alternatives 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 the flood; and postflood reoccupation and recovery. These procedures are currently in force under a coordinated plan involving Federal, State, and community governments.

Currently, an emergency warning system in the County of Tulare alerts the public in times of flooding. The system is operated through the Office of Emergency Services in Tulare and the County Sheriff's Office. The emergency system also includes the Corps of Engineers (Corps) project offices at Terminus and Success Dams.

Nonstructural measures were considered in accordance with Corps' regulations, which require that a nonstructural plan be included in a full array of alternatives. The feasibility of applying nonstructural measures of flood protection in Visalia and Farmersville was evaluated using a computer model developed by the Corps for the State of California. The model estimates the benefits and costs of implementing various nonstructural measures. The results indicated that constructing new development on fill to raise the structures out of the flood plain

would be more cost effective than other nonstructural measures such as ring levees, floodwalls, raising existing structures, and relocations. Therefore, there are no feasible nonstructural measures for existing structures.

2.4 ALTERNATIVES CONSIDERED IN DETAIL

Plan formulation results are discussed in detail in Chapter 5 of the Feasibility Report. During the plan formulation process, as part of the optimization studies, the following optimizations of raising the spillway at Terminus Dam were analyzed: 10 feet, 15 feet, 21 feet, and 26.1 feet. Plan formulation results indicated that the NED plan would be raising the spillway 21 feet. The locally preferred plan would also raise the spillway 21 feet but would change water control diagram for the reservoir. Therefore, Alternative 1 (no action) and Alternative 2 (NED plan), and Alternative 3 (locally preferred plan) are discussed below and throughout the EIS/EIR.

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. Without-project conditions for the affected environment are described in Chapter 3. 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, and that the spillway would not be raised nor would any other changes be made to Terminus Dam. Flooding would continue downstream and at the Tulare lakebed, resulting in loss of agricultural production and damage to homes, businesses, and public facilities. Water supply for agriculture would remain at its current level, and ground-water overdraft problems would continue.

Under the no action alternative, future reservoir operations over the proposed project life (2000-2100) would differ from the existing conditions. The remaining sediment storage space (about 1,000 acre-feet) in the reservoir would be filled prior to the year 2000. However, conditional storage during the rainflood season would be allowed when the ground is dry and the runoff minimal. Since the sediment pool was found to be at the 1,000 acre-foot level, the Corps and local sponsors have deviated from strict adherence to reservoir operations at low elevations using precipitation parameters and yearly reservoir deviations, and have never actually drawn the reservoir down to 1,000 acre-feet. These modifications have allowed some water to remain in the reservoir for fisheries and recreation. The water is also used as a carry-over water supply in case of a dry year. Without the project, the conditional storage space would continue for about 50 years as

sediment would continue to build up in the reservoir, eventually diminishing conditional carryover space. During the winter rainflood season, the reservoir could be drawn down at any time for flood control purposes.

2.4.2 Alternative 2 (NED Plan)

Alternative 2, the NED plan, consists of raising and widening the spillway at Terminus Dam. The spillway would be raised 21 feet from 694 feet, m.s.l., to 715 feet, m.s.l. This would raise the gross pool by 21 feet and add 42,600 acre-feet of flood storage space in Lake Kaweah. The conditions would remain as described for the no-action alternative for the sediment pool at the reservoir. However, the NED plan would provide 7,000 acre-feet of conditional storage above the sedimentation space when the ground is dry and surface runoff is minimal. The 7,000 acre-feet of conditional storage would remain constant over the life of the project. However, the reservoir could be drawn down at any time during the flood season.

The spillway would be widened from the existing 307 feet to 455 feet. An ungated concrete ogee section would be placed over the existing concrete broadcrested sill. Rock excavation would be required at the right and left abutments, with most of the excavation taking place on the left abutment. The excess material would be placed on the downstream face of the dam.

No new access roads would be required, and no existing access roads would be relocated. The existing bridge over the spillway would be lengthened by 140 feet to accommodate the widening of the spillway. This lengthening would involve adding two 70-foot concrete spans to the bridge.

To accommodate the rise in gross pool elevation, the existing State Highway 198 bridge over Horse Creek would be relocated immediately upstream of the existing bridge. Currently, the lowest elevation on the bridge is 711.5 feet, m.s.l. This bridge would be reconstructed at a new height of 718.5 feet, m.s.l. This is an increase of about 7 feet. The highway leading into and out of the bridge would also be raised, and the highway would be reconstructed for about 1,500 feet on each side. The structural design would be the same as the existing highway. The location of the bridge and highway would be slightly offset. During construction, the existing bridge would be kept open and then demolished when the new bridge is completed and open to traffic.

The total land required for construction of the selected plan would be 618 acres. There are 243 acres in the reservoir area between 694 feet, m.s.l., and 715 feet, m.s.l., this area would not be cleared of vegetation before inundation. There are several structures that may need to be relocated due to the project. These

structures would be entitled to relocation assistance benefits. The relocations include one motel and 6 dwellings.

Many of the existing recreation facilities in the Kaweah and Horse Creek Recreation Areas would be periodically inundated under the project alternatives in the spring and early summer when the reservoir fills. These facilities include boat launching ramps, parking lots, camp grounds, picnic areas, playgrounds, and restrooms. As part of the project, to maintain basic minimum facilities, two vault toilets and the county boat building would be relocated and the boat ramp at Lemon Hill would be extended to remain above the new gross pool. The vault toilets that would be relocated are at Lemon Hill and Horse Creek. However, no non-Federal sponsor was initially willing to cost share in the study of a recreation plan, to relocate the remaining inundated recreation facilities to adjacent areas above 715 feet, m.s.l.

Plan Accomplishments

Terminus Dam currently fills and unregulated spills occur about once in 46 years. The NED plan would change the frequency of Terminus Dam spilling to about the 70-year event. However, Visalia would still be subject to flooding from the Dry Creek Basin, estimated to be about the 15-year event. Currently, the Tulare lakebed has about a 2.7-year level of protection from the Kaweah River. The NED plan would increase flood protection to about the 3.2-year level.

The NED plan would reduce flood damages up to the 225-year event. However, for events larger than the 225-year, the plan would increase downstream flood damages by releasing more water through the wider spillway.

The NED plan would not create any "new" water for the Kaweah River Basin. Under existing conditions during the flood season, Terminus Dam releases that cannot be beneficially used in the downstream area end up as potential floodwater in Tulare lakebed. With the NED plan, the larger storage capacity of the reservoir would capture more of those "floodwaters" for beneficial uses. The increased storage of floodwater during the winter flood season is temporarily stored and then released downstream under controlled conditions. During the spring snowmelt runoff season, the increased size of the reservoir would store and control the release of snowmelt runoff. Therefore, the enlarged reservoir both reduces downstream flooding and allows increased storage of irrigation water. Proper timing and regulation of releases would "convert" this additional potential floodwater into an irrigation supply. The additional average annual irrigation supply that could be stored is about 8,400 acre-feet. The members of the Kaweah and St. John's Rivers Association have rights to this water.

A 17-megawatt hydropower generating plant was retrofitted to Terminus Dam and started producing power in 1990. The power plant may be modified by the non-Federal sponsor to adjust to the new gross pool elevation prior to completion of the project.

Project Operation

The existing dam and reservoir are operated by the Corps for the primary purpose of flood control, irrigation, and water supply. The Corps has historically coordinated closely with downstream water users to ensure that the reservoir is operated according to Federal requirements, contractual water rights, and local needs.

Implementation of the NED plan would not change the basic operation of the project. Timing of releases would be the about the same. Flood control space in the reservoir would be provided starting the first part of November, reaching the maximum floodspace by mid-November. Conditional storage of irrigation water would begin April 1 and reach maximum storage by May 1. From May through September, the reservoir would be operated to optimize irrigation water supply. The additional storage space provided by this plan would allow greater storage of snowmelt during the spring and summer months, which would allow irrigation water releases for a longer period during the irrigation season.

The flow of the Kaweah River would continue to be allocated at the dam to each of the water right holders based on diversion, storage, and water right schedules agreed upon by all water right holders. Allocation of irrigation supply would be based on inflow, as computed by the Corps and measured at the dam.

Operation of the dam and reservoir under Alternative 1 would decrease floodflows in the downstream distributaries mainly during the spring snowmelt season and thereby decrease flooding of adjacent agricultural lands and urban development. The plan would also reduce the volume and duration of flooding in the Tulare lakebed. However, the lakebed would continue to receive floodwaters from the other major streams, including the Kings, Tule, and Kern Rivers, as well as local drainages.

The Kaweah River floodwater which reaches the Tulare lakebed area flows either into the lakebed or into the south flood areas for storage and later use. The flow split varies depending on the timing of the flood, the rate of total inflow from all sources, the capacity to route floodwater to the south flood areas, and the availability of and demand for irrigation water. The economic analysis of the flood damages in the feasibility study assumed that the Kaweah River floodwaters

reaching the lakebed split evenly (50/50) between the lakebed area and the flood detention basins.

Because the lakebed is actively farmed, excess water is often rapidly pumped and stored in the south flood areas. As a result, habitat and wildlife use is higher in the south area basins than in the lakebed. To reflect this difference, the environmental evaluation assumed that 75 percent of the flows for smaller more frequent flood events that entered the lakebed were pumped immediately into the south area detention basins. This split has been coordinated with lakebed personnel (Hurlbutt pers comm, 1993) and allows a more realistic determination of project-related environmental effects for more frequent flood events.

Additionally for the environmental analysis, the reduction in flooded area at the lakebed was calculated using the average reduction in flooding from smaller more frequent flood events over a 27 year period of analysis. This was done to more accurately reflect the long-term effects of the project. The major flood events tend to skew the effects of the project at the lakebed and were therefore not included in the environmental analysis.

The flow split of 75/25 along with eliminating the larger flood events from analysis, resulted in a decrease in flooded area in the Tulare lakebed of 1,412 acres on an average annual basis. The remaining discussion of environmental resources, potential impacts, and mitigation measures in this EIS/EIR is based on this reduction of flooded area. The decrease in duration of flooding is the same with either flow split.

2.4.3 Alternative 3 (Locally Preferred Plan)

Alternative 3, the locally preferred plan, consists of raising and widening the spillway at Terminus Dam as described for Alternative 2. The structural components of the two alternatives are the same. However, Alternative 3 also changes the water control diagram and basin wetness parameter for Lake Kaweah.

The water control diagram shows the seasonal distribution of flood space and conservation space within the reservoir and describes the operational or release guidelines for the reservoir. Flood space is the space allotted within the reservoir for flood control to the downstream area while conservation space is the space allotted to irrigation water supply.

The basin wetness parameter is used as an index of soil moisture. The parameter is computed based on accumulated rainfall and associated soil conditions in the watershed. Soil moisture determines how much space is needed in the reservoir to store runoff.

Currently, the entire reservoir is used for flood control space during the flood season (mid-November to the end of the snowmelt season). The season is made up of two operation scenarios: rainflood operation and snowmelt operation. Rainflood operation begins in mid-November and extends to the end of April while the snowmelt operation begins on February 1 and ends at various times depending on yearly snowmelt conditions. During the rainflood season, the flood control space contains conditional space that can store carryover water based on the basin wetness parameter. Currently, the conditional rainflood space is 7,000 acre-feet, which means that based on the wetness parameter, up to 7,000 acre-feet can be stored in the reservoir during the rainflood operation season. During the snowmelt season, the Corps coordinates with the watermaster to determine reservoir storage based on snowmelt forecasting for each season. When conditions warrant it, however, the entire reservoir may be emptied for flood control purposes at any time.

During the reservoir modeling for predicting future conditions for Alternative 3, the 30-year average storage in the reservoir during the rainflood season was determined to be 12,000 acre-feet. As a result, Alternative 3 modifies the current water control diagram and basin wetness parameter to store up to 12,000 acre-feet during the rainflood season. Although actual storage during the rainflood season may be higher depending on conditions in the watershed. If necessary, the diagram would be modified in the future to allow for an inflow of sediment into the reservoir, but the revised wetness parameter would be a permanent addition to the diagram and would not be modified. When conditions warrant it, however, the entire reservoir would continue to be emptied for flood control purposes at any time.

Existing snowmelt operations would not change under Alternative 3. The Corps would continue to coordinate with the watermaster to determine reservoir storage based on snowmelt forecasting for each season.

Under Alternative 3, flows to the Tulare lakebed would remain as described for Alternative 2 for the smaller, more frequent flood years used in the environmental analysis. Alternative 3 would provide 3.1 year flood protection to the lakebed. The change in flood duration at the lakebed would also remain as described for Alternative 2.

Plan Accomplishments

Alternative 3 would provide the same level of flood protection to Visalia as Alternative 2. Visalia would be protected from floods from the Kaweah River to about the 70-year event, and the lakebed would be protected to about the 3.1-year level. Alternative 3 would reduce flood damages up to the 225-year event.

However, for events larger than the 225-year, the plan would increase downstream flood damages by releasing more water through the wider spillway.

As with Alternative 2, this plan would not create any "new water" for the Kaweah River Basin. Excess floodwaters that would be sent to the Tulare lakebed under existing conditions would be stored at the reservoir and released downstream under controlled conditions for irrigation. The additional average annual irrigation supply that could be stored is about 8,400 acre-feet. The power plant would be modified at described for Alternative 2.

Project Operation

Alternative 3 would not significantly change the existing timing of the basic flood control and water supply operations of the project. Flood control operation would begin in mid-November and end when the snowmelt season ends, usually by mid-June Operation for irrigation water supply would begin in May and continue through September.

However, Alternative 3 would modify the current water control diagram and basin wetness parameter to allow storage of up to 12,000 acre-feet of water during the rainflood season. This water could be carried over the winter rainflood season. The additional storage would allow irrigation water releases for a longer period during the irrigation season. Snowmelt operations would not change from existing conditions.

Under Alternative 3, there would be a decrease in flooded area in the lakebed of 1,412 acres on an average annual basis for smaller, more frequent flood events as described for Alternative 2.

2.5 COMPARATIVE IMPACTS OF THE ALTERNATIVES

For analytical purposes, the environmental effects of the various alternatives have been classified as direct and indirect impacts. Direct effects include both the effects that would result immediately from constructing the project and the effects that would result from operating the project. Indirect effects would result from the effects of the project on regional growth patterns in the study area. These impacts have been measured by comparing environmental conditions with the project to the conditions likely to prevail without the project. For this comparison, a 100-year period of analysis was used.

Table 2-1 summarizes the environmental effects of the no action alternative, NED plan, and the locally preferred plan. Chapter 4 describes in detail the environmental effects of the alternatives.

Mitigation for project-related impacts is discussed in detail in Chapter 4.0 and Section 5.7. Mitigation is summarized in Table 2-2 for Alternatives 2 and 3. 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

Mitigation for all direct effects of the NED plan or the locally preferred plan would be a joint responsibility of the Corps and the non-Federal sponsor on a cost-shared basis. The direct significant effects and the mitigation measures to avoid, minimize, or compensate for these effects are summarized in Tables 2-1 and 2-2 and are discussed in detail in Chapter 4 and Section 5.7.

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 report.

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 further 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 2-1
Summary of Environmental Effects

Affected Environment	Alternative 1 (No Action)	Alternative 2 (NED Plan)	Alternative 3 (Locally Preferred Plan)
Land Use	Urban and agricultural development would continue as it does now.	No change from current trends is expected.	No change from current trends is expected.
Socioeconomic	Population would continue to increase.	No change from current trends is expected.	No change from current trends is expected.
Recreation	Fishery resources may decline. Use of all other recreation facilities would increase.	Some recreation facilities would be periodically inundated. Fishery conditions would likely decline.	Some recreation facilities would be periodically inundated. Fishery conditions would improve in the winter.
Hazardous, Toxic, and Radiological Waste	Current monitoring and remediation efforts at identified HTRW sites would continue.	The proposed project may accelerate the plume associated with the LUFT site at Kaweah Recreation Area and in Three Rivers.	The proposed project may accelerate the plume associated with the LUFT site at Kaweah Recreation Area and in Three Rivers.
Transportation	Traffic volumes and LOS on SR198 at the reservoir would not change. Traffic volumes and LOS on roads in the downstream area would change due to increasing congestion. Conditions at the lakebed would not change.	Effects would be temporary and of short duration, and would consist of mainly traffic delays due to construction equipment and work at Horse Creek Bridge.	Effects would be temporary and of short duration, and would consist of mainly traffic delays due to construction equipment and work at Horse Creek Bridge..
Noise	Noise levels would be the same as existing conditions.	Adverse noise effects due the project would be short-term construction effects. Increased noise would be generated from heavy equipment during construction at the reservoir.	Adverse noise effects due the project would be short-term construction effects. Increased noise would be generated from heavy equipment during construction at the reservoir.
Air Quality	Regional air pollution emission rates would not change and may improve over time with stricter standards.	Adverse air quality effects would be temporary and short-term due to construction activities. Emissions would be due to construction equipment and other construction-related emissions.	Adverse air quality effects would be temporary and short-term due to construction activities. Emissions would be due to construction equipment and other construction-related emissions.
Water Quality	Surface and ground water quality would not change from existing conditions.	The proposed project would not have any adverse effects on water quality if best management practices are implemented.	The proposed project would not have any adverse effects on water quality if best management practices are implemented.

TABLE 2-1
Summary of Environmental Effects

Affected Environment	Alternative 1 (No Action)	Alternative 2 (NED Plan)	Alternative 3 (Locally Preferred Plan)
Vegetation and Wildlife	There would be no significant changes from existing conditions at the reservoir. No change is expected downstream or at the lakebed.	Construction and inundation would affect 93 acres of riparian scrub, 70 acres of riparian forest, 132 acres of oak savannah, and 38 acres of oak woodland. The downstream area would not be adversely affected and 1,412 average annual acres in the lakebed would be affected due to reduction in flooding.	Construction and inundation would affect 93 acres of riparian scrub, 70 acres of riparian forest, 132 acres of oak savannah, and 38 acres of oak woodland. The downstream area would not be adversely affected and 1,412 average annual acres in the lakebed would be affected due to reduction in flooding.
Fisheries	Fishery resources would decline due to the lack of sediment storage space to provide water during the winter.	Fishery conditions would not significantly improve over conditions described for Alternative 1.	Fishery conditions in the winter would improve over conditions described for Alternative 1.
Endangered Species	Habitat conditions would likely continue to decline without further protection.	The valley elderberry longhorn beetle, a listed species, would be adversely affected. Foraging habitat for the bald eagle may improve in some years. Two candidate plant species may also be affected.	Foraging habitat for the bald eagle would likely improve. The only listed species to be adversely affected would be the valley elderberry longhorn beetle. Two candidate plant species may also be affected.
Cultural Resources	On a regional basis, cultural resources sites would continue to be adversely effected due to urban expansion, agricultural practices, and natural processes.	No adverse effects to cultural resources would occur with the project.	No adverse effects to cultural resources would occur with the project.

TABLE 2-2
Summary of Mitigation

Affected Environment	Alternative 2 (NED Plan)	Alternative 3 (Locally Preferred Plan)
Land Use	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.	There would be no significant adverse effects on land use due to this alternative therefore, no mitigation would be needed.
Socioeconomic	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.	There would be no significant adverse effects on land use due to this alternative; therefore, no mitigation would be needed.
Recreation	A non-Federal cost-sharing partner has not been identified at this time; therefore; no recreation sites would be relocated.	A non-Federal cost-sharing partner has not been identified at this time; therefore; no recreation sites would be relocated.
Hazardous, Toxic, and Radiological Waste	HTRW sites affected by this alternative or project mitigation would be remediated according to applicable Federal, State, and local regulations.	HTRW sites affected by this alternative or project mitigation would be remediated according to applicable Federal, State, and local regulations.
Transportation	Temporary short-term construction effects would be mitigated through best management practices.	Temporary short-term construction effects would be mitigated through best management practices.
Noise	Temporary short-term construction effects would be mitigated through best management practices.	Temporary short-term construction effects would be mitigated through best management practices.
Air Quality	Temporary short-term construction effects would be mitigated through best management practices.	Temporary short-term construction effects would be mitigated through best management practices.
Water Quality	There would be no adverse effects due to this alternative if best management practices are implemented; therefore, no mitigation would be needed.	There would be no adverse effects due to this alternative if best management practices are implemented; therefore, no mitigation would be needed.
Vegetation and Wildlife	Mitigation includes 21 acres for riparian scrub, 14 acres for riparian forest, 320 acres for oak savannah, and 99 acres for oak woodland, and 366 acres for wetland habitat.	Mitigation includes 21 acres for riparian scrub, 14 acres for riparian forest, 320 acres for oak savannah, and 99 acres for oak woodland, and 366 acres for wetland habitat.
Fisheries	Conditions for fisheries would not change from without-project conditions; therefore, no mitigation for fisheries would be needed.	Conditions for fisheries would improve in the winter; therefore, no mitigation for fisheries would be needed.
Endangered Species	Mitigation for the valley elderberry longhorn beetle includes planting 276 elderberry seedlings/cuttings on 2.1 acres on project lands.	Mitigation for the valley elderberry longhorn beetle includes planting 276 elderberry seedlings/cuttings on 2.1 acres on project lands.
Cultural Resources	There would be no adverse effects to cultural resources; therefore, no mitigation would be needed.	There would be no adverse effects to cultural resources; therefore, no mitigation would be needed.

3. Operation and Maintenance. The Corps will prepare the O&M manual which the non-Federal sponsor is 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 non-Federal sponsor would be responsible for conducting semiannual inspections and reporting on all project features. The Corps has continuing oversight responsibilities to review the non-Federal sponsor's semiannual reports, ensure mitigation compliance, and issue orders to the non-Federal sponsor for corrective actions if necessary.

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

Recreation

- The vault toilets at Lemon Hill and Horse Creek Recreation Areas will be relocated to areas above 715 feet, m.s.l.
- The boat ramp at Lemon Hill will be extended to remain above the new gross pool elevation.
- The county boat building would be relocated above the new gross pool elevation.

Hazardous, Toxic, And Radiological Waste

- Any existing HTRW sites affected by the project, including any sites on mitigation lands, will be remediated. Response actions must be acceptable to the U.S. Environmental Protection Agency and applicable State regulatory agencies. The non-Federal sponsor is responsible for the development and execution of HTRW response actions at 100 percent non-project cost. Further investigations will be conducted and remediation plans will be developed in the PED phase of the project.

Transportation

- During the reconstruction of Horse Creek Bridge, temporary barriers and markings will be erected; existing speed limits will be drastically reduced in the area of construction; and flag-persons will control all vehicles.

Noise

- During project construction, noise generating equipment will be limited to work during daytime hours only. Additionally, all mobile equipment will be fitted with mufflers consistent with the best noise reduction technology.

Air Quality

- During project construction, the specific best management practices listed in Section 4.8.3 for combustion emissions and PM_{10} emissions will be implemented. These measures comply with the local air district's regulations.

Water Quality

- During project construction, the specific best management practices listed in Section 4.9.3 for work at Horse Creek Bridge and Terminus Dam will be implemented. Implementation of these measures will avoid adverse effects to water quality resources.

Vegetation And Wildlife

- Twenty-one acres of riparian scrub-shrub mitigation will be developed as described in Section 5.7.

- Fourteen acres of riparian forest, 320 acres of oak savannah, and 99 acres of oak woodland mitigation will be developed as described in Section 5.7.

- Three hundred and sixty-six acres of seasonal wetlands will be developed as described in Section 5.7.

Endangered Species

- Mitigation will be provided for the valley elderberry longhorn beetle in accordance with the "General Compensation Guidelines for the Valley Elderberry Longhorn Beetle" (Appendix C). A total of 276 elderberry seedlings/cuttings will be planted at the Horse Creek area. The seedlings/cuttings will be planted near areas of existing riparian vegetation.

- If preconstruction, engineering, and design studies determine that the candidate plants Kaweah brodiaea and the spiny-sepaled coyote-thistle will be inundated due to the project, they will be relocated to similar habitat on project lands.

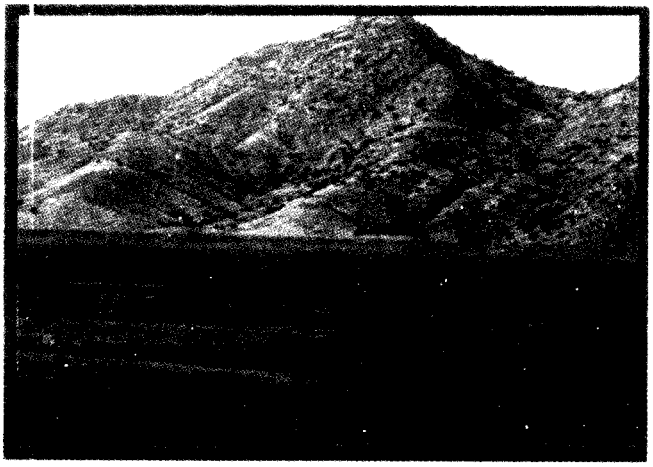
- Before construction begins in the Horse Creek area, the site will be examined by a biologist to determine if any southwestern pond turtles are present. If any turtles are found, a plan for avoidance will be developed with the FWS and DFG.

2.7 SELECTED PLAN

Based on the results of the feasibility studies, coordination and with the non-Federal sponsor, and guidance from Corps Headquaters, Alternative 2 (NED Plan) has been identified as the Selected Plan.

CHAPTER 3.0

AFFECTED ENVIRONMENT



Lake Kaweah drawdown zone

CHAPTER 3.0

AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter presents 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 are described here to provide a framework to compare with-project conditions and to determine project-induced impacts described in Chapter 4. Resources not affected by the project will be described first (environmental setting), followed by the resources that may be affected by the alternatives (affected environment). The environmental setting includes climate, topography, geology, soils and agriculture, and prime and unique farmlands. The affected environment includes land use, socioeconomics, recreation, hazardous, toxic, and radiological waste, transportation, noise, air quality, water quality, vegetation and wildlife, fisheries, endangered species, and cultural resources. These resources will be described in the same order in Chapter 4.

3.2 ENVIRONMENTAL SETTING

This section describes resources in the project area that will not be adversely affected by the project. These resources are presented here to add to the overall understanding of the project area. The information in the following section was developed by DWR in 1991 for the feasibility investigation.

3.2.1 Climate

The project area has a typical Mediterranean climate. Summers are long, hot, and dry; winters are cool, moist, and relatively short. The mean annual temperature at Lake Kaweah is 63 degrees Fahrenheit (°F). Temperatures range from less than 0 °F in the higher elevations to 110 °F in the summer at lower elevations. Mean annual precipitation at Lake Kaweah is 13.86 inches with 85 to 90 percent of the precipitation occurring between November and April. Precipitation generally occurs as rain below 5,000 feet and as snow above that elevation. However, warm winter storms have produced rain up to 11,000 feet, and snow has occurred on the valley floor below the dam. Runoff events correspond to rainfall and snowmelt.

Winds are typical of those found throughout the San Joaquin Valley and low foothill areas. Usually originating from the northwest, the winds may come from a different direction during the winter months. Typically, winds move up the Kaweah River Basin during the early morning and down toward the Valley in the evening. Fog is common from late November through mid-February on the valley floor.

3.2.2 Topography

The Kaweah River Basin ranges in elevation from 175 feet m.s.l. in the Tulare Lakebed to 12,600 feet m.s.l. in the Sierra Nevada. Along the western foothill front, granitic and basic intrusive rock outcrops form outliers of low to irregular hills rising from the valley floor. The topography above Terminus Dam is steep, mountainous terrain with deeply incised canyons. The area above 10,000 feet is characterized by mountain peaks and ridges. Below the dam the foothills slope gently to the Tulare lakebed.

The Kaweah River originates from a group of glacial lakes near Triple Divide Peak on the Great Western Divide, a secondary ridge parallel to the main crest of the Sierra Nevada. The main stem of the Kaweah River is formed by the North, Middle, East, and South Forks near the town of Three Rivers at the head of Lake Kaweah. These forks have an overall slope of 350 feet per mile and are fed by numerous short, steep streams with slopes ranging from 400 feet per mile to almost 1,000 feet per mile.

More than one-half of the basin tributary to Lake Kaweah lies within the boundaries of Sequoia National Park. The 561-square mile-watershed above Terminus Dam drains to the west and reaches the flattened slopes of the San Joaquin Valley floor about 2 miles below the dam. As the Kaweah River flows toward the valley floor, many distributaries branch from the main river creating the effect of a delta. A few of the Kaweah River's distributaries eventually reach the Tulare lakebed.

3.2.3 Geology

The Kaweah River Basin is composed of five major groups: (1) the Paleozoic metamorphic Calaveras Complex and equivalents, (2) the late Paleozoic-Mesozoic Kings River ophiolite and associated Kings-Kaweah structure, (3) the Mesozoic metamorphic Mariposa and Logtown Ridge Formations, (4) the Mesozoic grandodioritic Sierra Nevada batholith, and (5) recent alluvial and colluvial valley fill deposits.

The Calaveras Complex is exposed as roof pendants to the Sierra Nevada batholith. The Calaveras Complex rocks had originally extended across much of the Sierra Nevada, but have been mostly stripped off by uplift and subsequent erosion. The Lemoncove schist and quartzite that underlie Terminus Dam and form the isolated peak Lime Kiln probably belong to the Calaveras Complex.

The recent valley-fill deposits are unconsolidated sands and gravels averaging approximately 20 feet in depth at Terminus Dam and increasing to the west over the river delta in the form of alluvial fan deposits. Sands in the region are predominantly grains of feldspar, mica, and quartz while boulders are predominantly composed of granite, quartzite, and aplite.

At least 50 active or potentially active faults have been identified within 100 miles of Terminus Dam. Numerous earthquakes of magnitude 3.7 on the Richter scale and greater have occurred within 100 miles of Lake Kaweah. The major active faults considered to have a potential impact on Terminus Dam are the San Andreas fault (85 miles west), Owens Valley fault group (55 miles east), White Wolf fault (78 miles south), and Garlock fault (92 miles south). These faults are distant from Terminus Dam but are known to be active with long-duration shaking. The San Andreas and Owens Valley faults would be the most likely to generate critical motions within an area of influence to Lake Kaweah. While greater amounts of ground motion would likely occur from the Owens Valley fault group, earthquakes are expected to occur more frequently from the southern segments of the San Andreas fault. Past records indicate that the magnitude of any future earthquake from either of these faults could be in excess of 8 on the Richter scale. Table 3-1 provides fault information obtained from the "Kaweah River Basin Reconnaissance Report," 1987.

TABLE 3-1
Seismic Sources Affecting Terminus Dam

Source	Location* (miles)	Magnitude**	Recurrence Interval
San Andreas	85	8+	160 years
Owens Valley	55	8+	150 to 200 years
White Wolf	78	7.75	Uncertain
Garlock	92	7.75	Infrequent

* Distance from nearest approach to fault.
** Maximum credible earthquake magnitude (the severest earthquake that is believed to be possible at the site on the basis of geological and seismological evidence).

In July 1988, the Corps evaluated geologic and seismic influences around Lake Kaweah in a report entitled "Success and Terminus Dams, Lake Success and Lake Kaweah, Tule and Kaweah Rivers, California -- Geologic and Seismologic Investigation." The report concluded that no capable faults were found within the area considered. The report further stated that the Kings-Kaweah suture zone (located within the study area) is not known to contain seismically capable faults. In a report produced in July of 1983 entitled "Dynamics Analysis of Terminus Main and Auxiliary Dam," the Corps concluded that Terminus Dam would retain the reservoir under the given earthquake loadings considered in the analysis. Results also indicated that both the auxiliary and main dam are safe and would retain the reservoir in a severe earthquake.

The static stability of the embankment based on the raised gross pool was investigated as part of a post-earthquake slope stability evaluation of Terminus Dam performed in August 1995. The draft report from this evaluation is included in the Basis of Design and Cost Estimate appendix. The stability study concluded that raising the pool level 21 feet from the gross pool elevation of 694 feet would not significantly affect the equilibrium stability of Terminus Dam. However, current testing does not sufficiently demonstrate whether liquefaction could occur in the alluvium foundation at Terminus Dam. Recent foundation testing has been inconclusive regarding the safety of the existing dam, its potential foundation problems and sliding threat. Further foundation testing will be required before a final determination can be made regarding the safety of the existing dam. This testing is scheduled in 1996.

In conclusion, the dam stability condition is the same for both the existing and raised pool condition. Accordingly, dam safety is not affected by the raised pool condition. Should it later be determined that remediation is required, remediation of the dam would be funded under the Dam Safety Assurance Program, separate from this project.

3.2.4 Soils

Soils surrounding Lake Kaweah are characteristic of the types found on the lower Sierra Nevada foothills. These soils are typically moderately deep, gently rolling to very steep, and well drained to excessively drained. The soil ranges from coarse sandy loam to clay. The following description of soils in the project area was obtained from the U.S. Department of Agriculture (USDA), Soil Conservation Service (SCS) publication entitled "Soil Survey, Tulare County, California, Central Part" (1982).

The predominant soil type on the southern and eastern shores of Lake Kaweah is the Cieneba-Rock outcrop complex. This complex is approximately

55 percent Cieneba soil and 25 percent rock outcrop. Included in the region are a few small areas of Blasingame sandy loam, Vista coarse sandy loam, Walong sandy loam, Coarsegold loam, and riverwash.

The Friant-Rock outcrop complex is the predominant soil type on the northern and western shores of Lake Kaweah. This complex is approximately 50 percent Friant soil and 30 percent rock outcrop. Included in this region are a few small areas of Cieneba coarse sandy loam, Coarsegold loam, Vista coarse sandy loam, Walong sandy loam, and riverwash. Rock outcrop is granite on the southern and eastern shores and mica schist on the northern and western shores.

The area immediately downstream from Terminus Dam contains a number of open excavations from which most of the soil material has been removed. Soils downstream of the excavation to McKays Point are predominantly riverwash and Tujanga sand interspersed with Exeter loam, Porterville clay, Grangeville silt loam, and Coarsegold loam.

Riverwash consists of deep sand and gravel. These areas include dry riverbeds, low stream channels, or small islands within the stream channels. At normal high water, parts of these areas are inundated. Under flood conditions, nearly all of these areas are flooded.

Downstream from McKays Point, riverwash, Grangeville silt loam, and Tujanga sand are the predominant soil types along the Kaweah and St. Johns Rivers. Riverwash is deposited in areas of nearly barren riverbeds subject to frequent flooding during the rainy season. The Grangeville soils are poorly drained and are adjacent to the main rivers and streams. Tujunga soils are found on recent alluvial fans.

Soils in the Tulare lakebed area consist of Gepford-Westcamp-Houser and Tulare soils. The Gepford-Westcamp-Houser soils are very deep and somewhat poorly to poorly drained. Typically, the surface layer is clay or fine sandy loam with an underlying material of clay, silty clay, or silty loam. The Gepford-Westcamp-Houser soils are used mainly for irrigated row and field crops. The soils are saline-alkali and are limited by a perched water table, very long periods of flooding, and very slow permeability. Tulare soils are very deep and somewhat poorly drained. Typically, the profile is clay throughout with a perched water table at a depth of 4 to 6 feet. Tulare soils are also used mainly for irrigated row and field crops and may also be affected by a perched water table, very long periods of flooding and very slow permeability.

3.2.5 Agriculture, Prime, and Unique Farmlands

The study area is located in Tulare and Kings Counties, long known for their agricultural use. The combination of suitable soils, water supply, and a long growing season have made possible the development of highly specialized, intensive farming in the study area. In Kings County, field crops include cotton, alfalfa, barley, wheat, safflower, corn, irrigated pasture, sugar beets, soybeans, and rice. Vegetable crops include lettuce, tomatoes, cantaloupes, onions, watermelons, cauliflower, broccoli, carrots, peppers, cabbage, squash, brussel sprouts, and string beans.

Tulare County devotes much of its agricultural production to citrus trees. Nearly 90,000 acres of the county's warm, eastern foothills are now planted with citrus trees. Vegetable crops grown in the county include asparagus, beans, corn, cucumbers, melons, onions, peppers, potatoes, squash, and tomatoes. The dairy industry plays an important role in both counties.

The designation of prime farmland grew out of a program by the Natural Resource Conservation Service (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 Soil Conservation Service 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 USDA 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 USDA 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 lessen 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 Soil Conservation Service 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.

Coordination initiated for potential impacts to Prime, Unique, or Statewide Important Farmlands. The Terminus Dam and Kaweah Reservoir area was analyzed for potential farmland impacts. The Farmland Conversion Impact Rating was completed and sent to the Natural Resources Conservation Service for evaluation. The result of the impact rating was no prime and unique farmland acreage would be affected by the project.

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 of project-related impacts are discussed in Chapter 4.

3.3.1 Land Use

This section describes existing land use in the Kaweah River Basin Investigation study area and provides a summary of more detailed information included in the Land Use appendix of this report.

Land use data have been derived from historic records maintained by DWR, records provided by KDWCD, the Tulare Lake Basin Water Storage District, the County of Tulare, and the City of Visalia. Aerial photos were reviewed, and field

investigations were conducted. In addition, numerous individuals having extensive knowledge of the area were interviewed. Information was also provided by the Sacramento District economics branch.

Land use types were summarized in categories of native vegetation, agriculture, and urban/commercial. Existing land use acreages are shown in Table 3-2.

County development standards prohibit improvements near riparian woodlands and the development of residences within the 100-year flood plain (Foothill Growth Management Plan, 1981). The standards also prohibit the removal of native trees in open space areas. Lands outside of the development corridor have an intensive agriculture land use designation and a foothill-agriculture zoning, which requires a minimum parcel size of 160 acres. The primary activity in these zones is cattle grazing.

Native vegetation does not receive any special protection in the Tulare County general plan except for native trees with diameters greater than 6 inches, measured at 3 feet above ground surface, under the Planned Development - Foothill Combining - Special Mobile Home Zone (PD-F-M). These trees should be mapped on final site plans and should not be removed or graded around unless it is determined necessary due to circulation alignments or infrastructure requirements. Also, any portion of a development site which is adjacent to a water course area, is within the 100-year flood plain, contains undeveloped slopes of 30 percent or more, or exhibits environmental, archeological, or historical sensitive areas shall remain in open space.

Kaweah Reservoir

The investigation covers approximately 589 acres of land around the lake, including 243 acres of shoreline between the existing gross pool elevation of 694 feet to 715 feet, m.s.l. Plant communities of the Lake Kaweah area are typical of the western slope Sierra Nevada range. The area is characterized by oak-savanna interspersed with oak woodland which supports extensive grazing. Three picnic areas, one campground, one boat launching ramp, and one marina/ramp combination facility are located on the south shore of the lake for public recreation. The community of Three Rivers, which has approximately 3,500 people, is situated along the Kaweah River near where the river enters the lake. Three Rivers is primarily a retirement community and a tourist stop for visitors on their way to and from Kings Canyon and Sequoia National Park. Several single-family homes and motels are located along the Kaweah River as it enters the reservoir.

TABLE 3-2
Existing Land Use
(acres)

Land Use	Kaweah Reservoir	Downstream Area	Tulare Lakebed
Riparian	72	6,672	0
Grassland	145	7,030	0
Oak Savanna/woodland	228	10,107	0
Other/fallow (disturbed/flooded)	36	3,682	46,345
Row crops/pasture	0	230,078	50,267
Orchards	0	42,165	0
Cotton	0	102,644	88,333
Urban/commercial	27	65,469	0
Total	508	467,847	184,945

Source: Tulare Lake Basin Water Storage District

Approximately 3,071 acres of land have been acquired by the Corps for Terminus Dam and Lake Kaweah. Of this total, about 310 acres are in flowage easements and are not available for public use. The remaining 2,752 acres are held in fee and are available for public use except for a small area near the dam which is restricted against public entry for safety reasons. There is an outgrant of 192 acres to the State of California for highway right-of-way. Land uses by the Corps for Terminus Dam/Lake Kaweah are allocated into the following categories: project operations, intensive recreation, low-density recreation, and wildlife management (Corps, 1987).

Downstream Area

Land use downstream of Terminus Dam is closely tied to agriculture, especially as the land flattens and opens onto the San Joaquin Valley floor. Generally, much of the relatively narrow zone of agricultural land between Terminus Dam and Visalia is planted in citrus and deciduous fruit orchards, vineyards, interspersed with mixed vegetable crops.

Land use within the channels of the Kaweah River is open space and supports a variety of native and non-native riparian vegetation. The native vegetation consists of willows, grasses, forbs, scattered oaks, and cottonwood trees. The non-native, weedy giant reed has become naturalized in sections of many downstream channels, choking out much of the native vegetation. Riparian

vegetation was historically distributed along both the main waterways and the secondary, smaller overflow channels. Agricultural, urban, and industrial encroachment has eliminated the riparian vegetation along most of the smaller channels and reduced the remaining vegetation to a narrow band along the edge of the waterways.

Large and small patches of native vegetation are scattered throughout the land downstream of Terminus Dam. This area supports significant remnants of Great Valley oak riparian forest. This plant community is found only in California's Central Valley and is in serious decline. It is second only to Southern California's Engelman oak riparian forest in its threatened status. A prime example of the valley oak riparian forest community is found on the Kaweah Oaks Preserve. The 340-acre preserve is located on a distributary of the lower Kaweah River and is owned and managed by The Nature Conservancy.

Land within the city limits of the scattered municipalities, such as Visalia, Lemon Cove, Exeter, Farmersville, and Tulare, has been either developed for commercial uses or supports high- and low-density residential housing. Any remaining open space within the city limits has been significantly disturbed by the surrounding community. The communities of Visalia, Tulare, and Hanford are rapidly expanding their boundaries into the outlying agricultural areas. However, Tulare County has a strong land use plan that supports agriculture as the primary land use for elevations under 600 feet. Urban development boundaries are strictly enforced (Tulare County General Plan, 1988).

Tulare Lakebed

Tulare Lakebed is located within the Kaweah River flood plain. The majority of the land is developed for agriculture. The main crop is cotton, including lint and seed cotton. Safflower, seed alfalfa, wheat, and barley are also grown in the lakebed. There is no significant riparian vegetation or native habitat. Flooding in the lakebed can occur from the Kings, Kaweah, Tule, and Kern Rivers plus local runoff – individually or at the same time.

Lands at the south end of the lakebed have been improved and reserved for storing irrigation and floodwaters. These areas have been farmed in the past but did not prove productive. This area, referred to as the south flood area includes the South Wilbur and Hacienda Ranch Tracts. In 1981, DWR was petitioned for permission to transfer the State water rights associated with Hacienda Ranch to more productive farmland within the lakebed. The resulting agreement prohibits any application of controlled surface water or well water to the Hacienda Ranch property. Permission to sell must be obtained from DWR before any sale of Hacienda Ranch lands can occur. If it is sold, the same stipulation would hold that

no controlled surface water irrigation or well water can be applied (Covenants Between Parties Respecting Use of Land, Civil Code 1468, February 11, 1981).

3.3.2 Socioeconomics

This section describes existing socioeconomic conditions in the Kaweah River Basin Investigation study area. Local general plans and the 1990 Census were used to compile the following data. The three project areas are described primarily at the county level; however, when information is available, data are presented at the city or town level. Because the project area is primarily rural, few schools, public facilities, and utilities are located in the affected area.

Kaweah Reservoir

The reservoir is located in Tulare County, which includes 4,935 square miles and is the seventh largest county in California. The lake is important to the economic life of Tulare County. Lake Kaweah provides water storage for many downstream uses including agricultural water supply, power generation, groundwater recharge, recreation, aquatic habitat, and wildlife habitat. In addition, Lake Kaweah is a popular recreational site for fishing, camping, and boating.

Other than the town of Three Rivers, there is little urban development around the lake. There is no industrial development in this area. Development around the reservoir consists of two motels, a few small markets, and scattered residents. Three Rivers is mainly a retirement community with approximately 3,500 residents. No future development is expected in the area because of zoning laws and lack of employment opportunities. Terminus Dam was constructed by the Corps in 1962 as a flood control and agricultural water supply project and has become popular for fishing, boating, and camping and day use recreation. Many people visiting the lake stop at local markets for snacks, gas, and fishing tackle.

According to the 1990 Census, Tulare County has a population of 311,921. The county growth rate from 1980 to 1990 was approximately 30 percent, which is the same as the statewide average. Approximately 39 percent of the residents are of Hispanic heritage. This percentage is much higher than the State figure of about 26 percent. This difference can be attributed to the county's large agricultural industry, which employs a large number of Hispanic workers.

Agriculture and agriculture-related industries are the economic base of Tulare County. Nearly 20 percent of the employment in the county is in the agriculture business. Approximately 225 commercial crops are grown in Tulare County, which ranks as the second most productive agricultural county in the United States. The dependence on agriculture has resulted in a downward trend for employment and

income over the past few years with the recession and changes in the agricultural industry. The Tulare County Planning and Development Department prepared a plan titled "Economic Development Strategies" in June 1989. This plan calls for development of other industries, with a focus on tourism and recreation. A countywide tourism group was formed to implement this development strategy. One of the group's initial products is a brochure promoting tourism and recreation at Success Lake and Lake Kaweah.

The median family income in Tulare County is approximately $26,500, far below the State median of $40,500. There is also a very high poverty level in this county. However, the cost of living in this area is much lower than the State average. The average rent in Tulare county is $375, far below the State average of $560. Because agricultural employment is seasonal, the unemployment rate and housing vacancy rates vary. During the high agricultural production season, the unemployment and housing vacancy rates are low. However, during the low agricultural production season, the unemployment and housing vacancy rates are very high. The commodity prices and the dollar value overseas also affect the agricultural business and thus the unemployment rate in Tulare County.

Downstream Area

The downstream area of the project is also located in Tulare County. There are approximately 163,000 people living in this 780-square-mile area. However, most people live in the cities of Woodlake, Exeter, Farmersville, Visalia, and Tulare. Of these communities, Visalia is the largest with a population of 75,636 in 1990. The second largest city is Tulare with a population of 33,250. The ethnic composition of this area is similar to the reservoir area, with a high percentage of people from a Hispanic background. Small towns in the downstream area include Ivanhoe, Goshen, Lindcove, Seville, and Waukena.

The two distinct land uses in this portion of the study are urban and agricultural. Most people living in the urban sections of the downstream area are employed in the government, services, and retail trade industries. However, the overall economy depends on agriculture for survival. The median family income in this area was about $33,000 in 1990. There are large ranches used for cattle grazing, and a variety of crops are grown in this area. Crops include citrus and deciduous fruit orchards, vineyards, and mixed vegetable crops.

The median rents are $384 in Visalia and $336 in Tulare. Most of the area in the downstream portion of the project is agricultural land. Ranchettes are the most common residential parcels in the non-urban downstream area. No homes in this area of the study are expected to be affected by the project.

Tulare Lakebed

This area of the project is located in Kings County. The population of Kings County was 101,500 in 1990. The area in the study area has no urban development. This area is agricultural land and includes the Tulare lakebed. The King County general plan indicates that this area of the county is zoned for 40-acre minimum parcels.

Very similar in socioeconomic composition to Tulare County, agriculture is the economic base of this county. Approximately 95 percent of the land in Kings County is privately owned, and about 88 percent of the acreage is farmland. Cotton is the primary crop, followed by production of market milk. According to the Census of Agriculture, the net cash return from agricultural sales for Kings County was $113 million in 1992. Agriculture is the second largest employer in the county, employing 20 percent of the work force.

Kings County also has a number of major nonfarm employers, including two State prisons, a naval air station, a nationally known tire manufacturer, a processing plant for cottonseed and safflower oils, and a tomato-products canning factory. The two prisons employ 26 percent of the work force, and the remaining industries employ 17 percent of the total employment.

3.3.3 Recreation

Tulare County contains high mountain resorts and recreational areas of every description, and underdeveloped recreational resources are numerous. The combined acreage of Sequoia and Kings Canyon National Parks, and Sierra and Sequoia National Forests comprises 55 percent of the total area of Tulare County. These areas, together with Pine Flat, Success, and Kaweah Lakes; Tule, Kaweah, and Kings Rivers; and Mountain Home State Forest, offer a variety of recreational opportunities which include sightseeing, boating, water skiing, fishing, picnicking, hiking, and camping. Upstream of Lake Kaweah, rafting and kayaking take place on an 11-mile reach from the town of Three Rivers to the Slick Rock recreation area. Licensed rafting companies have been operating along this reach for the past 2 years.

The lakes mentioned above are all within a 50 road-mile radius of Lake Kaweah. The largest is Pine Flat Lake on the Kings River with approximately 6,000 surface acres. Success Lake on the Tule River has approximately 2,500 surface acres at gross pool.

Most of the existing recreation sites in the Kaweah River Basin are experiencing heavy visitation, which indicates a need for increased recreational

opportunities in the basin. Visitation is limited by the lack of facilities and various lake constraints. Any new projects or increase in facilities will begin to alleviate the demand for recreation in the Kaweah River Basin. The demand for recreation opportunities in the basin is expected to increase in the future.

Kaweah Reservoir

Lake Kaweah has recreation facilities at four major locations around its perimeter: Horse Creek, the Kaweah recreation area, Lemon Hill, and Slick Rock, see Figure 3-1. These were constructed in conjunction with the building of Terminus Dam and are operated by the Corps of Engineers. Camping facilities are limited to 80 developed campsites at Horse Creek for tents, recreational vehicles, and trailers. Other locations around the lake also provide fishing, swimming and picnicking. A full-service marina at Lemon Hill provides gasoline, berths, docks, mooring, boat rentals, and a four-lane boat launching ramp. A number of portable restrooms are located around the lake, while flush restrooms and showers are present at Horse Creek and Kaweah recreation area. Lake Kaweah has a mean recreation pool surface area of 1,065 acres and 1,913 surface acres at gross pool.

There are a total of 130 parking spaces for cars, and 160 car-trailer combinations. Limited parking at Lemon Hill and Kaweah recreation area severely restricts use of those areas, and encourages visitors to park along the sides of Highway 198. This creates rather hazardous situations with high speed traffic occurring in such close proximity to recreational parking. This safety hazard will be partially tempered by the addition of a new parking area, which is completed at the Lemon Hill area. The new parking lot will have 50 additional spaces for cars, and 80 new car-trailer combination spaces.

The recreation facilities at Lake Kaweah were constructed by the Corps and transferred to Tulare County for operation and maintenance and additional developments in June 1962 under terms of a 25-year license. In April 1972, Tulare County relinquished all planning, development and management of public recreation areas at Lake Kaweah back to the Corps. Since that time, upgrading of existing recreation areas for public health and safety, and operation and maintenance of facilities at the reservoir have been by the Corps. For the public's benefit, an area of land and water at Lake Kaweah has been outleased for development and operation of the commercial marina concession.

Downstream Area

Along the Kaweah River below Terminus Dam, some recreation improvements have been made. Cities within Tulare County, including Visalia, maintain parks and provide community centers for recreation purposes. These

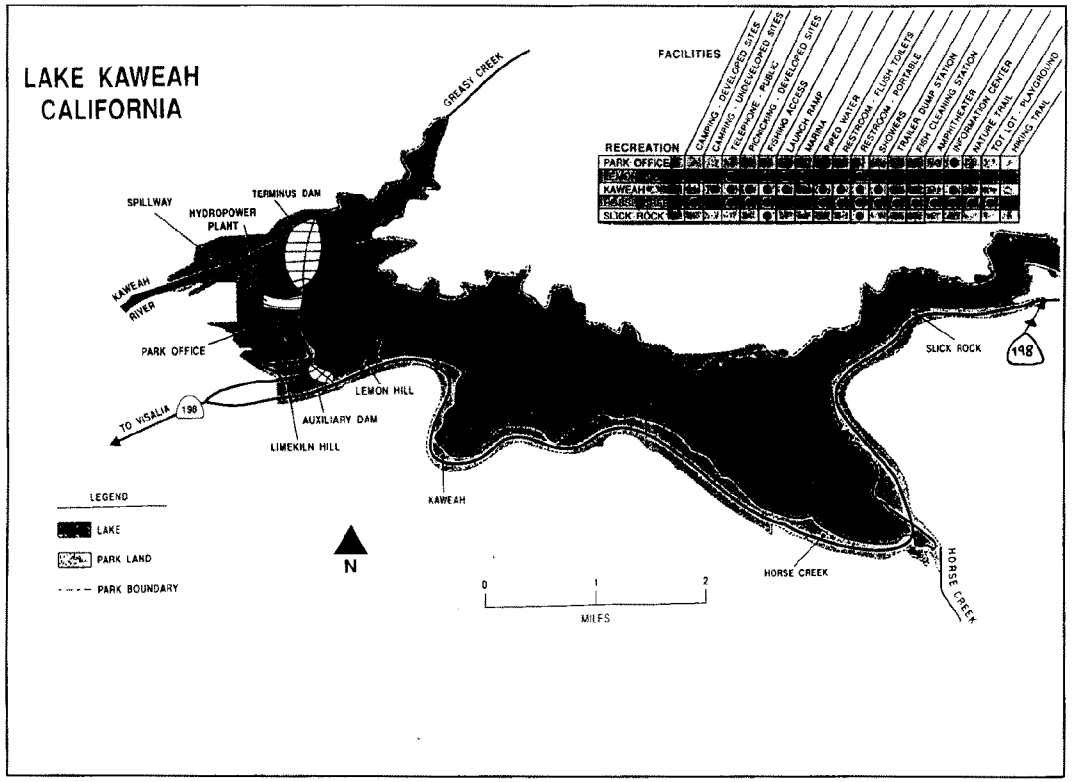

LAKE KAWEAH
CALIFORNIA
FACILITIES
RECREATION
CAMPING - DEVELOPED SITES
CAMPING - UNDEVELOPED SITES
TELEPHONE - PUBLIC
PICNICKING - DEVELOPED SITES
FISHING ACCESS
LAUNCH RAMP
MARINA
PIPED WATER
RESTROOM - FLUSH TOILETS
RESTROOM - PORTABLE
SHOWERS
TRAILER DUMP STATION
FISH CLEANING STATION
AMPHITHEATER
INFORMATION CENTER
NATURE TRAIL
TOT LOT - PLAYGROUND
HIKING TRAIL
PARK OFFICE
LEMON HILL
KAWEAH
SLICK ROCK
SPILLWAY
HYDROPOWER PLANT
TERMINUS DAM
GREASY CREEK
KAWEAH RIVER
PARK OFFICE
TO VISALIA
198
LEMON HILL
AUXILIARY DAM
LIMEKILN HILL
KAWEAH
SLICK ROCK
198
HORSE CREEK
HORSE CREEK
LEGEND
LAKE
PARK LAND
PARK BOUNDARY
N
0
1
2
MILES

Figure 3-1

recreational sites often include swimming pools, playgrounds, and ball fields for either public or private use.

Tulare Lakebed

No recreational facilities or areas are known to exist within the Tulare Lakebed.

3.3.4 Hazardous, Toxic, and Radiological Waste

This section describes the methods used to identify hazardous, toxic, and radiological waste (HTRW) sites associated with the Kaweah River Basin Investigation Project and presents a description of potential and known HTRW sites within the Lake Kaweah HTRW assessment area.

Regulatory Framework

The Corps policy regarding HTRW is presented in Engineering Regulation 1165-2-132, which was developed in response to the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended. Corps policy states that, for cost-shared projects, it is the non-Federal sponsor's responsibility to ensure cleanup and pay all response costs associated with any HTRW sites affected by a Corps' civil works project. Where HTRW sites are identified, response actions must be acceptable to the U.S. Environmental Protection Agency and applicable state regulatory agencies. Corps policy also requires that each civil works project must include a phased and documented review to provide early identification of known and potential HTRW sites that may be affected by a proposed Federal project.

Methods and Results

An Environmental Site Assessment was conducted by DWR in 1995 to identify HTRW sites associated with the Kaweah River Basin Project. The Lake Kaweah assessment area included Lake Kaweah and all land within 1 mile of the lake, while two downstream areas which are proposed as mitigation sites were also surveyed for HTRW sites (see section 4.5.2). The assessment area did not encompass the entire study region as referenced in other sections of this document because adverse impacts to HTRW sites are not expected to occur downstream from Terminus Dam. While collecting data, existing photographs and records were reviewed, sites were visited, and interviews were conducted with appropriate personnel from Federal, State, and local agencies. The Environmental Site Assessment is attached as Appendix L to the Feasibility Report.

Aerial Photograph and Topographic Map Review. Aerial photographs and topographic maps of the Lake Kaweah assessment area were reviewed carefully, and signs of human activity, such as roads, bridges, buildings, campgrounds, canals, soil disturbances, and other unusual features, were noted. Aerial photographs of the Lake Kaweah area taken between the months of April and June in the years 1974, 1981, and 1987 by the Tulare County Planning Department were reviewed, as well as the U.S. Geological Survey (USGS) Kaweah Quadrangle, California, 15 minute series, 1957 edition.

The results of the photographic and topographic review indicate that few changes have occurred in the project area over the period of analysis. Major construction features, such as roads and bridges as well as Terminus Dam and associated structures, have changed little in recent decades. The only significant construction changes at Lake Kaweah since 1974 include the addition of several buildings at the Horse Creek Campground and the creation of a boat ramp and marina toward the southwest end of the lake between 1981 and 1987.

Flood Map and Ground Water Reviews. Flood Insurance Rate Maps show that Lake Kaweah and areas immediately upstream along the Kaweah River lie within flood prone regions (Federal Emergency Management Agency, 1986) .

Ground water in the area surrounding Lake Kaweah is contained primarily in fractures in igneous and metamorphic crystalline rock but also occurs in alluvial soils and decomposed rock and soil lying above bedrock. Ground water in the area generally flows down slope towards the lake. Due to the poor filtering capacity of thin soils and the potential for rapid movement of water through fractures, ground water in the area is considered to have a high susceptibility to contamination. In addition, the limited volume of ground water near the lake limits dilutional potential and increases the possibility of contamination becoming a problem.

Review of Regulatory Agency Records. To assist in evaluating areas of potential environmental concern, records maintained by various regulatory agencies were reviewed.

United States Environmental Protection Agency. The Comprehensive Environmental Response, Compensation, and Liability Information System list and National Priorities List were reviewed. According to these lists, there are no suspected abandoned, inactive, or uncontrolled hazardous waste sites within the Lake Kaweah assessment area.

The Emergency Response Notification System database was reviewed for the locations of reported spills of hazardous materials. No such sites were identified within the Lake Kaweah assessment area.

The Treatment, Storage and Disposal Facilities database was reviewed for the location of these facilities. No facilities of these types were listed within the Lake Kaweah assessment area.

California Environmental Protection Agency. The California Environmental Protection Agency Cal-Sites List, which combines the Abandoned Sites Program Information System and State "Superfund" list, provides locations of known hazardous waste sites. No such sites were identified within the Lake Kaweah assessment area.

California Department of Health Services (DHS). The "Final Report on a Monitoring Program for Organic Chemical Contamination of Large and Small Public Water Systems in California" does not include any contaminated wells within the Lake Kaweah assessment area.

The California DHS Toxic Substances Control Division Hazardous Waste Information System was reviewed for hazardous waste generators. No such generators were listed within the Lake Kaweah assessment area.

California Integrated Waste Management Board. The Solid Waste Information System list, published by the Board, provides information regarding the location of landfills. No landfills were listed within the Lake Kaweah assessment area.

California Regional Water Quality Board. The California Regional Water Quality Control Board's Leaking Underground Fuel Tank (LUFT) list was reviewed for locations of LUFT sites in the vicinity of Lake Kaweah. The list identified two LUFT sites within the Lake Kaweah assessment area. One site is located at the Kaweah Recreation Area, which is operated on the south side of the lake, while the other site is located in the community of Three Rivers.

Mr. James Waters of the Tulare County Environmental Health Department was contacted regarding the LUFT site located at the Kaweah Recreation Area. Mr. Waters indicated the County owned and operated the tank prior to its removal in the late 1980's. The County is coordinating the effort to characterize and remediate the plume of product which has leaked into the soil surrounding the former tank site. He indicated that Tulare County currently is monitoring ground water in the area with a network of monitoring wells.

Mr. John Macedo of the Tulare County Environmental Health Department was contacted regarding the LUFT site located near the community of Three Rivers. He said the LUFT site is located at 41500 Sierra Boulevard in Three Rivers and identified the site as Pat O'Connell Service. Since discovery of the leak, the

tank has been removed. Mr. Macedo indicated the leak appeared to be limited in size and that the responsible party was in the process of further characterizing the extent of the plume.

Additional Communications and Document Reviews. Additional attempts were made to gain information on possible HTRW sites within the Lake Kaweah assessment area by contacting additional agencies and companies.

United States Army Corps of Engineers. Mr. Philip Deffenbaugh, Lake Kaweah Park Manager, and Mr. Gerald Whittaker, a Corps staff member, were interviewed. These individuals were familiar with the LUFT site at the Kaweah Recreation Area. They also said a significant portion of the Horse Creek Recreation Area on the south side of the lake, including at least two septic systems/restroom facilities, would be inundated as a result of the proposed project. Mr. Whittaker indicated that sewage from these facilities is pumped uphill for treatment, but it is possible that a portion of the distribution system at the campground is not water tight. Mr. Deffenbaugh and Mr. Whittaker were not aware of any other potential areas in or adjacent to the lake where HTRW sites might be encountered.

Southern California Edison Company. Mr. Tom Hanson of the Southern California Edison Company was contacted regarding the potential presence of polychlorinated biphenyl (PCB)-containing transformers in the Lake Kaweah assessment area.

According to Mr. Hanson, it is unlikely that transformers serving the project area contain PCB concentrations that would require special management under Federal regulations. According to a letter provided by the Southern California Edison Company (provided as part of Appendix L), a statistically valid sampling of over 20,000 transformers indicated that 96 percent of the equipment tested contained PCB concentrations less than 50 parts per million (ppm). The remaining 4 percent of transformers generally contained PCB concentrations below 100 ppm. Upon request, Southern California Edison will measure PCB concentrations in transformers and will pay associated costs if PCB concentrations exceed 50 ppm. If PCB concentrations are lower than 50 ppm, all costs associated with sampling and testing are paid by the party which requested the test.

Oil and Gas Maps. Oil and gas well locations as shown in the Munger Oil and Gas Map Book, page W-42, were reviewed. This map shows no oil or gas well locations within the Lake Kaweah assessment area.

Tulare County Environmental Health Department. A list of underground storage tanks was obtained from the Tulare County Environmental Health

Department. No underground storage tanks were identified within one mile of the project area.

California Department of Food and Agriculture. A sampling and analysis program for organochlorine pesticides, such as dichloro-diphenyl-trichloroethane (DDT) and its derivatives, was conducted on agricultural properties in Tulare County by the California Department of Food and Agriculture. The results of this program are presented in a document titled "Agricultural Sources of DDT Residues in California's Environment" (California Department of Food and Agriculture, 1985).

Four samples were analyzed from Tulare County. Although the samples yielded measurable concentrations of DDT-based derivatives, all recorded concentrations were below established limits for classification of DDT-contaminated soils as a hazardous waste under California regulations.

California Department of Water Resources. In July 1991, DWR compiled a report on geology and mining activity for the Kaweah River Basin Feasibility Investigation which included information regarding past and present mining activity in the project area (California Department of Water Resources, 1991). Although several known prospects and quarrying operations for limestone, as well as several prospects for tungsten, occur in the vicinity of Lake Kaweah, there appears to be minimal environmental concern based on the location, type, and magnitude of the deposits. It should be noted, however, that the largest limestone quarry in Tulare County once operated on Limekiln Hill near the Corps' park headquarters at the west end of the lake.

Site Reconnaissance. A site reconnaissance of the Lake Kaweah area was conducted on May 8, 1995. A small water body impounded by an earthfill dam was observed along the northwestern-most arm of the lake. This pond was later identified as a fisheries management structure constructed and operated by the DFG. A livestock corral exists further east along the lake's north shore.

A few residential structures are present at the east end of the lake, as well as the nearby community of Three Rivers. Three Rivers is located approximately 3 miles upstream of Lake Kaweah on the Kaweah River. Sewage disposal for buildings in these areas is provided mainly by individual septic systems with associated leachfields.

The LUFT site located at the Kaweah Recreation Area is marked by seven wellheads and lock boxes that serve as part of the monitoring program for the fuel leak. Two of the wells had free flowing water discharging from their casings during the site visit.

Although power poles with attached transformers are present along the southwest shore of the lake, they appear to be out of the area of potential inundation. Nothing of environmental concern was observed in the area of Terminus Dam, and no signs of mining or dumping activity were noted adjacent to Lake Kaweah.

Other Potential HTRW Concerns

Asbestos. Because the project area is characterized by undeveloped terrain, the potential for encountering asbestos-containing construction materials is remote.

Radon. Based on a review of the "California Statewide Radon Survey: Interim Results" published by the California Department of Toxic Substances Control, it is unlikely that radon presents a significant environmental concern within the project area.

Lead. Due to a general absence of structures in the project area, it is probable that the presence of lead in the form of lead-based paint does not present a significant environmental concern.

3.3.5 Transportation

This section describes the existing transportation system and traffic conditions in the study area. Tulare County has 4,930.6 miles of maintained public roads. County roads constitute the majority of maintained roads with 3,153.9 miles. Next are federal roads with 804.9 miles and city streets with 585.3 miles. State highways total 352.9 miles with 306.0 miles of rural roads and 46.9 miles of urban roads. The remaining 33.6 miles are all other State roads. The region is very dependent on the automobile and will remain so for some time.

Figure 3-2 presents regional transportation facilities (public roads) and daily traffic volumes for the study area. These facilities include State Route 99 (SR 99) and State Route 198 (SR 198). Traversing the study area north and south, SR 99 provides an important transportation link between northern and southern Central California. SR 198 serves as an interregional corridor between central coastal areas of California, the San Joaquin Valley and the Sierra Nevada and provides access to the urban communities of Coalinga, Lemoore, Three Rivers and Hanford and to the urbanized area of Visalia.

Tulare County is crossed by two transcontinental railroads. The main lines of the Southern Pacific and Santa Fe Railroads traverse the County from south to north. Caltrans provides a feeder bus service between Tulare County and the

AMTRAK station in Hanford. The bus serves the Cities of Porterville, Lindsay, Tulare, and Visalia with connections to both northbound and southbound trains.

There three airports of significance in Tulare County: Medford Field in the City of Tulare, the City of Visalia Municipal Airport, and the City of Porterville Municipal Airport.

Kaweah Reservoir

The shore of Lake Kaweah is paralleled on the south and east by SR 198. This is the only road of any significance in this area. The highway operates in an east-west direction with a speed limit of 55 mph. It is a two-lane road near the Reservoir and is the main route from Visalia to Lake Kaweah, Three Rivers, and Sequoia and Kings Canyon National Parks. The route is well maintained and is operating at a high level of service (LOS).

Downstream Area

SR 99, located about 5 miles west of Visalia, serves as a vital north-south transportation route for the State. SR 99 passes through the City of Tulare and southwest of Visalia.

SR 198 is part of the California Freeway and Expressway System between Interstate 5 and the Sequoia National Park boundary. It is adopted as a freeway between the Fresno-Kings County line and 0.25 mile east of Route 245 and between 0.4 mile east of Route 216 and Moro Road (2.6 miles west of Three Rivers). It is functionally classified as a minor arterial between the Monterey-Fresno County line and Interstate 5. From Interstate 5 to the Sequoia National Park boundary, it is classified as a principal arterial. Between Interstate 5 and SR 99, SR 198 is designated as a route for large trucks.

According to Caltrans Route Concept Reports, SR 198 is operating at an acceptable level of service and is expected to remain so for the future. However, growth and development are occurring in and near the City of Visalia, and subsequent Caltrans Route Concept Reports may be revised to reflect land use and socioeconomic changes in the area.

Tulare Lakebed

The Tulare lakebed is used primarily for agriculture. The roads in the area are used to transport equipment, farm workers, and products in and out of the lakebed. There are no arterial roads nor are there any significant public transportation routes through the lakebed.

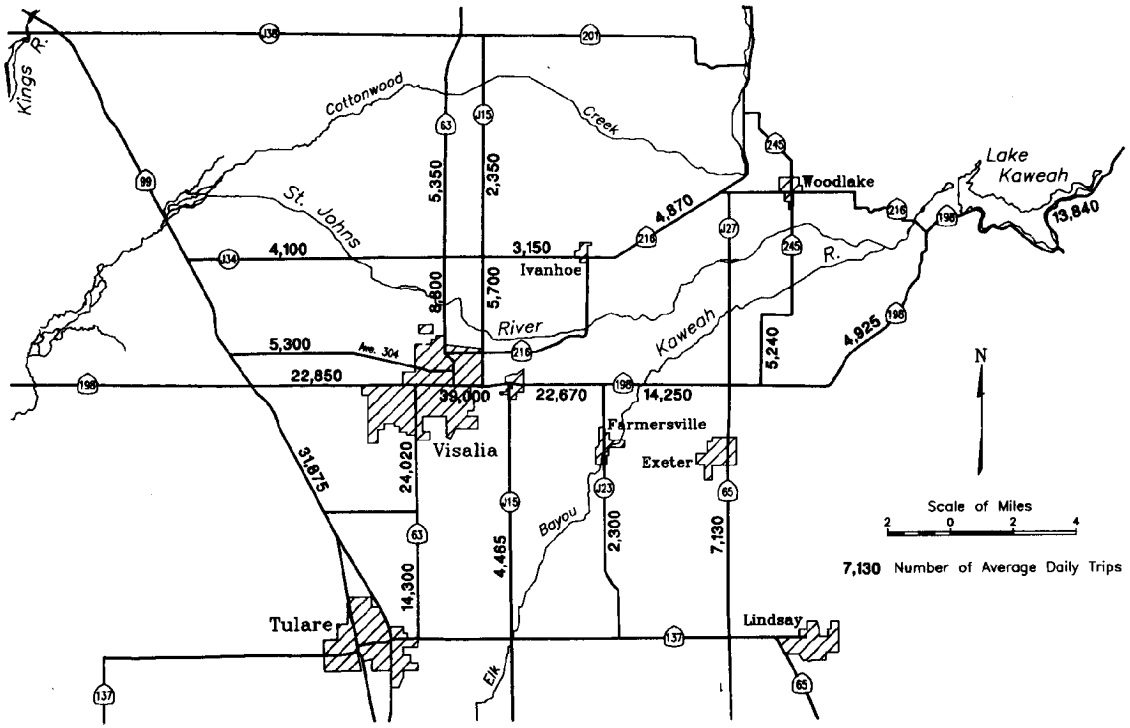


Figure 3-2 Existing Daily Traffic Volumes for Roadways in the Kaweah River Basin Investigation Study Area

3.3.6 Noise

This section describes existing noise conditions in the study area. The primary source of noise in the project area is from traffic on SR 198. Other noise sources include county roads, airports, industrial facilities, and auto racing. Noise-sensitive land uses include educational facilities; medical, nursing, and mental care facilities; residential areas; churches; hotels and motels; outdoor sports and recreation facilities; and business and professional offices.

In order to determine existing noise conditions within the project area, the most recent Noise Elements of the Tulare and Kings County General Plans were reviewed. The Noise Elements contain policies and noise-level criteria which are consistent with current State requirements and noise-level descriptors.

Human response to environmental noise is subjective and varies considerably from individual to individual. Noise is usually defined as unwanted, disturbing sound. The effects of noise can range frcm interference with sleep, concentration, and communication to physiological and psychological stress and, at the highest intensity levels, to hearing loss.

Community noise is commonly described in terms of the "ambient" noise level which constitutes the normal or existing level of environmental noise at a given location. The unit of measure for sound is the decibel (dBA), which describes the amplitude of sound. Day-night average decibel levels (L_{dn}) show a very good correlation with community response to noise. Results of the most recent community survey of noise levels (L_{dn}) at 17 monitoring sites are shown on Figure 3-3.

The seriousness of any given sound is a combination of its intensity and duration, and time of day. For example, louder noises are perceived as acceptable if they last for short periods of time. Similarly, levels which may be regarded as acceptable during the day, can be annoying or intolerable during the evening or nighttime. A noise environment of 50 to 60 L_{dn} is considered to be acceptable for residential uses. Listed below are several examples of the noise levels associated with common situations, given in L_{dn}.

Jet takeoff at 200 feet	125
Motorcycle at 20 feet	110
Freight train at 50 feet	95
Freeway traffic at 50 feet	80
Vacuum cleaner	70
Average office	50
Library	40

Kaweah Reservoir

In the foothill and mountain areas of Tulare County, background noise levels are generally very low. Exceptions occur near major roadways or along rivers and streams where running water may be a significant source of sound. Major sources of noise at Lake Kaweah are traffic and boating. Noise levels are somewhat lower during the late night and early morning hours when traffic and boating are at a minimum.

Monitoring sites near Lake Kaweah confirm that background noise levels are low. L_{dn} values ranging from 40 to 65. However, on the Lake itself, noise levels are slightly higher during summer daytime hours due to recreational boating. Normally-acceptable noise levels for water recreation range from 50 to 75 dB.

Downstream Area

Significant sources of noise in the downstream area include State and county highways, airports, operations of Southern Pacific and Santa Fe Railroads, and agricultural activities varying by season. Results of the community noise surveys indicate that noise levels in areas containing noise-sensitive land uses in the incorporated and unincorporated areas of Tulare County range from 29 to 65 DB L_{dn} (see Figure 3-3).

Tulare Lakebed

The major source of noise in the Tulare lakebed is farming equipment. Noise levels in the lakebed are lower when crops are not being planted or harvested and during nighttime hours. Some of the more common noise sources associated with farming include tractors, harvesting equipment, spray equipment, cotton ginning operations, aerial crop-dusters, and stationary power sources including internal-combustion pump engines.

Decibel values in agricultural areas commonly range from 75 to 85 dBA. A diesel engine at 50 feet or a cotton gin at 120 feet both produce up to 75 dBA. Air crop-dusters produce 85 dBA at 600 feet.

3.3.7 Air Quality

This section addresses existing air quality conditions in the study area. The study area is in the San Joaquin Valley air basin, which contains more than 30,000 square miles and is the second largest air basin in the State.

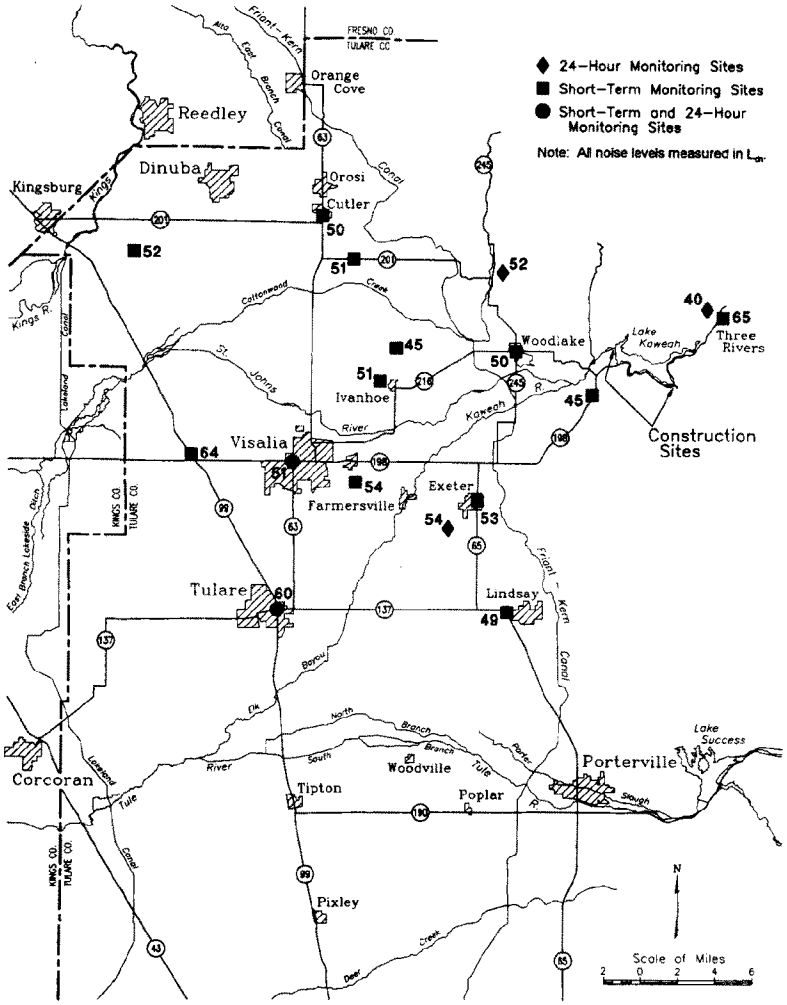


Figure 3-3 Community Noise Survey Monitoring Sites

Source: Noise Element, Policy Document, Tulare County Planning and Development Department, 1988

Air quality is generally influenced by wind direction and velocity, geography, vegetation, climate, and the volume of natural and artificial pollutants introduced into the air basin. Agricultural, industrial, and other human activities in the San Joaquin Valley generate materials which cause air pollution. Motor vehicles are the largest source of organic gasses, carbon monoxide, and oxides of nitrogen. The highest oxidant concentrations occur during the summer months. Nitrogen dioxide, hydrocarbons, carbon monoxide, suspended particulate matter, and particulate lead concentrations are greatest during the fall and winter. These peak periods are due to the abundance of sunlight during the summer months and the stable atmosphere and light winds during much of the winter. Wind flow patterns for the San Joaquin Valley air basin are characterized by mean winter flows through the Valley toward the northwest, spring airflows with a southeasterly pattern, and mean summer flows from northwest to southeast (Figure 3-4).

The California Environmental Protection Agency's Air Resources Board has designated Tulare County a nonattainment zone for fine particulate matter, 10 microns or smaller in size (PM_{10}), and ozone. In response to this nonattainment status, the San Joaquin Valley Air Pollution Control District (SJVUAPCD) adopted a 1994 Serious Area PM_{10} Plan, a 1994 Ozone Attainment Demonstration Plan, and the 1995 Regulation VIII Fugitive Dust/PM_{10} Synopsis (SJVUAPCD, 1994). Tables 3-3 through 3-5 show the existing ambient air quality data and standards for general pollutants, 10-micron particulate matter, and suspended particulate matter in the study area (California Air Resources Board, 1993).

3.3.8 Water Quality

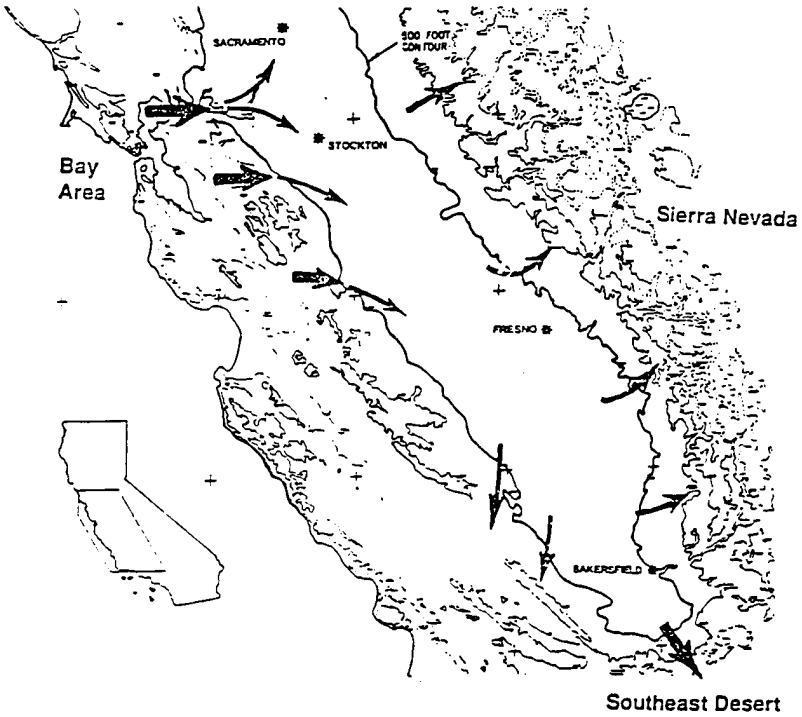
This section addresses existing surface and ground water quality conditions in the study area.

Kaweah Reservoir

Water from the Kaweah River and Lake Kaweah provides habitat for fish and wildlife, and is used for irrigation water supply, hydropower generation, and recreation. The existing lake is only weakly thermally stratified, or unstratified, in the summer months due to reduced pool depths. Weak stratification results in just slightly above zero dissolved oxygen concentrations in the hypolimnion during the summer months. Consequently, the lake does not serve well as a two-story fishery with warm water fish in the top portion of the lake and cold water fish in the bottom portion.

There are occasional levels of toxic trace elements (barium, copper, lead, and zinc) in the lake which exceed freshwater aquatic life criteria. All other water quality criteria are within acceptable State and Federal primary and secondary

FIGURE 3-4
Wind Flow Entries and Exits



Source: California Air Resources Board

TABLE 3-3
Existing Air Quality Data for General Pollutants
Station 5400568, Visalia
1993

Pollutant	Annual Mean[1] (parts per million)		Standard[2] (parts per million)		Annual State Exceedances		Total Number of Samples
	All Hours	Daily Maximum	State	Federal	Hour[3]	Day[4]	
Ozone	0.031	0.063	0.09	0.120	234	60	8,118
Carbon monoxide	0.800	2.000	20.00	35.000	0	0	8,275
Nitrogen dioxide	0.023	0.044	0.25	0.053	0	0	8,239

[1]Hourly concentrations.
[2]California ambient air quality standards.
[3]Total number of hourly State air quality standards exceedances for year.
[4]Total number of daily State air quality standards exceedances for year.

TABLE 3-4
Existing Air Quality Data for 10-Micron Particulate Matter
Station 5400568, Visalia
1993

Pollutant	Annual Statistics[1] (micrograms per cubic meter)		Standard (n) (micrograms per cubic meter)		Number of Samples Greater than n[2]	Total Number of Samples
	Geometric Mean	Arithmetic Mean	State	Federal		
Particulate matter	45.000	52.800	50[3]	150[4]	30	60
Particulate sulfate	1.970	2.240	5[5]	--	0	60
Particulate nitrate	3.530	6.350	5[5]	--	21	60
Particulate chloride	0.050	0.067	1[5]	--	0	60
Particulate ammonium	1.065	2.067	2.0[5]	--	15	60

[1]24-hour average 10-micron particulate matter concentrations.
[2]n = State standard.
[3]California ambient air quality standards. Based on geometric mean of all reported values taken during the year.
[4]National ambient air quality standards. Based on averaging the quarterly arithmetic means.
[5]No State or Federal air quality standards. This value represents first level of significance according to the California Air Resources Board.

TABLE 3-5
Existing Air Quality Data for Suspended Particulate Matter
Station 5400568, Visalia
1987[1]

Pollutant	Annual Geometric Mean[2] (micrograms per cubic meter)	Standard (n) (micrograms per cubic meter)		Number of Samples Greater than n[3]	Total Number of Samples
		State	Federal		
Total suspended particulates	106.60	100[4]	150[5]	15[5]	59
Suspended sulfates[6]	2.93	25[2]	--	0	27
Suspended nitrates[6]	2.04	10[7]	--	0	27

[1]Complete data for suspended particulate matter were not reported from Station 5400568 in Visalia in 1988 and 1989.
[2]24-hour average concentrations.
[3]n = Federal standard.
[4]California ambient air quality standards. Based on occurrences of 24-hour average 10-micron particulate matter concentrations.
[5]National ambient air quality standards. Based on occurrences of 24-hour average 10-micron particulate matter concentrations.
[6]Data presented is from the California Air Resources Board Giant Forest Station (5400571) in Sequoia National Park. Data were not reported from Station 5400568 in Visalia in 1987.
[7]No State or Federal air quality standard. This value represents first level of significance according to the California Air Resources Board.

TABLE 3-6
Existing Water Quality Data for Kaweah River Above and Below Kaweah Reservoir 1987[1]

Parameter[2]	Location	
	Kaweah River at Three Rivers	Kaweah River Outflow
Total dissolved solids (TDS)	38.5	59.5
Total soluble solids (TSS)	ND[3]	ND
Volatile soluble solids (VSS)	ND	ND
Chloride (Cl)	1.8	3.3
Bicarbonate (HCO_3)	37.3	56.1
Sulfate (SO_4)	ND	ND
Total iron (Fe)	0.10	0.20
Dissolved iron (Fe)	0.04	0.05
Total manganese (Mn)	ND	0.03
Dissolved manganese (Mn)	ND	0.003
Boron (B)	ND	0.02
Dissolved silica (Si)	1.6	1.6
Calcium (Ca)	9.0	28.0
Magnesium (Mg)	1.2	4.3
Sodium (Na)	4.3	12.0
Potassium (K)	2.1	1.1

[1]U.S. Army Corps of Engineers, 1987.
[2]All parameters are in milligrams per liter (mg/L) and below State and Federal MCL's.
[3]ND values were less than detection limits.

TABLE 3-7
Existing Water Quality Data for Kaweah Reservoir
1987[1]

Parameter[2]	Location		
	Lake Near Dam	Lake at Kaweah River	South Fork Kaweah River Near Mouth
Total alkalinity	38.0	20.0	22.0
Specific conductivity (μmho/cm)	87.9	41.6	50.7
Total hardness	30.0	14.0	16.0
pH	7.6	7.5	7.3
Phosphate (Ortho)	<0.01	<0.01	<0.01
Total dissolved solids (TDS)	53.0	25.0	30.0
Nitrate (NO_3)	<0.05	<0.05	<0.05
Hardness ($CaCO_3$)	38	20.0	22.0
Boron (B)	0.07	0.07	0.05
Calcium (Ca)	10.0	5.0	5.7
Carbonate (CO_3)	ND[3]	ND	ND
Chloride (Cl)	5.8	4.4	5.6
Iron (Fe)	0.03	0.02	0.04
Magnesium (Mg)	1.3	0.3	0.5
Nitrate (NO_3)	<1.0	<1.0	<1.0
Potassium (K)	1.7	1.1	1.2
Silica (Si)	5.5	3.6	4.1
Sodium (Na)	5.7	3.2	4.5
Sulfate (SO_4)	2.4	1.7	3.1

[1]U.S. Army Corps of Engineers, 1987.
[2]All parameters in mg/L unless otherwise indicated and below State and Federal standards.
[3]ND = less than detection levels.

TABLE 3-8
Existing Water Quality Data for Trace Elements
Kaweah Reservoir
1987 and 1990

Parameter[1]	Location		
	Lake Near Dam[2]	Lake at Kaweah River[3]	South Fork Kaweah River Near Mouth[2]
Antimony (Sb)	<1	<0.05	<1
Arsenic (As)	<1	<0.005	<1
Barium (Ba)	25 [4]	8[4]	8[4]
Beryllium (Be)	<1	<0.002	<1
Cadmium (Cd)	<1	<0.005	<1
Chromium (Cr)	<1	<0.005	<1
Cobalt (Co)	<1	<1	<1
Copper (Cu)	1	<0.005	1
Lead (Pb)	<1	<0.02	<1
Mercury (Hg)	<1	<0.0005	<1
Molybdenum (Mo)	1	<1	<1
Nickle (Ni)	<1	<0.02	<1
Selenium (Se)	<1	<0.002	<1
Silver (Ag)	<1	<0.01	<1
Thallium (Tl)	<1	<0.05	<1
Vanadium (V)	1	1	<1
Zinc (Zn)	8[4]	0.02	3

[1]All parameters in micrograms per liter (μg/L).
[2]U.S. Army Corps of Engineers, 1987.
[3]California Regional Water Control Board, Central Valley Region, 1990.
[4]Value exceeds the State primary or secondary MCL.

maximum contaminant levels (MCL's) (Tables 3-6 through 3-8). Several years of phytoplankton sampling have found no excessive blooms; however, there are sufficient phytoplankton to support higher trophic states. Favorable Diatom and Green species appear to frequently dominate the summer crop. Kaweah Reservoir showed a slight depression in pH in August, combined with a dissolved oxygen deficit below 13 feet, most likely resulting from normal bacterial activity and decomposition of organic debris. Light clarity of the surface waters is satisfactory, ranging from 6.5 to 9 feet. No reportable concentrations of pesticides, herbicides, or polychlorinated biphenyls (PCB's) have been found in the lake waters (U.S. Army Corps of Engineers, 1987; USCE, 1989; USCE, 1993).

Potential water quality contamination sources for the lake include septic facilities in the lakeside campground and adjacent rural community, and a site where a leaky underground Tulare County gasoline storage tank was removed. Surface water total and fecal coliform monitoring, conducted by the Three Rivers Community Services District in 1994 and 1995, showed counts ranging from 2.2 to greater than 16 most probable number (MPN), which are within the acceptable State drinking water standard of 200 MPN or less (Melon pers comm, 1995).

Contamination from Tulare County's gasoline tank resulted in ground water exceedance of State levels for benzene, toluene, and zylene, the major constituents of gasoline. The KDWCD in conjunction with Tulare County has monitored the site for six years and is currently considering a remediation plan including flushing and vapor recovery (Deffenbaugh pers comm, 1995; The Resources Agency, 1995).

Downstream Area

The downstream area is characterized by urbanization, natural vegetation and agriculture. Downstream ground water sampling showed high electrical conductivity, very high hardness, high boron in some wells, and slightly elevated levels of nitrates and the organic compound dibromochlorobenzene (DBCP). Samples from 1988 for nitrates were 27 milligrams per liter (mg/L), which are elevated but do not exceed the MCL for drinking water of 45 mg/L. The DBCP detection at 0.62 micrograms per liter (μg/L) exceeded the MCL for drinking water of 0.2 μg/L. All other inorganic compounds were below the MCL's and no other inorganic compounds were detected (The Resources Agency, 1995).

Ground water quality is generally good for this area; however, agricultural pesticides and fertilizers are affecting the wells as evidenced by the occasional elevated levels of nitrate and the detectable levels of DBCP. Ground water flow in this area is generally away from the Kaweah River into the surrounding areas, which minimizes the effects of these ground water contaminants in this area.

Surface water quality in the downstream area meets State and Federal safe drinking water quality standards as well as the secondary standards for industrial and agricultural water (California Code of Regulations, Title 22).

Tulare Lakebed

Ground water monitoring in the Tulare lakebed showed that water quality is generally good and all toxics are below the MCL for drinking water standards. All agricultural standards for pesticides, herbicides, and other organic compounds were below or within acceptable limits (California Code of Regulations, Title 22; U.S. Army Corp of Engineers, 1993; The Resources Agency, 1993).

3.3.9 Vegetation and Wildlife

The information in this section is taken from the Preliminary Draft Fish and Wildlife Coordination Act Report (CAR) for the Kaweah River Basin Investigation prepared in March 1994, from the Draft Environmental Assessment for the Lake Kaweah Water Control Manual Update prepared by Entrix, Inc., February 1993, and from the Kaweah River Corridor Enhancement Study, Part Two, Environmental Habitat, prepared by KAS Consultants (KASCO), July 1993. The draft CAR is included in Appendix A, and the final report will be appended to the final EIS/EIR. The draft environmental assessment was never finalized. The corridor study was a public document prepared for the City of Visalia, KDWCD, and Tulare County.

Kaweah Reservoir

Plant communities in the Lake Kaweah area are typical of the lower western slopes of the Sierra Nevada range. Grasslands, live and blue oak woodlands, riparian forest, and riparian scrub are the dominant plant communities.

Oak woodlands exist on all sides of the reservoir above the gross pool elevation of 694 feet m.s.l. Denser forests occur on north-facing slopes and along the drainages of south-facing slopes. The most extensive woodland is the blue oak woodland. Other species associated with this woodland include interior live oak, valley oak, and California buckeye. Digger Pine is usually a common associate to the blue oak woodlands in the foothills surrounding the Central Valley, but for unknown reasons this species is absent from much of Tulare County. On the drier south-facing slopes, the woodland consists of scattered trees in a savannah-type grassland. Both oak woodland and oak savannah vegetation are shown in Figure 3-5.

Most riparian vegetation around Lake Kaweah exists below the current inundation zone. Within this zone, the riparian vegetation largely consists of

riparian scrub-shrub habitat (Figure 3-6). This habitat is almost exclusively composed of willows and scattered buttonbush. Some of the willows were planted from 1988 to 1990 by the California Conservation Corps crews and various other volunteers. Along the Kaweah River and the tributaries feeding the reservoir, well-developed stands of riparian forest exist. These areas are dominated by black willow, black cottonwood, Fremont Cottonwood, and California sycamore. Cattails occur in some pools along the channels and along the streambanks. There are no jursdictional wetlands around the reservoir.

Besides the willow stands mentioned above, the repeated annual cycle of inundation and exposure of the reservoir precludes the formation of significant perennial plant cover below the gross pool elevation. Some introduced species associated with wetlands, such as cocklebur, are adapted to highly disturbed habitats and have become common to dominant on the exposed margins of Lake Kaweah.

Annual grassland, dominated by non-native grass and broad-leaved species, occurs on the open hillsides surrounding the reservoir and in the understory of the oak woodland communities. Species include wild oats, pine bluegrass, California needlegrass, foxtail brome, and red-stem filarea.

Some plant communities surrounding Lake Kaweah, particularly on the northeast side of the lake, are frequently in a disturbed or degraded condition due to cattle grazing and movement.

The vegetation of the project area is an important component of wildlife habitat. The diversity of habitat types in the project area supports a variety of wildlife species, especially birds. The oak woodlands and accompanying grasslands around the reservoir provide habitat for a number of mammals including mule deer, raccoon, badger, opossum, desert cottontail, black-tailed hare, spotted skunk, striped skunk, California ground squirrel, and numerous small mammals such as the California vole, deer mouse, and house mouse.

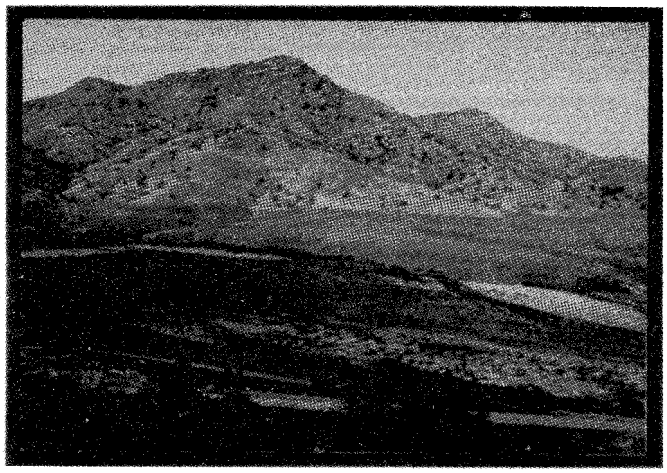


Figure 3-5 Oak Woodland/Savannah Vegetation at Lake Kaweah

Figure 3-6 Riparian Scrub-Shrub Vegetation in Lake Kaweah

Habitat surrounding the reservoir also provides foraging and roosting habitat for several raptor species. Permanent residents at Lake Kaweah and surrounding area include the black-shouldered kite, red-tailed hawk, northern harrier, Cooper's hawk, red-shouldered hawk, American kestrel, and turkey vulture. Golden eagles can be seen year-round, but they are uncommon. A number of species winter in the area including ferruginous hawks and rough-legged hawks. Wintering bald eagles and ospreys have been observed foraging for fish within the reservoir area. Upland game birds include the band-tailed pigeon, mourning dove, and ring-necked pheasant.

The open water of the reservoir provides habitat for waterbirds, particularly during the winter. Wintering species of waterfowl include green-winged teal, mallard, Canada goose, northern pintail, American widgeon; diving ducks include the common merganser and ruddy duck. Shorebirds such as the killdeer and least sandpiper feed along the shallow edges of the reservoir and river. Herons and egrets such as the great blue heron, green-backed heron, and great egret are found in Lake Kaweah year-round.

The project area also provides habitat for a variety of reptiles and amphibians. Common reptiles include the western fence lizard, western skink, gopher snake, common king snake, and the western rattlesnake. Representative amphibians in the area are the western toad, bullfrog, Pacific tree frog, and the California slender salamander.

Downstream Area

Three major categories of natural habitat are found in the downstream area: riparian forest, oak woodland, and grassland.

Typical riparian plant species, dominated by willow, cottonwood, and sycamore, are found downstream of Terminus Dam. Riparian vegetation is especially dense around the old gravel excavation pits just below the dam. Cattails and other emergent vegetation also occur sporadically along channel banks. Riparian vegetation communities dominated by valley oaks are also found downstream of Terminus Dam. The valley oak riparian community is found only in California's Central Valley and is in serious decline. Remnants of Great Valley willow scrub habitat are also found along the river and stream channels. This community consists of a variety of willow species, as well as Fremont cottonwood, California rose, and California wild grape.

Land use downstream of Terminus Dam is closely tied to agriculture. Much of the agricultural land between Lake Kaweah and Visalia is planted in citrus and

deciduous fruit orchards interspersed with mixed vegetable crops. Generally, the land has been cultivated up to the edge of the floodways of the Kaweah River's natural distributaries and tributaries, leaving little or no margin between the cultivated land and the instream riparian vegetation.

As the Kaweah River branches onto the San Joaquin Valley floor, urban land uses combine with agriculture to further reduce riparian vegetation. Vegetation becomes sparse or absent as the river divides into various distributaries approaching the Tulare lakebed.

Away from the streamside environment, conditions become drier, and the riparian forest and valley oak riparian forest changes to valley oak woodland. Valley oak woodlands are characterized by having a relatively open canopy cover. Understory vegetation typically consists of annual grasses such as ripgrut brome, wild oats, and foxtail barley. Native creeping wild rye is also commonly found in this community. Small areas of native grassland communities are scattered among the non-native grassland which dominates most of the grassland habitat in the downstream area.

Wildlife in the downstream area relies on these habitat types. Mammals using the riparian corridor include beaver, river otter, mule deer, coyote, gray fox, desert cottontail, jackrabbits, striped skunks, ringtail, mink, broad-footed mole, western harvest mouse, California vole,and long-tailed weasel.

Many birds, such as the western bluebird, American robin, northern mockingbird, phainopepla, and house finch use the native fruit-bearing shrubs and vines within the riparian areas. California towhee and rufous-sided towhee are present all year within the downstream area, but are found locally only where there is extensive, dense brushy understory. Black-headed grosbeak, blue grosbeak, and lazuli bunting are summer visitors, and are all presumed to be nesting within the downstream area.

Riparian habitats, as well as all wetland habitats are prolific insect producers. Northern oriole, common yellowthroat, yellow warbler, black phoebe, ash-throated flycatcher, and western wood pewee are a few of the birds found within the downstream area that feed almost exclusively on insects. Northern oriole, yellow warbler, ash-throated flycatcher, and western wood pewee are summer visitors, while common yellowthroat and black phoebe are year round residents. All these insect-eating bird species are known to nest within the study area.

Borrow pits near the confluence of Dry Creek and the Kaweah River support important areas or riparian vegetation. Birds of particular interest at this site

include willow flycatcher, yellow warbler, yellow-breasted chat, red-shouldered hawk, and Cooper's hawk.

Some common amphibians and reptiles found within the downstream area include western toad, Pacific treefrog, bullfrog, western pond turtle, western fence lizard, western whiptail, gopher snake, common garter snake, western black-headed snake, western rattlesnake, California legless lizard, Gilbert's skink, and southern alligator lizard.

Tulare Lakebed

The historic year round and seasonal wetlands of the Tulare Lake Basin have been replaced with irrigated agricultural fields, floodwater detention basins, evaporation ponds, private duck-hunting clubs, and State and Federal wildlife refuges. Currently, intermittently flooded habitat in the Tulare lakebed exists in the Hacienda and Wilbur floodwater storage areas totalling about 20,000 acres. Farming practices have eliminated most native vegetation (Figure 3-7). Small portions of the South Wilbur and Hacienda flood areas are partially vegetated.

During the winter and spring months, the Tulare lakebed is intermittently flooded by rains and snowmelt flooding from the Kings, Tule, Kern, and Kaweah Rivers. Generally, these flows into the lakebed are directed to the south flood detention areas first and then to specific areas in the lakebed. The wildlife that depends on habitats at the Tulare lakebed include migratory waterfowl, shorebirds, and other waterbirds of the Pacific Flyway. Flooded areas in the lakebed provide important breeding, feeding, brood-rearing and loafing habitat during the spring and summer, and resting and feeding habitat during the winter.

Species include mallard, pintail, cinnamon teal, shoveler, ruddy duck, western grebes, white-faced ibis, snowy plover, long-billed curlew, killdeer, least sandpiper, long-billed dowitcher, Caspian, black and Forester's terns, great, snowy and cattle egrets, black-crowned night-heron, and red-winged blackbirds. Large colonies of black-necked stilts and American avocets are among the most abundant species, representing about 50 to 70 percent of all breeding birds in the area (FWS, 1994).

3.3.10 Fisheries

Kaweah Reservoir

Fish resources in Lake Kaweah include both warm water and cold water species. A complete list of fish species in Lake Kaweah is included in Appendix A. The California Department of Fish and Game (DFG) annually stocks Lake Kaweah with rainbow trout in the winter and spring when the water

temperatures are low enough to support the fish. Trout probably do not survive the high water temperatures and low dissolved oxygen levels prevalent in the summer when the reservoir is drawn down due to irrigation releases. Some fish may move into the cooler waters of the Kaweah River as summer reservoir conditions occur, allowing survival of some cold water fish species for more than 1 year. The majority of fish taken by anglers are bluegill, rainbow trout, and largemouth bass.

Lake Kaweah supports a warm water fishery year-round. Species include large and smallmouth bass, spotted bass, white catfish, black and white crappie, carp, western roach, green sunfish, and threadfin shad.

In the fall of 1987, Kaweah Reservoir and the lower reaches of the Kaweah River were treated with Rotenone, a chemical that is toxic to all species of fish. The treatment was performed to eradicate white bass from the Kaweah River system and to complete its removal from lakes and streams in the Central Valley of California. White bass are considered, by some, to be a threat to striped bass, salmon, and other fisheries in the Sacramento-San Joaquin Delta. Restocking of the reservoir took place after the Rotenone treatment.

Along with the white bass, nearly 100 tons of carp were eradicated from the reservoir. Loss of the carp was considered a secondary benefit since carp are known to destroy spawning nests and consume the eggs of game species. Carp also increase reservoir turbidity by stirring up bottom sediments.

Currently, several factors limit the warm water game fishery in the reservoir: poor water quality, limited cover, competition from nongame fish, and water level fluctuations. As the lake drops to critical levels during the summer, dissolved oxygen tends to decrease, and the water temperature rises, making conditions less than ideal for the fishery. Water level fluctuations in the spring can change the lake level drastically due to snowmelt runoff. These spring fluctuations disrupt the fish spawning cycle. Irrigation releases normally begin around June 1, when most nest-building fish species have just completed spawning and young fish are hiding in flooded vegetation at the lake edge. As the lake level begins to drop, young fish are forced out of the shoreline cover and are exposed to increased predation.

Another problem facing the fishery at Lake Kaweah is the lack of a permanent dedicated minimum pool. Terminus Dam does not include a permanent minimum pool in the project authorization. In the past, the sediment pool has served as the inactive pool, providing fish and wildlife habitat. The authorized sediment storage space (8,000 acre-feet) is almost full with about 1,000 acre-feet remaining. Storage of additional water in the conditional space above the

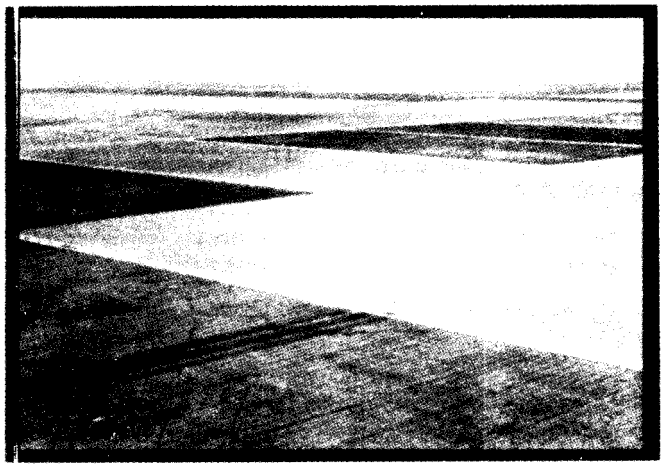


Figure 3-7 Tulare Lakebed

sedimentation space is allowed during the winter months when rainfall conditions permit. Storage in the conditional space has allowed the fishery to be sustained, but storage in this space is not guaranteed. As sediment continues to accumulate in the reservoir, the conditional storage space will diminish over an estimated 50-year period. The reservoir currently can be drawn down to 1,000 acre-feet during the winter if flood control conditions warrant it.

Numerous fish enhancement measures have been implemented at the reservoir by DFG in coordination with the Corps.

- Anchoring spawning containers for channel catfish to the reservoir's bottom, just below the water level.
- Planting approximately 100 acres of wheat and barley on land within the reservoir's drawdown zone. When the reservoir's water level rises, the grain provides food and shelter for juvenile fish.
- Anchoring dead fruit trees, reclaimed Christmas trees, and brush piles to the bottom of the reservoir as brush cover for young fish.
- Constructing nearly 7 miles of fencing near the reservoir's edge to prevent grazing cattle from disturbing the shallow water zone.
- Constructing and maintaining a small spawning pool on the Greasy Creek arm of the reservoir to offset the adverse effects of the water level fluctuation in the reservoir.
- Planting willows in the drawdown zone of the reservoir and providing them with drip irrigation during the dry season. These willows provide cover for fish when the reservoir is full.

Downstream Area

The historic intermittent nature of in-stream flows in the Kaweah River have had a profound effect on the fishery. It is unlikely that a stable, permanent fishery ever existed on the river since flows were based on seasonal runoff from the Sierra Nevada and were interrupted for 4 to 8 months every year.

As a result of construction of various water management structures, there are several areas along the St. Johns River with standing water even during periods when water is not being released from Kaweah Reservoir. Fish species present in the Lower Kaweah and St. Johns Rivers are introduced by releases from the

reservoir and the Friant-Kern Canal. Releases from Terminus Dam are introduced into the lower reaches of the Kaweah River at the Terminus Forebay. Water is diverted from the Friant Kern Canal into the St. Johns River and Kaweah River near Woodlake.

The species composition of the fishery below Terminus Dam is typical of most warm water fisheries in California. Water temperatures are too high and in-stream flows too intermittent to support a cold water fishery, which is characterized by the presence of salmonid fishes. Most of the species present are introduced game fish (bass or sunfish), escaped bait fish (threadfin shad and golden shiner), or fish used for pest control (mosquitofish).

In the fall of 1987, the white bass eradication treatment also killed all other fish in the river (at the time of application). This status of the fishery was evaluated at this time.

Fish samples from the Lower Kaweah River in 1987 revealed a total of 15 species. Most of the sample included of the following species: common carp, Sacramento sucker, white catfish, redear sunfish, and spotted bass. The Kern brook lamprey was also collected at this time. The Kern brook lamprey is a native fish which is a Category 2 candidate for Federal listing as threatened or endangered. Little is known about its distribution or status. Other native fish that have been collected on the Kaweah River are Sacramento squawfish and Sacramento sucker. Also, that two other native species, California roach and hardhead, likely occur below Terminus Dam.

In 1992, the DFG also sampled the Kaweah River at three locations between McKays Point and the Terminus Forebay. This sample produced seven species: bluegill, green sunfish, brown bullhead, black crappie, largemouth bass, spotted bass, and mosquitofish. Kern brook lamprey was not found during the DFG sampling.

Tulare Lakebed

In the late 19th century, commercial fisheries existed in the Tulare lakebed, as well as commercial markets for frog legs, waterfowl, and turtles. Because of the changes in the lakebed and the current agricultural practices, fish presently inhabit only the canals and altered rivers in the area. However, fish still inhabit the lakebed when it is flooded. Species remaining in the aquatic areas of the lakebed include some native species such as tule perch, Sacramento sucker, riffle sculpin and endemic minnows (FWS, 1994). Nonnative fish species include striped bass, channel and white catfish, largemouth bass, Mississippi silversides, golden shiner, and mosquitofish.

When the lakebed was flooded in the record rainfall year of 1982-83, fish productivity of the flooded areas was exceptionally high. The DFG assumed that this productivity was due to fertilizer used in farming activities, plus the nitrogenous by-products of crops inundated by floodwaters. The fishery was extremely popular with anglers at the time because of the high numbers of fish and resulting high catch rates.

3.3.11 Endangered 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 potentially 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 (E), threatened (T), 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.

Candidate species for Federal listing are assigned to one of two categories depending on the existing base of information and the biological appropriateness of listing. Federal Category 1 (FC1) includes species for which the U.S. Fish and Wildlife Service (FWS) has compiled substantial information on biological vulnerability and magnitude of threat to support listing the species as endangered or threatened. Federal Category 2 (FC2) includes species for which the existing base of information is incomplete but which appear, based on the information that is available, to warrant continued consideration for listed status. The State also maintains lists of Candidate-Endangered Species and Candidate-Threatened Species which are afforded legal protection similar to officially listed endangered and threatened species.

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 endangered species act. Under the CESA, however, the DFG is empowered to review projects for potential impacts to State-listed species and their habitats.

The Corps has prepared a comprehensive Biological Data Report (BDR) that presents ecological and geographical information on Federal (F) and State (S) listed, proposed (P), and candidate (C) species (see Appendix C). The BDR also presents information on potential project effects and general threats to a species' survival. The species described and analyzed in the BDR were identified in two letters from the Endangered Species Office of the Sacramento FWS dated January 30 and September 27, 1995, and a search of California's Natural Diversity Database (NDDB) performed on June 23, 1995. The original species listed in the January letter from FWS were used as the basis for the endangered species analysis and were considered in the selection of surveyed species. However, discussions of the additional listed and proposed species identified in the updated September letter are included in the BDR, but no additional surveys have been done. If analysis of potential effects on these additional species indicates that surveys are necessary, they would be done before project construction begins.

Following review of the Biological Assessment, BDR, and information in other sources, the FWS will issue a formal Biological Opinion including a determination of jeopardy or non-jeopardy for each species potentially affected by the project. If the Biological Opinion includes one or more findings of jeopardy to the continued existence of species, the FWS will identify reasonable and prudent measures to avoid jeopardy. Based on this information, appropriate mitigation measures would then be developed and implemented by the Corps and non-Federal sponsor.

Potentially Affected Species

This section briefly describes the physical characteristics, distribution, and possible presence of the listed and proposed species and species of special concern that may be affected by the proposed Kaweah Basin project. Selection of these species was made by consulting the Endangered Species Office of the FWS, using the NDDB, and reviewing the available literature. Potential effects to these species are presented in Section 4.12. Further information related to these and other species that may occur in and around the study area can be found in Appendix C.

Blunt-nosed Leopard Lizard (*Gambelia silus*). FE, CE. The blunt-nosed leopard lizard derives its name from its relatively short snout and dark blotches which occur on its back and tail (DFG, 1991). This large lizard measures from 3 to

5 inches from snout to base of tail and typically has gray or green dorsal coloration. The blunt-nosed leopard lizard has whitish crossbars along its back and tail, and breeding females have orange or reddish spots along their sides.

The blunt-nosed leopard lizard inhabits sparsely vegetated plains, alkali flats, low foothills, grasslands, canyon floors, large washes, and arroyos throughout the San Joaquin Valley and adjacent foothills from San Joaquin County south into San Luis Obispo County (DFG, 1991).

Potential habitat for this species may exist in the Tulare lakebed, and due to the listed status of this species, surveys were undertaken to determine the current status of this species in the study area.

Bald Eagle (*Haliaeetus leucocephalus*). FT, CE. Adult bald eagles are large raptors with brownish-black bodies and white heads, necks, and tails. Immature birds, which reach adulthood in 4 or 5 years, are mostly brown but may be irregularly blotched with white or light yellow colors. The wingspan of the bald eagle ranges from 6.5 to 8 feet, and the birds weigh from 8 to 14 pounds (DFG, 1985).

The bald eagle inhabits a variety of habitats, including coastal and montane cliffs, caves, riparian zones, and deciduous and evergreen forests. Bald eagles typically nest in multi-storied forests with old-growth characteristics located near permanent bodies of water (FWS, 1986). The bald eagle historically was widespread throughout the North American continent. Although bald eagles still winter throughout much of their historic range, breeding areas now are restricted to Alaska, Canada, the Pacific Northwest, the Great Lakes, Chesapeake Bay, and Florida.

Although a search of the NDDB revealed no recorded sightings of the bald eagle in the study area, a previous study documented occasional sightings of both adult and immature bald eagles at Lake Kaweah (ECOS, 1990). In addition, several eagles were sighted near Terminus Dam during the winters of 1994 and 1995 (Parker pers comm, 1995).

Swainson's Hawk (*Buteo swainsoni*). No Federal status, ST. The Swainson's hawk is a medium-sized hawk with a dark chest band, light wing linings, and dark flight feathers (Peterson, 1990). The Swainson's hawk may also appear in a dark phase, at which time the both the wing linings and flight feathers are dark and the tail is narrowly banded. The tail is often gray above and becomes light at the base.

The Swainson's hawk inhabits plains, rangelands, open hills, and landscapes

supporting sparse trees throughout much of western North America and northern Mexico (Peterson, 1990). In California, migratory Swainson's hawks breed in the Central Valley, where typical nesting habitat often includes riparian areas (ECOS, 1990). Swainson's hawks also occur in California on the eastern flank of the Sierra Nevada Range.

A search of the NDDB revealed no recorded sightings of the Swainson's hawk within the study area. The project area lies at the southern end of the Central Valley breeding range, where Swainson's hawk nests are few and scattered. There are noted nest sightings outside the immediate project area.

San Joaquin Kit Fox (*Vulpes macrotis mutica*). FE, ST. The San Joaquin kit fox is the largest of several subspecies of kit foxes in North America. This fox has tan to gray dorsal coloration in the summer, which turns silvery gray during the winter. Ventral coloration is white throughout the year, and the long bushy tail is black-tipped. The slender San Joaquin kit fox is characterized by relatively long legs and large conspicuous ears. Adults have an average body length of 20 inches, an average tail length of 12 inches, and typically stand from 9 to 12 inches tall at the shoulder. The average adult weight is approximately 5 pounds.

The San Joaquin kit fox typically inhabits grasslands or open shrub/scrub habitats in arid regions of southern California (DFG, 1990). The historic range of this fox included most of the San Joaquin Valley, but its distribution is now limited to relatively undisturbed patches scattered among agricultural fields from Merced to Kern County (DFG, 1991). Other populations may inhabit the Interior Coast Range as far north as Contra Costa County and portions of Monterey, Santa Clara, San Benito, and Santa Barbara Counties.

Potential habitat for the kit fox may occur in the Tulare lakebed portion of the study area. Due to the listed status of this species and the potential habitat in the study area, surveys were done to determine the current status of this species in the study area.

Tipton Kangaroo Rat (*Dipodomys nitratoides nitratoides*). FE, CE. The Tipton kangaroo rat is one of three subspecies of the San Joaquin kangaroo rat and typically is about 8 to 9 inches long including the tail (William, 1979). This rat is compact with a flattened head, small ears, and a short neck. The hind legs are elongated, and a long tufted tail may equal the body length from nose to base of tail. The Tipton kangaroo rat has brownish dorsal coloration and white ventral coloration.

The Tipton kangaroo rat typically inhabits shrubby alkaline sink communities and saltbush (*Atriplex* spp.) shrublands (Williams, 1979). The historic distribution

of this rodent covered the Tulare Basin region of the San Joaquin Valley, but most of this land has been developed in recent decades (Williams, 1985). Remaining habitat typically comprises small scattered parcels distributed among agricultural fields.

Potential habitat for the Tipton kangaroo rat may occur in the Tulare lakebed portion of the study area. Due to the listed status of this species and potential habitat in the study area, surveys were done to determine the current status of this species in the study area.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*). FE, no State status. The valley elderberry longhorn beetle is a stout-bodied insect with antennae that may be as long as its body. The typical body length of this beetle ranges from about 0.5 to 0.8 inch. The hard outer wings are dotted with four oblong metallic green spots, which are bordered by bright red-orange coloration. Females are slightly larger than males, ranging from about 0.7 to 1.0 inch in body length (USACE, 1990).

The valley elderberry longhorn beetle is host specific and, as its name implies, spends the majority of its time on elderberry plants (*Sambucus* spp.). This beetle completes its entire life cycle in association with elderberry, feeding on the plant in both juvenile and adult forms, and prefers larger trees with a minimum circumference of about 6 inches (USACE, 1990). The valley elderberry longhorn beetle once was distributed throughout the lower Sacramento and upper San Joaquin Valleys of California in riparian and moist valley oak habitats. This distribution has since been restricted to fragmented areas following the extensive destruction of riparian habitat in California.

Although a search of the NDDB revealed no recorded sightings of the valley elderberry longhorn beetle within the study area, its habitat requirements and historic distribution suggest that it may be present. Therefore, surveys were done to determine the current status of this species in the study area.

California Jewelflower (*Caulanthus californicus*). FE, CE. The California jewelflower is an annual herb of the mustard family (Brassicaceae) and grows to a height of about 1 foot. This plant is erect and has wavy-margined leaves, which typically are clustered in a circular pattern at the base of the plant. The flowers, which occur on branches, are translucent white and tipped with purple to green coloration (FWS, 1995).

The California jewelflower typically inhabits sandy soils in grasslands or mixed grassland-shrub habitats. All known populations of this plant have been observed in association with native and non-native plant species. The California

jewelflower historically occurred throughout the Tulare Basin and southern San Joaquin Valley from Fresno to Kern County and was described by an early collector as being "abundant on the plains of the San Joaquin from Tulare southward" (FWS, 1995). The flower was also recorded as present in the Cuyama Valley of Santa Barbara County. In 1990, California jewelflower populations were known to occur primarily in only three areas, including an introduced population in the Nature Conservancy's Paul Paine Preserve in Kern County, as well as at sites in Santa Barbara and San Luis Obispo Counties (FWS, 1995).

A search of the NDDB indicated no recent sitings of the jewelflower in the study area. Due to its status as a listed species and its historical range, however, surveys were done to determine the current status of this species in the study area.

San Joaquin Adobe Sunburst (*Pseudobahia peirsonii*). PE, CE. The San Joaquin adobe sunburst is an erect annual herb of the sunflower family (Asteraceae) and grows to a height of about 18 inches (Stebbins, 1991). This plant is loosely covered with white wooly hair, and alternating leaves exhibit a bipinnate structure triangular in outline. The flower heads, which occur individually at the end of branches, are bordered by bright yellow ray flowers.

The San Joaquin adobe sunburst typically inhabits heavy adobe clay soils where water retention properties are high, such as those found in and near the foothills of the southeastern San Joaquin Valley (Stebbins, 1991). This plant occurs in the southern Sacramento Valley and throughout the San Joaquin Valley in grasslands and grassland-blue oak woodland habitats (Brown, 1982).

A search of the NDDB revealed the last recorded sighting in the vicinity was in 1936. However, due to the proposed status of the sunburst and its historical range, surveys were done to determine the current status of this species in the study area.

Foothill Yellow-legged Frog (*Rana boylii*). FC2. The foothill yellow-legged frog has gray, brown, reddish, or olive dorsal coloration which is usually flecked or mottled (Stebbins, 1972). In addition, there is a light-colored triangular patch on its snout. Ventral coloration, including the undersides of the legs, generally is yellow.

The foothill yellow-legged frog typically inhabits rocky stream areas in valley-foothill hardwood, valley-foothill hardwood-coniferous, valley-foothill riparian and mixed coniferous forests, as well as wet meadows, coastal scrub, and chaparral habitats. The foothill yellow-legged frog has been found in the Coast Ranges from the California-Oregon border south to the Transverse Mountains in Los Angeles County. This species also occurs in most of northern California west of the Cascade crest and along the western side of the Sierra Nevada Range south to Kern

County. Livezey reported an isolated population in San Joaquin County on the floor of the Central Valley. Isolated populations are also known from the mountains of Los Angeles County.

A search of the NDDB revealed no known occurrences in the study area However, there are several recorded sightings of the foothill yellow-legged frog near the study area along the North and South Forks of the Kaweah River upstream of Lake Kaweah. Therefore, surveys were done to determine the current status of this species in the study area.

Tricolored Blackbird (*Agelaius tricolor*). FC2, State species of special concern. The tricolored blackbird is a perching bird ranging in length from about 7 to 9.5 inches (Terres, 1980). The male is black with a dark red shoulder patch bordered by a conspicuous white margin. The female is dark brownish in color with light streaks on forehead and throat (Peterson, 1990).

The tricolored blackbird typically inhabits stands of cattail and bulrush in marshes or along streams and reservoirs in valleys and foothills. The bird also occurs in streamside forests, wet meadows, rangelands, and alfalfa and rice fields (Terres, 1980). This species is sparsely distributed from southern Oregon east of the Cascade Mountain Range to northwest Baja California.

A search of the NDDB revealed no recorded sightings of the blackbirds around Lake Kaweah, but there may be suitable foraging habitat in the Tulare lakebed. Therefore, surveys were done to determine the current status of this species in the study area.

White-faced Ibis (*Plegadis chihi*). FC2. The white-faced ibis is a dark, chestnut colored bird with long legs and a long down-curved bill (Peterson, 1990). This species stands about 22 to 25 inches tall and derives its name from the white border that lines the base of the bill on breeding individuals.

The white-faced ibis is a wading bird which typically inhabits freshwater marshes and irrigated farmlands and rice fields and is often associated with bulrushes and reeds (Terres, 1980). This species primarily occurs in central North America, east of the Sierra Nevada, and west of the Mississippi River. Small populations are known to breed in the Central Valley of California, while other populations have been observed wintering in central southern California (Terres, 1980).

Although a search of the NDDB revealed no recorded sightings of the white-faced ibis in the study area, its habitat requirements and known distribution suggest

that it may be present in the Tulare lakebed area. Therefore, surveys were done to determine the current status of this species in the study area.

Mountain Plover (*Charadrius montanus*). FC2. Mountain plovers, in breeding plumage, have a white forehead and line over the eye, contrasting with a dark crown (Peterson, 1990). This species ranges in size from about 8 to 9.5 inches and can be distinguished from other plovers by the absence of banding across its breast and the presence of a dark band on its tail. Non-breeding plumage is characterized by brownish dorsal coloration and a buffy tinged breast. Otherwise, ventral coloration is typically white.

The mountain plover typically inhabits semiarid grasslands, plains, and plateaus. The common breeding range of this species extends from northern Montana and North Dakota to New Mexico and western Texas. Winter range generally includes southern Texas and Mexico, as well as the Central Valley of California, where birds are found in short grasslands or barren fields (Cogswell, 1977).

Although a search of the NDDB revealed no recorded sightings of the mountain plover in the study area, its habitat requirements and known distribution suggest that it may be present. Therefore, surveys were done to determine the current status of this species in the study area.

Western Snowy Plover, interior population (*Charadrius alexandrinus nivosus*). FC2, State species of special concern. The western snowy plover is one of two subspecies of snowy plover which occur in the United States. The western snowy plover consists of two distinct subpopulations--the coastal and the interior populations--as determined through extensive banding studies (Buford pers comm, 1995). The western snowy plover is a pale bird typically about 6.5 inches in size (Peterson, 1990). It has a thin dark bill, dark or grayish legs, a partial band across its breast, and a dark ear patch. Females and juveniles may lack black plumage.

While the coastal population of the western snowy plover typically inhabits coastal areas such as beaches, sandy flats, estuaries, and salt ponds (Zeiner et al., 1990) as a year-round resident, the interior population migrates inland to breed in areas including agricultural waste water evaporation ponds and the perimeters of alkaline lakes (Buford pers comm, 1995). In general, western snowy plovers are distributed throughout the western United States from southern Washington through Baja California. Some populations winter in Baja California and Mexico, and the interior population breeds inland in the western United States from Oregon and Nevada to California. In California, breeding birds of the interior population occur in the Central Valley and along the eastern edge of the Sierra Nevada.

Since this species is known to use the evaporation ponds near the Tulare lakebed, surveys were done to determine the current status of this species in the study area.

Heartscale (*Atriplex cordulata*). FC2. The heartscale is an annual plant and commonly reaches a height of 6 to 14 inches (Munz and Keck, 1973). Branches of the heartscale are stout, straw-colored, scaly, and either spreading or upright. Leaves are numerous, less than half an inch long, sessile, and roughly egg to heartshaped. Flowers are unisexual and found in clusters at the base of leaves.

Heartscale typically inhabits alkaline or saline soils that are often hard and/or trampled (Munz and Keck, 1973). The plant is distributed below about 600 feet in the Sacramento and San Joaquin Valleys from Glenn to Tulare County.

Although there are no NDDB records for the heartscale in the study area, habitat may occur in the Tulare lakebed area. Therefore, surveys were done to determine the current status of this species in the study area.

Brittlescale (*Atriplex depressa*). FC2. The brittlescale is an annual plant and typically grows to a height of less than 10 inches (Hickman, 1993). The stems of this species, which are whitish and smooth to scaly, typically grow flat along the ground although the tips may curve upward. Leaves are egg to heartshaped, generally white and scaly, and typically less than a quarter inch long.

Brittlescale usually inhabits alkaline or clay soils below 600 feet (Hickman, 1993). The plant is distributed from the southern end of the Sacramento Valley through the San Joaquin Valley.

Although there are no NDDB records for the brittlescale in the study area, habitat may occur in the Tulare lakebed area. Therefore, surveys were done to determine the current status of this species in the study area.

Lesser Saltscale (*Atriplex minuscula*). FC2. The lesser saltscale is an annual plant and typically grows to a height of less than 20 inches (Hickman, 1993). Individuals of this species have many stems, which are generally erect, and spreading brittle branches that are often reddish and peeling. Leaves are tiny, egg to heartshaped, and generally white-scaly below and green above.

The lesser saltscale typically inhabits sandy, alkaline soils below 600 feet (Hickman, 1993). The plant is distributed in the southern San Joaquin Valley from Fresno to Kern County.

Although a search of the NDDB revealed no recorded sightings of the lesser saltscale in the project area, its habitat requirements and known distribution suggest that it may be present. Therefore, surveys were done to determine the current status of this species in the study area.

Lost Hills Saltbush (*Atriplex vallicola*). FC2. The lost hills saltbush is an annual plant and typically grows to a height of less than 10 inches (Hickman, 1993). Individuals of this species have few stems, which are generally erect and gray-scaly to smooth. Leaves are elliptical to eggshaped, green to gray in coloration, scaly, and typically less than half an inch long.

The lost hills saltbush typically inhabits dried ponds and alkaline soils below 600 feet (Hickman, 1993). The plant is distributed in the San Joaquin Valley with specimens having been collected in Fresno, Kings, Kern, and San Luis Obispo Counties (CNPS, 1988).

Although a search of the NDDB revealed no recorded sightings of the lost hills saltbush in the project area, its habitat requirements and known distribution suggest that it may be present. Therefore, surveys were done to determine the current status of this species in the study area.

Kaweah Brodiaea (*Brodiaea insignis*). FC2, CE. The Kaweah brodiaea is a perennial herb and typically grows from 4 to 12 inches tall. Leaves are long and narrow and grow from the base of the flower stem which is leafless. Flowers are cylindrical in shape with widely spreading lobes, pink to rose-purple in coloration, and grow at the end of thin stalks which may be up to 1.5 inches long (Hickman, 1993).

The Kaweah brodiaea typically inhabits heavy clay soils in foothill woodlands, savannahs, and grasslands at elevations from 720 to 1,380 feet. This species is limited in distribution to the Kaweah and Tule River watersheds of Tulare County in the Sierra Nevada foothills east of the San Joaquin Valley (Hickman, 1993).

A search of the NDDB revealed several recorded sightings of the Kaweah brodiaea near, but not within, the study area both upstream and downstream from Terminus Dam. These records were substantiated by a vegetation survey conducted in 1991 (DWR, 1991). Therefore, surveys were done to determine the current status of this species in the study area.

Recurved Larkspur (*Delphinium recurvatum*). FC2. The recurved larkspur is a perennial plant with smooth stems which typically grow to a height of less than 24 inches (Hickman, 1993). Leaves are smooth and few to many lobed and may grow either from the base or the stems of the plant. The flowers, which grow on thin

stalks up to 2 inches long, generally are light blue in color with lower petals being white and a short posterior spur ranging up to 0.7 inch in length.

The recurved larkspur typically inhabits fine, poorly drained, alkaline soils in grasslands and saltbush (*Atriplex* spp.) scrublands from about 100 to 1,800 feet (Hickman, 1993). This species is distributed in both the Sacramento and San Joaquin Valleys from Glenn and Butte Counties to Kern County.

A search of the NDDB revealed no recorded sightings of the recurved larkspur within the study area. However, there may be suitable habitat in the study area. Therefore, surveys were done to determine the current status of this species in the study area.

Spiny-sepaled Coyote-thistle (*Eryngium spinosepalum*). FC2. The spiny-sepaled coyote-thistle is an erect plant of the carrot family (Apiaceae) with branching stems that may grow up to 30 inches in height (Hickman, 1993). Leaves are oblong to oblanceolate, toothed around the edges, and range from 3.5 to 14 inches in length. The small white flowers occur in egg-shaped or circular clusters at the end of thin stalks which may be up to 0.8 inch long.

The spiny-sepaled coyote-thistle inhabits vernal pools and depressions in grasslands from 300 to 600 feet (Hickman, 1993). This species is distributed throughout the eastern San Joaquin Valley and adjacent foothills from Fresno to Tulare Counties (CNPS, 1988).

A search of the NDDB revealed several recorded sightings of the spiny-sepaled coyote-thistle in and near the study area. One recorded sighting substantiated during a 1991 vegetation survey (DWR, 1991) occurred just above the high water mark at the east end of Lake Kaweah. Therefore, surveys were done to determine the current status of this species in the study area

3.3.12 Cultural Resources

This section discusses cultural resources found in the study area. Cultural resources or historic properties include buildings, structures, objects, sites, districts, and archeological resources associated with historic or prehistoric human activity which 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.

Federal agencies are required to consider cultural resources during project planning and implementation. A number of laws and regulations guide this process. Principal among these is the National Historic Preservation Act of 1966, as

amended (Public Law 95-515). In particular, the Section 106 review process of this act and implementing regulations (36 CFR 800) guide the manner in which this law is carried out.

Cultural Overviews

Archeological Background. Archeological research in the southern Sierra Nevada has focused on the major themes of establishing local and regional culture histories, studying subsistence-settlement patterns, and identifying ethnolinguistic groups. Although the region has long needed more investigation, some recent efforts by Moratto (1972, 1984), TCR/ACRS (1984), Meighan et al. (1988), and Jackson et al. (1990) are beginning to shed light on prehistoric lifeways in the southern Sierra Nevada.

A specific cultural chronology for the Kaweah River Basin has yet to be established. Absence of obsidian source determination and temperature constants of the Kaweah River Basin have made conversion of obsidian hydration data into reliable dating difficult. Based on study of projectile points found at the Greasy Creek site, located at the confluence of Greasy Creek and the Kaweah River, occupation of the area may date back 3,000 years (Jackson et al., 1990).

Early pioneers of archeology in the region used relatively simple methods as compared to modern methods. Gifford and Schenk (1926) provided the first archeological survey of the southern San Joaquin Valley. Hewes (1941) and Elsasser (1960) both attempted comprehensive overviews of the southern San Joaquin Valley and southern Sierra Nevada. However, it wasn't until the 1980's that the region came under more intense archeological scrutiny.

Ethnographic Background. The Foothill Yokuts made the area around Terminus Dam and Lake Kaweah their home for centuries before Euro-American encroachment. The remainder of the area along the Kaweah River and Tulare lakebed was Southern Valley Yokuts territory.

Kroeber (1925) believed that the Yokuts were unique among California groups because they were divided into true tribes with a distinct name, dialect, and territory. Tribal boundaries were vague, but streams generally formed the basis for settlements. The Foothill Yokuts lived in brush dwellings with low conical roofs. Southern Valley Yokuts had small, lightly built shelters covered with tule mats. Settlements were located on low mounds next to water courses.

Subsistence for both groups depended on hunting and gathering, supplemented by fishing. Foothill Yokuts used deer, quail, and acorns as major staples, along with salmon. Southern Valley Yokuts relied on fishing to a greater

extent, catching salmon, sturgeon, and perch. The Southern Valley Yokuts also made use of acorns, tule roots, seeds, and waterfowl for food (Spier, 1978; Wallace, 1978).

Limited ethnographic data exists on the Yokuts because of the tremendous loss of life among the Native Americans after Euro-American encroachment into their territory. Disease, especially malaria, devastated the Native American population. Cook (1955) estimated that 75 percent of the California Indian population succumbed to disease. By the time Americans took control of the state, the native people were already in a precarious position. By the 1870's when Stephen Powers began his survey of California Indian groups, the Valley Yokuts were no longer an identifiable group. Those still alive probably intermingled with other Yokuts groups or had assimilated into Euro-American society (Powers, 1977).

Historic Background. Pedro Fages discovered Tulare Lake in 1772. In 1804 Father Juan Martín of Mission San Miguel crossed the Coast Range and visited the large Indian village of Bubal at the southern end of the lake. Evidence exists that a mission-seeking expedition visited Tulare Lake in 1814, but details are sketchy. During the Mexican period, at least two punitive raids visited the lake villages to recover stolen horses and runaway neophytes (Hoover et al., 1990).

Fur traders quickly hunted beaver to near-extinction in the region and left behind a legacy of horse raiding among the surviving Yokuts. Jedediah Smith likely met with the Wuchmni in February 1926 and remained in the area of Lake Kaweah for 2 days (Smith, 1977).

The first settlement in the area did not occur until cattleman Hale Dixon Tharp established a homestead on Horse Creek, which now flows into Lake Kaweah between Lemon Cove and Three Rivers, in 1856. Limestone deposits led to the formation of the small settlements of Lime Kiln (1879) and Lemon Cove (1888). Three Rivers was established in 1879 as an apple colony. These communities remained small and remote (Meighan et al., 1988).

Methodology and Previous Studies

The study area was first surveyed for cultural resources by Franklin Fenenga in the 1940's as part of the Smithsonian Institution River Basin Survey program (Fenenga, 1948). This survey focused on the inundation area behind the proposed Terminus Dam, and Fenenga found the area to have a high concentration of sites. Eventually, three sites were excavated prior to construction of the dam.

Additional archeological investigations in the Lake Kaweah area were performed during the late 1950's and early 1960's. In 1984, the University of

California, Los Angeles (UCLA), Archeology Department was contracted to perform a survey of all Corps lands at Lake Kaweah. The resulting report was a summary of historical, ethnographic, and archeological research to date in the area. In 1990, another study was made of the area, focusing primarily on the Dry Creek area (Meighan et al., 1988; Jackson et al., 1990). Results of these surveys are presented below.

Results of Investigation

Kaweah Reservoir. The UCLA survey in 1984 produced evidence of the Limekiln Quarry of 1888. Features found included loading ramps, quarry pits, mine shafts, and railroad ties. Six additional prehistoric sites were found and recorded. In 1990, a cultural resources survey of the Dry Creek reservoir area and expanded affected area around Lake Kaweah located 29 previously unrecorded sites in the Dry Creek area. No newly discovered archeological resources were found in the Lake Kaweah area. The seven sites reported by UCLA in 1984 were evaluated for eligibility for the National Register of Historic Places.

Downstream Area. Very little systematic survey work has been conducted in the downstream area. Although few sites are known, there are several water courses aside from the Kaweah River that could have been used by the Yokuts as permanent village sites or temporary camps.

Three village sites have been identified through ethnographic research for the downstream area. Waitatshulu, Dawaw Nawshid, and Chuntow were established on various channels of the Kaweah River after it emerged from the mountains.

Tulare Lakebed. Previous archeological investigations on the southern end of the lakebed have led experts to believe that the Tulare Lake area was a highly populated area in prehistoric times. Three major village sites have been identified along the 1880's-era lake shore. These villages were known as Yimel, Walna, and Wititsolowin. Agricultural diversion began in the 1860's and increased until salinity levels increased and the fishery disappeared sometime around 1900. After construction of flood control dams on the rivers that drain into the lakebed, Tulare Lake remained dry and under cultivation. Prehistoric sites would likely not be located within the lake inundation area since the seasonally wet conditions would have discouraged habitation.

CHAPTER 4.0

ENVIRONMENTAL CONSEQUENCES

Upper reach of Lake Kaweah

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 to offset adverse project effects is also discussed for each resource. The proposed mitigation sites discussed in this document were evaluated and selected with the intent of mitigation being implemented on those sites. However, as the project progresses, mitigation sites may change due to a number of factors including site suitability and availability. If different mitigation sites are selected, those sites would be evaluated in a supplemental environmental document for public review and comment.

A project or action can cause direct, indirect and cumulative effects on the environment. Direct effects caused by the action occur at the same time and place as the action. Direct effects 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 impacts 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 reasonably foreseeable future actions. Direct and indirect effects of the proposed project are discussed in this chapter while cumulative effects are discussed in Chapter 5.

4.2 EFFECTS ON LAND USE

This section (1) describes direct and indirect effects of the alternatives on land use, (2) suggests mitigation measures for those effects, and (3) provides a

summary of more detailed information included in the Land Use appendix in this report.

Future land uses were determined by reviewing numerous planning documents, Tulare and Kings County General Plans, the Foothill Growth Management Plan, and the Rural Valley Lands Plan. In addition, future conditions were estimated using maps, reports, hydrologic data, and site visits.

Several knowledgeable people familiar with the project or the area were contacted to obtain their professional opinions about land use changes in the future, for both with- and without-project conditions. Their opinions were taken into account while making future projections. The names of these individuals and their comments are included in the Land Use appendix of this report.

Acreages of future land use with and without the project are shown in Table 4-1 .

TABLE 4-1
Future Land Use With and Without Project
(acres)

Land Use	Future with Project Alternatives			Future Without Project		
	Kaweah Reservoir	Downstream Area	Tulare Lakebed	Kaweah Reservoir	Downstream Area	Tulare Lakebed
Riparian	2	6,672	0	72	6,672	0
Grassland	66	7,030	0	145	7,030	
Oak savanna/ woodland	92	10,107	0	228	10,107	0
Other/fallow (disturbed/ flooded)	6	3,682	46,345	36	3,682	46,345
Row crops/ pasture	0	228,597	50,267	0	228,597	50,267
Orchards	0	42,165	0	0	42,165	0
Cotton	0	102,644	88,333	0	102,644	88,333
Urban/ commercial	21	66,950	0	27	66,950	0
Total	187	467,847	184,945	508	467,847	184,945

Source: Tulare Lakebed Water Storage District

Land use changes resulting from a reduction in the 100-year flood plain were calculated graphically using flood plain maps developed and provided by the Corps. Land use in the existing 100-year and the post-project 100-year flood plains were identified, digitized, and tabulated.

Potential land use changes resulting from additional water storage facilities were determined by a literature review which included the 1993 California Water Plan Update for the Tulare Lake Region and through discussions with knowledgeable individuals.

The Tulare and Kings County General Plans were investigated in order to determine the existing zoning for land uses. The California Department of Finance, Demographic Research Unit, was contacted for the population projections for Tulare and Kings Counties to determine future projected growth in the area.

Factors that can affect future land use changes and are considered to be significant included increased availability of water, elimination of flooding, changes in cropping patterns, water delivery systems, and lands going out of production due to ground-water overdraft.

4.2.1 Alternative 1

Without the project, increasingly high costs for water and the lack of reliable water supplies will likely result in some agricultural lands going out of production due to ground water overdraft. Non-agricultural land use would remain as described under existing conditions.

Historically, lands were developed for irrigated agriculture using ground water and unregulated flows of the Kaweah River. The advent of the Friant-Kern Canal water supply helped offset and slow the rate of ground water overdraft. Water conservation provided by Terminus Dam helped control the Kaweah River and further slowed the rate of ground water overdraft. In spite of these measures, ground water overdraft continues to exist in the service area.

In addition to affecting water supplies, ground water overdraft can potentially cause subsidence which compacts the sediments and lowers infiltration capabilities of a ground water aquifer.

4.2.2 Alternative 2

Alternative 2 would increase flood protection to downstream areas and add additional water storage space in the reservoir. Therefore, potential land use

changes associated with this alternative resulting from reduced flooding and additional water storage space were analyzed.

The existing and post-project 100-year flood plains are summarized in Table 4-2. Acres of land removed from the flood plain are those lands that would no longer be subject to inundation by 100-year events under project conditions.

TABLE 4-2
Land Use in Existing and Post-Project 100-Year Flood Plains
(acres)

Land Use	Downstream Area			Tulare Lakebed		
	A	B	A-B=C	D	E	D-E=F
	Existing 100-Year Flood Plain	Post-Project 100-Year Flood Plain	Acres Removed	Existing 100-Year Flood Plain	Post-Project 100-Year Flood Plain	Acres Removed
Riparian	2,288	2,216	72	0	0	0
Grassland	1,797	1,136	661	0	0	0
Oak savanna/ woodland	5,899	5,281	618	0	0	0
Other (disturbed/ flooded)	528	210	318	*	*	1,412[1]
Row crops/ pasture	35,204	20,148	15,056	0	0	0
Orchards/ vines	33,703	20,239	13,464	0	0	0
Cotton	20,540	9,868	10,672	0	0	0
Urban/ commercial	19,255	13,298	5,957	10	10	0
Total	119,214	72,396	46,818	*	*	1,412

*the existing 100-year floodplain contains 15,949 acres inundated for about 71 days, the post-project 100-year floodplain contains 14,360 acres inundated for about 65 days.

[1]1,412 acres represents the acres removed from flooding in the lakebed on a average annual basis from smaller more frequent flood events.

The NED plan would not create any new water for the Kaweah River Basin. However, the increased storage capacity in the reservoir could be used to store additional water for irrigation during the non-flood season. Under existing

Terminus storage conditions, this additional water could eventually be floodwater to the Tulare lakebed. As a result, the enlarged reservoir would reduce downstream flooding and allow increased storage of water. Proper timing and regulation of releases would convert this additional potential floodwater into an irrigation supply.

Implementation of the NED plan would not change the basic operation of the existing water storage project. From May through September, the reservoir would be operated to optimize irrigation water supply. The additional storage space provided by this alternative would allow greater storage of snowmelt during the spring and summer months, which would allow irrigation water releases for a longer period during the irrigation season.

The flow of the Kaweah River would continue to be allocated at the dam to each of the water right holders based on diversion, storage, and water right schedules agreed upon by all water right holders. Allocation of irrigation supply would be based on inflow, as computed by the Corps and measured at the dam.

The University of California Extension Service's concern is that without the project, valuable agricultural lands may go out of production due to the continuous overdraft problem in the area and the associated increase in pumping costs. The additional storage would allow for more efficient use of irrigation water, reducing ground-water pumping by providing surface water longer in the growing season.

Kaweah Reservoir

The NED plan would inundate approximately 243 acres of shoreline around Lake Kaweah. Some existing riparian oak woodland and grassland areas would be inundated, changing these land uses to grasslands that are periodically inundated. Mitigation for these habitats is part of the mitigation plan for this alternative. It is estimated that 6 residences, one motel, and some recreation facilities would also be inundated. However, the residences and relocations would be acquired and the owners compensated.

The area immediately adjacent to the existing gross pool of Lake Kaweah is Federally owned and is protected from private development. All lands within the Terminus Dam/Lake Kaweah area are zoned for the protection of public use of the lake's recreation areas. This would also be the case with this alternative in place. Because there is no incentive to change, land use around the reservoir would not be affected by this alternative.

The primary source of water around the Kaweah Reservoir is ground water. This source is not expected to change with this alternative.

Downstream Area

Operation of the dam and reservoir under Alternative 2 would decrease flows in the downstream distributaries during the spring snowmelt season, reducing the potential for local flooding. This alternative would increase flood protection to the urban areas of Visalia. Elimination of the floodplain in some areas might increase development by individuals because of the removal of the expense of satisfying FEMA requirements. However, any development is subject to strict development guidelines by local agencies and is constrained within designated urban boundaries.

Some of the alfalfa and mixed grassland may be converted to poultry farms, dairies, or feedlots where flood protection is provided. Under current regulations, they are prevented from being located in the 100-year flood plain unless they are elevated above the 100-year flood level.

Changes in natural lands composed of riparian habitat, woodlands, and non-grazed native grasslands are not projected to occur as a result of this alternative. These lands have generally not been developed because of their location, slope, lack of water supply or conveyance system, poor soil type, or value in their native state. Alternative 2 would not change these factors; therefore, natural lands are expected to remain the same with the project.

Several local people were contacted by telephone to obtain their projections for the future of the study area based on increased water storage at Lake Kaweah and reduction in the 100-year flood plain. The names of these individuals and their comments are included in the Land Use appendix of this report. In general, the comments indicated that urban expansion was already proceeding in the existing 100-year flood plain and that reduction of the flood plain would have no significant impact on that development. They also said that there would probably be some conversion of pasture land to dairies or poultry farms in the areas eliminated from the flood plain.

Based on development and zoning information from the city and county general plans, best professional judgment, and local projections, Alternative 2 would have no significant adverse impacts on land use in the downstream area.

Tulare Lakebed

The NED plan would reduce the volume and duration of flooding in the Tulare lakebed, mostly from snowmelt flooding. The area flooded would decrease by 1,412 acres on an average annual basis for smaller more frequent flood events, and the duration of flooding would decrease over existing conditions. However,

the lakebed would continue to receive floodwater from other major streams, including the Kings, Tule, and Kern Rivers, as well as local drainage.

Flooding of the lakebed from the Kings, Tule, and Kern Rivers and local drainages would not change with this alternative. The frequency of major flooding would remain the same; consequently, there would be no incentive to convert limited riparian habitat or grasslands to agricultural lands in the lakebed due to a reduction in flooding. At this time all lands in the lakebed that are suitable for agricultural conversion have been converted.

Therefore, this alternative would not significantly affect land use in the Tulare lakebed.

4.2.3 Alternative 3

Kaweah Reservoir

Under Alternative 3, the locally preferred plan, land use around the reservoir would not change from existing conditions as described for Alternative 2.

Downstream Area

Under Alternative 3, future land use in the downstream area would change as described for Alternative 2. Urban expansion is already occurring in the existing 100-year flood plain and would continue with or without the project.

Tulare Lakebed

Alternative 3 would reduce the volume and duration of flooding in the lakebed as described for Alternative 2. However, the agricultural land uses would not change from existing conditions.

4.2.4 Mitigation

Kaweah Reservoir

Some existing riparian oak woodland and grassland areas would be inundated by the NED plan and the locally preferred plan, changing these land uses to grasslands that are periodically inundated. Mitigation for these habitats through the protection of off-site equivalent habitat is part of the proposed project. Mitigation lands and measures are described more fully in Sections 4.10.3 and 5.7.

The project alternatives would adversely affect land use around Lake Kaweah by inundating approximately 243 acres of shoreline around the reservoir. Six residences, one hotel, and some recreation facilities would be inundated. The residences and relocations would be acquired and the owners compensated.

Downstream Area

Mitigation for land use effects in the downstream area would not be required because there would be no significant adverse effects due to the NED plan or the locally preferred plan.

Tulare Lakebed

Mitigation for land use effects in the Tulare lakebed area would not be required because there would be no significant adverse effects due to the NED plan or the locally preferred plan.

4.3 EFFECTS ON SOCIOECONOMICS

This section evaluates the effects of the project alternatives on the socioeconomic factors in the study area. Significant socioeconomic effects occur when people's lives are affected by a project. These effects can include residential relocations, job losses, land use changes, population, business losses, and changes in public services. However, the alternatives are not expected to increase population, local growth, or remove large quantities of private lands from the tax rolls. As a result, no significant adverse effects on these socioeconomic factors would not be expected, and they are not discussed further in this section.

4.3.1 Alternative 1

The land use analysis indicates that without the proposed project, agricultural lands could be taken out of production due to ground-water overdraft. However, the amount of land taken out of production would be minimal compared to the total agricultural lands in the study area. Consequently, employment in the area would not be significantly affected without the project.

4.3.2 Alternative 2

With Alternative 2, impacts to socioeconomic conditions would include the relocation of homes and businesses within the project area. These effects would be considered long-term and would affect the individuals living in the homes and working at any businesses.

Kaweah Reservoir

Within the reservoir area, there are residential properties that would be affected by this alternative. Some homes would have to be relocated because the water level at Lake Kaweah would be higher and the properties would be within the new flowage easements. Public Law 91-646 and Public Law 100-17 requires that the individuals being relocated because of a Federal project be fully compensated for their losses. The people who live within the new flowage easements would fall under these laws and would thus be compensated by the Corps or the non-Federal sponsor. These people include not only property owners but also tenants. These laws provide for relocation assistance benefits and possibly severance damages. It is estimated that 6 homes would need to be relocated.

One motel would be adversely affected by the NED plan. This hotel is one of only two hotels in the area and would either be relocated or closed permanently. Employees of the hotel would lose their hotel-related employment if the hotel is closed. However, other employment opportunities may exist in and around the area. The construction of the project would generate approximately 30 jobs in the project area over a 3-year period. These jobs would employ people who live in the project area and would otherwise be unemployed.

Downstream Area

There would be no changes in the socioeconomic conditions in the downstream area; therefore, no adverse effects would occur due to this alternative.

Tulare Lakebed

Because no major changes would occur to the socioeconomic conditions in the Tulare Lakebed area, there would be no adverse effects due to this alternative.

4.3.3 Alternative 3

Kaweah Reservoir

Under Alternative 3, the locally preferred plan, socioeconomic conditions for the reservoir area would be affected as described for Alternative 2.

Downstream Area

There would be no changes in the socioeconomic conditions in the downstream area; therefore, no adverse effects would occur due to this alternative.

Tulare Lakebed

Because no major changes would occur to the socioeconomic conditions in the Tulare lakebed area, there would be no adverse effects due to this alternative.

4.3.4 Mitigation

Kaweah Reservoir

Mitigation for Alternatives 2 and 3 in the Kaweah Reservoir area would include compensation to any land owners and tenants for the loss of their property and homes. These losses would include several homes and one hotel. Currently, there is an inadequate supply of commercial motel units available in the area to replace the loss of units. It is not known at this time if all the residences could be replaced. The owners and tenants would be fully compensated under Public Law 91-646 and Public Law 100-17. No other mitigation for socioeconomic effects of the project alternatives would be required.

Downstream Area

Mitigation for socioeconomic effects in the downstream area would not be required with the project alternatives because there would be no significant adverse effects due to the proposed project.

Tulare Lakebed

Mitigation for socioeconomic effects in the Tulare Lakebed area would not be required because there would be no significant adverse effects due to the project alternatives.

4.4 EFFECTS ON RECREATION

This section describes the effects of the project alternatives on the recreational facilities and use of the three areas. A detailed analysis of the recreation benefits and costs associated with the project alternatives is included in Appendix E.

4.4.1 Alternative 1

Kaweah Reservoir

The no-action alternative assumes that no Federal action would take place and the reservoir pool behind Terminus Dam would remain at its present size. Recreation would continue to be a primary feature of Lake Kaweah. In recent years, Lake Kaweah has experienced an average of 570,000 annual recreation visits. No new recreation developments are proposed in the nearby area to draw visitors away from the reservoir. The new parking lot that was completed at Lemon Hill in April 1996 allows for greater visitation. However, the anticipated increase in future attendance due to the greater parking capacity at Lemon Hill is independent of whether or not this proposed Federal action takes place. In other words, the likely increase in visitation at Lemon Hill under the no-action alternative would be the same as the likely increase in visitation at Lemon Hill with the proposed project alternatives. The project alternatives include raising the spillway and gross pool level and modifying the existing four-lane boat ramp. Without the ramp extension, potential recreation visitation losses of at least 50 percent could occur at Lemon Hill during inundation periods above 700 feet, m.s.l.

Previously, the sediment space plus space allowed by the precipitation parameters of the current flood control diagram has served as the inactive pool in the reservoir. However, after the sediment space is full, the space allowed by the precipitation parameters would gradually fill in (about 50 years). The reservoir could be emptied each year for flood control purposes.

Downstream Area

The no-action alternative would have no significant effects on recreation facilities in this area.

Tulare Lakebed

The no-action alternative would have no significant effects on recreation facilities in this area.

4.4.2 Alternative 2

Kaweah Reservoir

The raising of the gross pool level by 21 feet would periodically inundate 243 acres along the perimeter of the reservoir at the height of the primary recreation season, and add 216 surface acres of water.

Existing recreation facilities at the reservoir are divided into four major areas: Lemon Hill, Kaweah, Horse Creek, and Slick Rock (see Figure 3-1). Many of the facilities would be flooded under Alternative 2. However, no non-Federal sponsor was initially willing to cost share in the studying of a recreation plan to relocate these existing facilities. The Corps would relocate vault toilets and the county boat patrol building to adjacent areas above 715 feet, m.s.l. Since the vault toilets and boat patrol building are considered basic minimum facilities, relocation would be part of standard construction activity. The boat ramp at Lemon Hill would also be extended to remain above the new gross pool elevation, thus serving as a basic minimum facility to continue monitoring and patrolling of the reservoir. In addition, other recreation facilities, including roads, remaining launch ramps, parking areas, camping sites, and picnic areas, would be reconditioned by the Corps after each flood event.

At Lemon Hill, the existing four-lane boat launching ramp becomes mostly inaccessible at an elevation of 700 feet. However, park personnel and Corps staff believe that due to the existing slope of the road approaching the ramp, the ramp can be easily modified to ensure that boats can be launched from all four lanes. Without the ramp extension, proper monitoring and patrolling of the reservoir would not be possible. In addition, potential recreation visitation losses of at least 50 percent could occur during inundation periods above 700 feet, m.s.l. By extending the ramp approximately 175 feet upslope, and widening 50 to 70 feet, monitoring and patrolling could be done, and no change in visitation would occur at Lemon Hill. (The inundation of the marina electrical system would require relocation, and this would be a project cost. No determination of potential recreation losses associated with inundation of the electrical system and/or its relocation has been made.)

A water surface level of 700 feet, m.s.l., would inundate almost all recreation facilities and parking at the Kaweah Recreation Area. Picnic facilities (shade shelters and tables) and the boat launching ramp would be unusable. It is estimated that visitation losses of 75 percent would occur at Kaweah during flood events of over 700 feet, m.s.l.

At Horse Creek, the main campground at the reservoir, 40 to 60 camp sites would be inundated if the gross pool level is raised by more than 6 feet. Each camp site consists of a fire ring, table, and parking slot. One "tot lot" play area and the entrance station would also be inundated. The relocation of the State Highway 198 bridge over Horse Creek would affect recreation since the proposed construction staging area is also used as a parking lot for many recreation activities. It is estimated that visitation losses of 75 percent would occur at Horse Creek during flood events of over 700 feet, m.s.l.

The future of winter carryover water in the reservoir would be similar to that described for Alternative 1. Conditional space would be available in the reservoir for 7,000 acre-feet each winter depending on rainfall conditions. A water surface level of 700 feet, m.s.l., would inundate almost all parking at the Slick Rock area. It is estimated that visitation losses of 75 percent would occur at Slick Rock during flood events of over 700 feet, m.s.l. Above Slick Rock, an 11-mile reach of reservoir/river is rafted from April to August. There are 20 to 25 rapids and two "take-out" points (Kaweah Park Resort and Slick Rock) in this 11-mile reach. Between these two points, the two rapids are the "Channel or Jungle Run" (Class III) and "Holiday Falls" (Class IV). Currently, "Holiday Falls" is partially inundated when the reservoir is at gross pool (about once every 3 years). Alternative 2 would increase inundation upstream of the existing reservoir about 2,325 linear feet. This would likely completely inundate the "Holiday Falls" rapid when the reservoir is at gross pool. As the water level in the reservoir recedes, however, the rapid will become usable.

Downstream Area

Alternative 2 would have no significant effects on recreation in this area.

Tulare Lakebed

Alternative 2 would have no significant effects on recreation in this area.

4.4.3 Alternative 3

Kaweah Reservoir

Alternative 3 consists of raising and widening the spillway at Terminus Dam as described for Alternative 2. The structural components of the two alternatives are the same. However, Alternative 3 also changes the water control diagram and basin wetness parameter for Lake Kaweah. The effects from implementation of Alternative 3 would be similar to the effects from Alternative 2.

Alternative 3 would modify the current water control diagram and basin wetness parameter to allow the conditional storage of up to 12,000 acre-feet of water during the rainflond season. The basin wetness parameter would be a permanent addition to the water control diagram and would never be changed. The additional water would likely benefit those recreationists who boat and fish during the winter months. Analysis of past recreation use statistics show that regardless of the amount of water in Lake Kaweah during the winter months, recreation use remains fairly constant. Thus, the additional water provided during the winter months by implementation of Alternative 3 does not result in

measurable increases in recreation benefits as compared to the No-Action Alternative or Alternative 2.

Downstream Area

Alternative 2 would have no significant effects on recreation in this area.

Tulare Lakebed

Alternative 2 would have no significant effects on recreation in this area.

4.4.4 Mitigation

Kaweah Reservoir

As part of standard construction activity, the Corps would relocate two restrooms and extend the boat ramp at Lemon Hill. Other recreation facilities, including roads, remaining launch ramps, parking areas, camping sites, and picnic areas, would be reconditioned by the Corps after each flood event. Since there is not non-Federal sponsor willing to cost share in additional recreational development at the reservoir, no mitigation measures would be necessary.

Downstream Area

Since no effects on recreation are anticipated due the project alternatives, no mitigation would be necessary.

Tulare Lakebed

Since no effects on recreation are anticipated due to the project alternatives, no mitigation would be necessary.

4.5 EFFECTS ON HAZARDOUS, TOXIC, AND RADIOLOGICAL WASTE

This section described the effects of the project alternatives on hazardous, toxic, and radiological waste sites in the study area.

4.5.1 Alternative 1

Under this alternative, no Federal action would occur within the project area. Therefore, no additional effects on HTRW would be expected. Current monitoring and remediation efforts at identified HTRW sites, such as the LUFT sites at the

Kaweah Recreation Area and Pat O'Connell's Service Station in Three Rivers, would continue.

4.5.2 Alternative 2

The Environmental Site Assessment identified both known and potential HTRW contamination within the Lake Kaweah assessment area and the project may potentially affect these HTRW sites. The elevated lake level associated with this alternative would flood both the fisheries facility and the livestock corral located on the north shore of Lake Kaweah. It should be noted, however, that the fisheries facility is designed for inundation and currently is flooded on an annual basis. It also is likely that substantial portions of the Horse Creek Recreation Area, including several restroom facilities, would be inundated. Although sewage from these facilities is pumped uphill for treatment, if the distribution system is not water tight, leakage may result in the contamination of soil and ground and surface waters. It is likely that dispersal of the plume associated with the LUFT site at the Kaweah Recreation Area would be accelerated under this alternative. Contamination of the lake is possible if the LUFT site is not remediated thoroughly prior to project construction or before the level of the lake is raised. It is possible that dispersal of the plume associated with the LUFT site in Three Rivers also would be accelerated if ground-water levels in the area are elevated significantly due to raising the spillway 21 feet.

In addition, if ground-water levels are raised sufficiently by this alternative, septic systems used by residences at the east end of Lake Kaweah and in Three Rivers might be flooded, resulting in the contamination of ground and possibly surface waters in the area.

As presented in section 4.10.3 of this document, raising the elevation of the spillway 21 feet would require mitigation to replace lost wildlife habitat values. As part of the HTRW review provided by DWR, known and potential HTRW sites on the two proposed mitigation properties were evaluated. These mitigation sites are called the Lindsay Strathmore Irrigation District (LSID) site and the Tulare Lakebed site and are located in Tulare and Kings County, respectively. The methods and tools used to identify HTRW concerns on the mitigation properties were the same as those used to identify HTRW sites in and adjacent to the Lake Kaweah assessment area (see section 3.3.4). During the preparation of the Environmental Site Assessment, DWR identified several known and potential HTRW sites on the mitigation properties.

Lindsay Strathmore Irrigation District Mitigation Site

The LSID site currently supports native and non-native vegetation. Riparian vegetation borders the Kaweah River, while valley oaks are scattered across the remainder of the site. The site currently is used for cattle grazing. No homes or buildings have existed on the property since 1956 according to aerial photographs taken in 1956, 1970, 1978, 1985, and 1993 as part of DWR's crop survey program. A few, small dirt roads were visible in 1978 photographs of the property, but these roads faded in subsequent years. The roads appear to have been associated with a storage area located near the center of the site, and Mr. Dennis Keller, a consulting engineer with LSID, said this area was used to store hay for cattle fodder during the drought of 1978. In addition, 1970 photographs revealed an area of soil disturbance near the south-central portion of the property. Mr. Keller attributed this soil disturbance to berry bush removal operations. Another possible area of disturbance near the northern edge of the site was faintly visible in the 1956 photos. The locations of trees and irrigation ditches have changed little from 1956 to 1993.

A review of DWR well records and ground-water contour maps published by DWR's San Joaquin District for the springs of 1961, 1962, 1964, 1976, 1979, 1984, and 1993 indicated that the depth to ground water in the vicinity of the LSID property varies from 7 feet to 26 feet. Depth to ground water typically is greater in the fall than in the spring, and the direction of flow is generally toward the southwest. Ground water near the mitigation site is deeper than the bed of the Kaweah River, resulting in water flowing from the river into subterranean aquifers and away from the river. According to DWR ground-water quality records, the quality of ground water in the vicinity of the mitigation property is generally good. Samples collected from a well 1.5 miles south of the site, however, indicated nitrate concentrations are slightly elevated, although still below the maximum contaminant level established for drinking water. In addition, concentrations of dibromo-chloropropane (DBCP), which is an agriculturally used pesticide, were found to exceed maximum contaminant levels. These results indicate the use of fertilizers and pesticides have adversely affected ground water in the area.

According to records obtained from the Tulare County Environmental Health Department, three underground storage tank sites were identified within 1 mile of the LSID site. According to Mr. Gary Gaglioli of the Tulare County Environmental Health Department, however, there are no known environmental concerns related to any of these tanks.

A sampling and analysis program for organochlorine pesticides, such as DDT and its derivatives, was conducted on agricultural properties in Tulare County by the California Department of Food and Agriculture (California Department of Food

and Agriculture, 1985). Four samples analyzed from Tulare County yielded measurable concentrations of DDT-based derivatives, although recorded concentrations were below established limits for classification of DDT-contaminated soils as a hazardous waste under California regulations. The possibility remains, however, that greater concentrations of DDT-derived substances may be present at localized sites on the mitigation property.

A site reconnaissance of the LSID mitigation property was conducted on May 22, 1995. Mr. Dennis Keller, a consulting engineer for LSID, indicated that the LSID site has been used primarily for livestock grazing since the 1930's and the property had not been used for residential or commercial purposes during this time. Close examination in the vicinity of a small grove of eucalyptus and palm trees growing in the south-central portion of the site revealed no evidence of previous structures or other signs of human habitation.

During the 1930's, ground water was extracted briefly from the site, and the extraction wells still exist on the property. The six large wells are in poor condition, and three of the wells are sufficiently uncovered to allow animals or small children to fall into them. All of the wells are susceptible to contamination from floodwater. Depth to water in the wells was approximately 9 feet at the time of the site visit.

Tulare Lakebed Mitigation Site

The Tulare Lakebed mitigation site currently supports an intensive, agricultural operation. No homes or other buildings have existed on the property since 1957 according to aerial photos taken in 1957, 1973, 1981, 1988, and 1991 as part of DWR's crop survey program. With the exception of a small area in the northeast corner of the property, aerial photos indicate the site was not cultivated prior to 1973. From 1973 through 1991, however, the entire property appears to have been in agricultural production. In addition, 1957 photographs and the USGS topographic map indicate that a canal once crossed the property in an east-west direction. This canal is missing from subsequent photographs.

A review of DWR well records and ground-water contour maps published by DWR's San Joaquin District for the springs of 1961, 1962, 1964, 1976, 1979, 1984, and 1993 indicated that the depth to ground water in the vicinity of the Tulare Lakebed site varies from about 22 feet to 145 feet. No seasonal trends in depth to ground water were apparent, and the direction of flow is generally toward the east. Water samples collected from a well approximately 1 mile north of the mitigation site indicated water quality in the area is good. No maximum contaminant levels established for drinking water were exceeded, and no pesticides, herbicides, or other organic compounds were detected during testing.

A review of oil and gas well locations as shown in the Munger Oil and Gas Map Book, page W-40, identified two wells within one-half mile of the Tulare Lakebed site. One well is located to the east and the other to the southeast of the property. These two wells were documented by the Division of Oil and Gas as having been properly abandoned.

A sampling and analysis program for organochlorine pesticides, such as DDT and its derivatives, was conducted on agricultural properties in Kings County by the California Department of Food and Agriculture (California Department of Food and Agriculture, 1985). Two samples analyzed from Kings County yielded measurable concentrations of DDT-based derivatives, although recorded concentrations were below established limits for classification of DDT-contaminated soils as a hazardous waste under California regulations. The possibility remains, however, that greater concentrations of DDT-derived substances may be present at localized sites on the mitigation property.

A site reconnaissance of the Tulare Lakebed mitigation property was conducted on May 19, 1995. Although nearly the entire site is planted in alfalfa, a small area (approximately 50 feet by 50 feet) in the extreme northeast corner of the property is littered with broken cement, aggregate, and asphalt, indicating the corner may have been occupied previously by some type of structure. Additionally, a few small oil stains are present on the soil at this site, as well as a pile of one-quarter inch diameter steel pipe. This type of pipe typically is used as "air line" in wells, suggesting there may have been a well at this site at one time. A check of DWR well records, however, did not show a well at this site.

Three wells currently exist on the Tulare Lakebed mitigation property. One well, which is powered by an electric motor, is located approximately one-quarter mile west of State Highway 43 and south of Lansing Avenue between the road and the ditch. Minor oil stains are present on the soil around the well motor. Two other wells exist west of State Highway 43 between the road and the ditch; one is 0.25 mile south of Lansing Avenue, and the other is 0.5 mile south of Lansing Avenue. These two wells are powered by diesel engines and have significant areas of discolored soil around the engines, indicating spilled fuel or oil.

4.5.3 Alternative 3

Under Alternative 3, HTRW resources would be affected as described in Alternative 2.

4.5.4 Mitigation

Kaweah Reservoir

After consultation with applicable Federal and State regulatory agencies, HTRW sites affected by the NED plan and the locally preferred plan, including those on sites used to mitigate the loss of wildlife habitat values, must be remediated. Response actions must be acceptable to the U.S. Environmental Protection Agency and applicable state regulatory agencies, such as the California Environmental Protection Agency and the Regional Water Quality Control Board. For cost-shared projects (such as this one), the non-Federal sponsor is responsible for ensuring that the development and execution of Federal, State, and/or locally required HTRW response actions are accomplished at 100 percent non-project cost. Further investigations would be conducted and remediation plans would be developed in the preconstruction, engineering, and design phase of the project.

Downstream Area

Remediation for any HTRW sites affected by the NED plan or the locally preferred plan would be accomplished as described in the Kaweah Reservoir section.

Tulare Lakebed

Remediation for any HTRW sites affected by the NED plan or the locally preferred plan would be accomplished as described in the Kaweah Reservoir section.

4.6 EFFECTS ON TRANSPORTATION

This section evaluates the effects of the project alternatives on transportation systems and conditions in the study area. Potential effects on transportation and traffic in the study area due to project alternatives were analyzed by identifying LOS for the roadways in the study area and existing average daily traffic volumes for major transportation routes. Projected average daily traffic volumes without the project were then compared with predicted average daily traffic volumes with the project.

For planning purposes, traffic volumes are quantified in the form of number of vehicles on the roadway to the number of lanes in the roadway. These numbers, called V/C ratios, are in turn translated into LOS ratings (Table 4-3). V/C ratios of 60 percent or less are designated LOS "A"; 60 to 70 percent is considered LOS "B"; 70 to 80 percent is LOS "C"; 80 to 90 percent is LOS "D";

and 90 percent or greater is LOS "E/F". Ratios of 80 percent or more (LOS "D" or worse) are considered to reflect significant congestion.

To determine if project-generated traffic and transportation effects would be significant, three significance criteria were used: (1) predicted change in roadway level of service, (2) safety considerations, and (3) roadway transportation index (TI) rating.

TABLE 4-3
Relationship of Peak-Hour Traffic to Levels of Service for Surface Streets
(Source: Highway Capacity Manual, 1985)

Roadway	Level of Service A	Level of Service B	Level of Service C	Level of Service D	Level of Service E/F
Two lanes	0-9,150	9,151-10,500	10,501-12,000	12,001-13,500	13,501-15,000
Four lanes	0-18,300	18,301-21,000	21,001-24,000	24,001-27,000	27,001-30,000
Six lanes	0-27,000	27,001-31,500	31,501-36,000	36,001-40,500	40,501-45,000

According to CEQA, Appendix G (1), "A project will normally have a significant effect if it causes an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system." To apply this significance criteria, the type and amount of project-generated traffic was estimated. Existing and project-added volume-to-capacity ratios were then calculated and the level of service was determined.

Caltrans 1993 traffic volumes and the Tulare County Association of Governments/Transportation Planning Agency provided existing average daily traffic volumes and projected average daily traffic volumes for the major transportation routes in the study area. This information is shown in Table 4-4.

Transportation effects were considered significant if project-added traffic volumes would contribute to or degrade any existing peak-hour traffic volumes.

Safety issues were assessed based on the traveled roadway width, size of project vehicles, potential impacts of large slow-moving vehicles and adequacy of

TABLE 4-4
Level of Service on Critical Roadways in the Study Area

Roadway	# of Lanes	Location	Existing		Future With Project		Future Without Project	
			DTV[1]	LOS[2]	DTV	LOS	DTV	LOS
SR 63	4	Ave. 232 - 264	14,300	A	34,900	F	34,900	F
SR 63	4	Ave. 264 - SR 198	24,202	D	52,400	F	52,400	F
SR 63	4	Ave. 304 - 328	8,800	A	18,143	A	18,143	A
SR 63	2	Ave. 328 - 384	5,350	A	12,917	D	12,917	D
SR 65	2	Carins Corner - 198	7,130	A	11,397	C	11,397	C
SR 99	4/6	Tulare to Traver	31,875	C	86,160	F	86,160	F
SR 198	4	SR 99 - SR 63	22,850	C	49,300	F	49,300	F
SR 198	4	SR 63 - J15	39,000	F	44,100	F	44,100	F
SR 198	4	J15 - J23	22,670	C	NA	-	NA	-
SR 198	4	J23 - SR 65	14,250	A	NA	-	NA	-
SR 198	2	SR 65 - Kaweah Marina	4,925	A	NA	-	NA	-
SR 198	2/4	Kaweah Marina - Three Rivers	13,840	A	NA	-	NA	-
SR 216	2	SR 198 - SR 63	4,870	A	9,270	B	9,270	B
SR 245	2	SR 198 - Woodlake	5,240	A	2,745	A	2,745	A
J15	2	Ave. 352 - 384	2,350	A	3,669	A	3,669	A
J15	2	Ave. 320 - 328	5,700	A	3,412	A	3,412	A
J15	2	Ave. 208 - 240	3,330	A	5,489	A	5,489	A
J15	2	Ave. 240 - 256	6,800	A	7,380	A	7,380	A
J27	2	Ave. 19 - 332	4,050	A	5,540	A	5,540	A
Avenue 304	4	Road 72 - 80	5,300	A	14,303	A	14,303	A
J34	2	Ave. 80 - SR 63	4,100	A	4,960	A	4,960	A
J34	2	SR 63 - SR 65	4,630	A	9,450	B	9,450	B

[1]DTV - Daily Traffic Volume
[2]LOS - Level of Service

line of sight. In instances where project traffic could create a substantial safety risk, impacts were considered significant.

Roadway traffic index rating effects, or the potential for damage to roadway surfaces resulting from the operation of heavy equipment, were assessed based on whether or not the weight of the project vehicles could exceed roadbed design standards. Potential effects to road surfaces were considered significant.

4.6.1 Alternative 1

With this alternative, no federal action would be undertaken to modify the existing spillway at Lake Kaweah.

Kaweah Reservoir

Traffic volumes and LOS on the section of SR 198 which borders Lake Kaweah would not change in the future under the no-action alternative. The existing LOS is "A" and is expected to remain so.

Downstream Area

Traffic volumes and LOS would change under the no-action alternative as indicated in Table 4-4. Significant congestion over existing conditions would be realized in the future with the no-action alternative. Four roadways would change to a LOS rating of F as depicted on Table 4-4 while one roadway would change to a D and one to a C rating.

Tulare Lakebed

Traffic volumes and LOS would not change under the no-action alternative.

4.6.2 Alternative 2

Construction-related impacts would be insignificant because the activity would be temporary and of short duration. Work on the project alternatives would require two construction seasons. Oversized vehicles would transport materials throughout the region, and workers would commute to the site via SR 198.

Kaweah Reservoir

Project construction would take place in two main areas – at the spillway and at Horse Creek Bridge.

At the spillway, a concrete ogee section would be placed over the existing concrete broad-crested sill. The spillway would be widened from the existing 305.5 feet to 455 feet. Rock excavation would be required at the left and right abutments, with the majority of the excavation taking place on the left abutment.

Due to the proposed raise in gross pool elevation of Lake Kaweah, SR 198 and Horse Creek Bridge would be relocated. The existing Horse Creek Bridge is a steel super structure with concrete piers and abutments. The existing bridge is about 250 feet in length and 34 feet in width, and existing piers are about 77.5 feet in height. Presently, the lowest structural chord elevation of the bridge is 711.4 feet m.s.l. Current American Association of State Highway and Traffic Officials requirements are that the bridge must pass the 100-year-event flood stage. In order to maintain a 1-foot freeboard for the low structural chord, the bridge would have to be raised a minimum of 11.7 feet for an increase in gross pool elevation of 21 feet.

The bridge would have to be reconstructed, since the existing bridge alignment is curved in both the horizontal and vertical direction and is skewed on the cross section. The new bridge would be located immediately upstream of the existing bridge (within 500 feet). SR 198 approaches, both upstream and downstream, would be relocated for a distance of approximately 1,500 feet in each direction. The design sections of the relocated bridge and SR 198 would meet current State and Federal highway requirements and would be comparable to the existing structures. The bridge replacement would not improve traffic volumes or the LOS (which is currently "A").

Construction of the project alternatives would require two construction seasons. The first season would commence in April and would extend through November. This season would involve relocation and construction of the Horse Creek Bridge. The second construction season would begin the following March and would continue through November. Raising and enlarging the spillway would occur during the second construction season.

The equipment operating schedule for both construction seasons would consist of nine-hour workdays within a five-day workweek. During the summer months (June through August), construction would start at 6 a.m. and end at 4:30 p.m. During the remaining months, construction would start at 7 a.m. and end at 5 p.m.

The primary impact of this project on traffic flow would be related to construction delays resulting from trucks slowing to turn onto the project access road and the detour caused by reconstruction of Horse Creek Bridge. The decrease in speed would cause a back-up of other vehicles behind the trucks or waiting to

cross the bridge with limited capacity. This is considered a significant direct impact.

During relocation and construction of the Horse Creek Bridge, equipment would be used at the project site for approximately 71 equipment hours per day. This equates to about 9 equipment vehicles on the roadway and 20 worker vehicles. During construction of the spillway, about 358 equipment hours per day would be used. This equates to about 35 pieces of equipment delivered to the site and about 10 pieces of equipment traveling on SR 198 daily. In addition, there would be about 80 worker vehicles traveling on SR 198 daily.

Construction of the bridge would take place during the summer months when traffic volumes are the highest due to recreation use in the area. Travelers would be affected by the movement of construction materials and workers. However, the effects would be short-term and would not significantly contribute to or degrade existing peak-hour traffic volumes. The work would not take place on weekends when traffic volumes are the highest.

The greatest safety concern would be the disruption to existing traffic circulation resulting from reconstruction of the Horse Creek Bridge. The existing highway approaches and bridge would be used as the new bridge and approaches were constructed.

The proposed construction area is limited, so extensive construction traffic control would be required in order for construction equipment to maneuver in the area. Temporary barriers and markings would be erected, existing speed limits would be drastically reduced in the area of construction, and flag-persons would be used to control all vehicles.

The existing traffic index is adequate to accommodate heavy equipment in limited numbers. The anticipated number of pieces of equipment that would be required to complete both seasons of construction is not great enough to cause damage to pavement surfaces.

Downstream Area

Effects on traffic volume, traffic safety and road surface quality in the downstream area would be minimal. The impacts of an additional 29 or 90 vehicles on the LOS for SR 198 would be insignificant. The LOS for SR 198 from SR 99 through Visalia to the project sites at Lake Kaweah currently range from "A" to "F". These LOS would not change as a result of project-generated traffic.

It is not expected that existing land use in the study area would change as a result of the project. The City of Visalia is experiencing growth under existing conditions and the effect of the project on regional traffic and associated impacts would be minimal. Growth would proceed as anticipated under California Department of Finance population projections and adopted local plans.

Tulare Lakebed

No adverse effects on traffic volume, traffic safety or road surface quality in the Tulare lakebed would result from this alternative.

4.6.3 Alternative 3

Kaweah Reservoir

Under Alternative 3, project effects to transportation resources would be as described for Alternative 2.

Downstream Area

Project effects on traffic, volume, traffic safety, and road surface quality in the downstream area due to this alternative would be minimal as described in Alternative 2.

Tulare Lakebed

No adverse effects on traffic volume, traffic safety, or road surface quality in the Tulare lakebed would result from this alternative.

4.6.4 Mitigation

The primary effect of the NED plan or the locally preferred plan on traffic flow would be related to delays resulting from trucks slowing to turn onto the project access road and the detour caused by reconstruction of Horse Creek Bridge. The decrease in speed would cause a back-up of other vehicles behind the trucks or waiting to cross the bridge with limited capacity. This is considered a significant direct impact.

Kaweah Reservoir

The greatest disruption to existing traffic circulation would occur as a result of reconstruction of the Horse Creek Bridge. Temporary barriers and markings would be erected, existing speed limits would be drastically reduced in the area of

construction, and flag-persons would be used to control all vehicles. In addition, the existing highway approaches and bridge would continue to be used as the new bridge and approaches were constructed.

Downstream Area

Mitigation for traffic impacts in the downstream area would not be required because there would be no effects resulting from project-generated traffic in this area.

Tulare Lakebed

Mitigation for traffic impacts in the Tulare lakebed would not be required because there would be no effects resulting from project-generated traffic in this area.

4.7 EFFECTS ON NOISE

Analytical noise modeling techniques, in conjunction with actual field noise level measurements, were used to develop generalized L_{dn} contours for major sources of noise within Tulare County and its incorporated cities for existing and future conditions.

Analytical noise modeling techniques 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/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.

Noise exposure contours for major sources of noise within the incorporated and unincorporated areas of Tulare County were examined for use in this report. The conclusions of those analyses are presented below.

A particular noise impact should be considered significant based upon comparisons with applicable State and local noise-level standards and recognized public health criteria. Local noise-level criteria which may be applied to the project are the adopted policies and recommended standards of the updated Noise Elements for Tulare County (1988) and Kings County (1993). The Noise Elements

contain policies and noise-level criteria which are consistent with current State requirements and noise-level descriptors.

All respective noise elements cite 60 dBA L_{dn} as the established daytime noise standard. Short-term construction-generated noise is normally exempt from these noise standards. Nevertheless, potential noise effects of the project were evaluated. For the purposes of this report, effects are considered significant if project-generated noise levels would exceed the adopted noise standards of Kings and Tulare Counties.

4.7.1 Alternative 1

There would be no adverse direct or indirect noise effects with the no-action alternative. Noise levels would remain as those described under existing conditions.

4.7.2 Alternative 2

The direct noise effects of the NED plan would be limited to short-term construction impacts. Noise sources associated with construction are exempt from noise standards, provided such activities do not take place before 6 a.m. or after 9 p.m. on any day except Saturday or Sunday, or before 7 a.m. or after 5 p.m. on Saturday or Sunday. Long-term operation of the proposed project would not affect noise levels in the project area. Since there would be no significant land use changes associated with the project, no indirect noise effects have been identified.

Kaweah Reservoir

Noise would be generated by heavy equipment operating during construction work, which would be taking place in two main areas – at the spillway and at Horse Creek Bridge. Construction of the project would require two construction seasons. The first season would start in April 1999 and would extend through November 1999. This season would involve the relocation and construction of the Horse Creek Bridge. The second construction season would begin in March 2000 and would continue through November 2000. Raising and enlarging the spillway would occur during the second construction season.

The equipment operating schedule for both construction seasons would consist of nine-hour workdays within a five-day work week. During the summer months (June through August) construction would start at 6 a.m. and end at 3 p.m. During the remaining months, construction would start at 7 a.m. and end at 4 p.m. These hours are consistent with the noise standards for construction discussed above.

During relocation and construction of the Horse Creek Bridge, equipment would be used at the project site about 71 equipment hours per day. During construction of the spillway, about 358 equipment hours per day would be used.

Noise from construction activities would dominate the noise environment in the immediate area. The temporary construction noise impacts vary depending on the type of equipment being used. Earth-moving equipment noise typically ranges from about 70 to 95 dBA at 50 feet from the source and drops to below 60 dBA by about 300 feet from the source. Equipment to be used during construction and hours of operation are identified in Table 4-5. Figure 4-1 depicts equipment noise levels at 50 feet from the source.

Residences are greater than 300 feet from both construction sites and are not likely to experience dBAs above 60 due to project construction. The nearest residential areas to the construction sites are the City of Woodlake, approximately 5 miles downstream, and Three Rivers, approximately 6 air miles upstream. The closest individual residences to each of the construction sites are approximately one-half mile away. Therefore, there will not be any significant adverse noise effects as a result of project construction.

Downstream Area

Construction noise would be generated by increased traffic on area roads. Truck traffic associated with transporting heavy materials and equipment would be the most significant project-generated mobile noise source. Because this increase would be of short duration and primarily limited to daytime hours, and because the majority of haul routes follow heavily traveled roadways with existing elevated traffic noise levels, effects would be considered short-term adverse but less than significant.

Tulare Lakebed

No construction associated with the project would occur in the Tulare lakebed. Therefore, no adverse effects to noise in the Tulare lakebed would result from the proposed project.

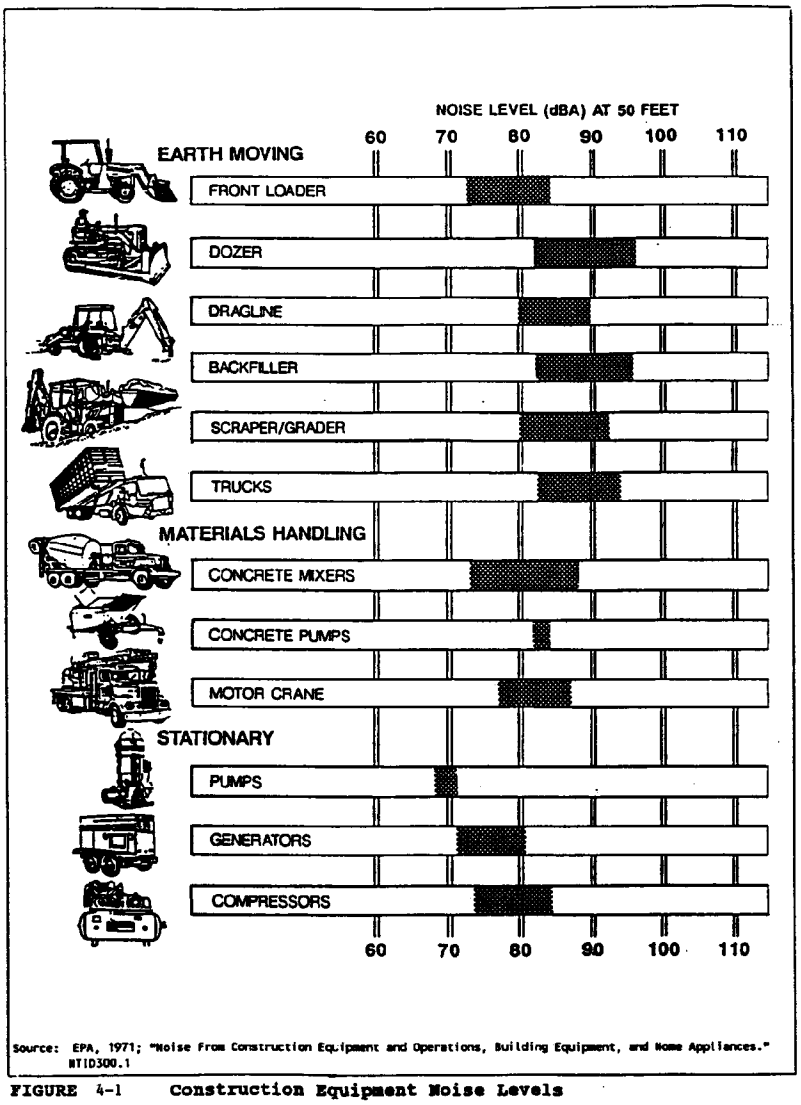
4.7.3 Alternative 3

Kaweah Reservoir

Under Alternative 3, project-related noise effects would be as described for Alternative 2.

TABLE 4-5
Equipment to Be Used During Construction

EQUIPMENT DESCRIPTION	TOTAL HOURS
AIR COMPR, 185 CFM, 100 PSI	332
AIR COMPR, 250 CFM, 100 PSI	742
AIR COMPR, 375 CFM, 100 PSI	81
AIR COMPR, 750 CFM, 100 PSI	468
PAVING BREAKER, 86 LB (ADD COMP)	162
AIR HOSE, 1", 50', HARDROCK	906
ASPHALT FIN, 10' SPW, PNEUM	42
ASPHALT FIN, 5'-12' SPW, PNEUM	48
SWEEPER, 7", ADD TRACTOR, W/SPRINK	42
CHIPPER, 16" CAPACITY, TRLR-MID	287
COMPACTOR, VIBROPLATE, 22.8"	2
CONC PUMP, 117 CY/HR, 75' BOOM, TRK	11
CONCRETE VIBRATOR, 2.5"	22
CONCRETE VIBRATOR, 6.0"	1622
CRANE, HYD, SELF, 22 TON	65
CRANE, HYD, TRKMTD, 60T W/110' BOOM	1965
CR, ME, CWLR, LIFTING, 65T W/180' BOOM	260
CRANE, TOWER, SK400 18500	320
DRILL, AIR TRACK, 2.5-4" DIAM, 12' FD	412
DRILL, R-BLSTH, 6¾"-9$\frac{7}{8}$", TRK	136
GRADER, MOTOR, CAT12-G, ARCTIC	231
HYD EXCAV, CRWLR, 1.4 CY BKT	4
HYD EXCAV, CRWLR, 2.35 CY BKT	7378
HYD EXCAV, CRWLR, 1.5 CY BKT	287
PAVING STRIPER (INCLUDING TRUCK)	12
LDR, FE, CRWLR, 3.75 CY, 973	289
LDR, FE, WH, 4 CY, ARCTIC, 966-E	7540
LDR, W/BH, WH, 1.0 CY FE BKT/24" DIP	1023
LDR, W/BH, WH, 1.5 CY FE BKT/30" DIP	292
HYDRA-PAK TAMPER, 21" W, 30" L, 27" H	7392
TRK, HWY, LINE TRK W/AERIAL PLATFM	31
RIPPER, SING-SHNK BEAM, HYD, D-8	32
RIPPER, MULTI-SHANK BEAM, HYD, D-8	7128
ROLLER, STATIC, SELF, 15 T, 11 TIRE	42
ROLLER, SM-DR, SELF, 12 T, 3 WHL, 3" OVL	83
BLADE, STRAIGHT, HYDR, FOR D-8	7200
DOZER, CWLR, CT D-8N (ADD BLADE)	14168
DOZER, WH, 824C W/STRAIGHT BLADE	2
DOZER, WH, 280C W/STRAIGHT BLADE	64
TRUCK OPT, REAR DUMP BODY, 8 CY	1280
TRUCK OPT, REAR DUMP BODY, 12 CY	18
TRUCK OPT, FLATBED, 8' x 9'	1115
TRK TRLR, END DUMP, 20 CY, 24 T	20554
WATER TANKER TRAILER, 5000 GAL	2
TRK, HWY, 4x4, F250, ¾ T, 8800 GVW	7710
TRK, HWY, F600, 21000 GVW, 2 AXLE	42
TRK, HWY, 48,000/64,000 GVW, 3 AXLE	20554
TRK, HWY, 4x2 3500 PICKUP, 8600 GVW	76
TRK, HWY, 2 AXLE, 24000 GVW, 4x2	1115
TRK, HWY, 3 AXLE, 41000 GVW, 6x4	1298
TRK, WTR, OFF HWY, 15000 GAL, CAT613C	7232
WELDER, 200 AMP W/1 AXLE TRLR	52
MISC POWER TOOLS	1817
SMALL TOOLS	81992



Source: EPA, 1971; "Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances." NTID300.1

FIGURE 4-1 Construction Equipment Noise Levels

Downstream Area

In the downstream area project-related noise effects would be short-term and less than significant as described for Alternative 2.

Tulare Lakebed

No construction associated with the project would occur in the Tulare lakebed. Therefore, no adverse effects to noise in the Tulare lakebed would result from this alternative.

4.7.4 Mitigation

Adverse effects due to project-related noise may be identified by comparing noise levels generated by the project to existing noise levels in the project area and to applicable noise level standards. When projects are not compatible with existing adjacent land uses due to noise, mitigation measures may be necessary.

The primary effect of the project alternatives on noise would be related to construction. This impact is limited in time and space. Noise will be generated by heavy equipment operating between April and November and March through November of the succeeding year, and during daytime hours. The noise will be limited to the area surrounding the construction sites at Horse Creek Bridge and at the spillway.

Kaweah Reservoir

Short-term construction-generated noise is normally exempt from noise standards. However, suggested mitigation measures could include working during daytime hours only and fitting all mobile equipment with mufflers consistent with the best noise reduction technology.

Downstream Area

Mitigation for noise effects in the downstream area is not required because the noise effects resulting from the project alternatives are considered short-term adverse but less than significant.

Tulare Lakebed

Mitigation for noise effects in the Tulare lakebed is not required because there are no effects resulting from project-generated noise in this area.

4.8 EFFECTS ON AIR QUALITY

This section will identify potential adverse effects to air quality and recommend mitigation measures. The following literature sources were consulted in evaluating regional, State, and Federal air quality background and standards for the project area:

- California Environmental Quality Act (CEQA) Statutes and Guidelines. 1992.
- CEQA Air Quality Handbook. 1992.
- Air Resources Board. 1993 Annual Air Quality Data Summary.
- Federal Environmental Protection Agency. 1985. AP-42 Report.
- San Joaquin Valley Unified Air Pollution Control District. 1994 Adopted Ozone Attainment Demonstration Plan.
- San Joaquin Valley Unified Air Pollution Control District. 1994 Serious Area PM_{10} Plan.

Existing ambient air quality data (parts per million) were obtained from the closest California Air Resources Board monitoring stations in Visalia, providing the most comprehensive information in the study area (Tables 3-3 thru 3-5).

Air pollutant threshold limits (tons/year) were obtained from the San Joaquin Valley Unified Air Pollution Control District (District) (SJVUAPCD, 1994).

The District has established certain criteria for determining local air basin impact significance. These criteria comply with State and Federal standards for identified air pollutants, and identify threshold limits for the air basin for pollutants which exceed State standards. Project emissions which exceed the threshold limits set forth by the District are considered significant and need to be mitigated. In addition, any exposure of sensitive receptors to substantial pollutant concentrations would be considered a significant impact. Sensitive receptors are defined as residential areas and other areas where young, old or infirm people would be present (CEQA, 1992; Federal Register, 1985; U.S. Environmental Protection Agency, 1994; SJVUAPCD, 1994) .

Acceptable pollutant threshold limits and mitigation measures were discussed with the District and Sacramento Metropolitan Air Quality Management District staff (Mitchell pers comm, 1995; Ornelus, 1995). Projected daily equipment emissions were calculated and compared with Federal and District thresholds (Table 4-6 and 4-7).

4.8.1 Alternative 1

Under the no-action alternative, there would be no Federal involvement and the proposed project would not be constructed. This alternative would avoid project-related emissions. Regional air pollution emission rates would not change as a result of this action. However, regional air quality may improve over time as stricter emission-reducing regulations are implemented.

Kaweah Reservoir

The Kaweah River Basin has a history of flooding, resulting in significant damages above and below Terminus Dam to both agricultural and urban areas. Future high precipitation years may result in flooding and transport of sediments to surrounding urban and agricultural areas. Emergency removal of sediments and clearing of debris following flooding would result in short-term impacts to air quality in the project area (U.S. Army Corps of Engineers, 1992).

Downstream Area

The downstream area air quality may be affected under the no-action alternative by short-term impacts resulting from the emergency removal of flood-transported sediments following flood events.

Tulare Lakebed

No direct, adverse effects would result in the Tulare lakebed from this alternative. However, short-term impacts may result from the emergency removal of transported sediments following flood events.

4.8.2 Alternative 2

The NED plan would be a source of equipment emissions and construction-related emissions. These effects are expected to be direct, short-term effects on air quality.

Kaweah Reservoir

Construction of the project would require two construction seasons. The first season would be limited to the months of April through November and would involve the relocation and construction of the Horse Creek Bridge. The second season would begin the following March and continue through November and would involve raising Terminus Dam and enlarging the spillway.

TABLE 4-6
Projected Equipment Emissions

Equipment[1]	Total Hours	Pounds of Emissions				
		CO	ROG	NO_x	SO_x	PM_{10}
AIR COMPR, 185 CFM, 100PSI	332	3.65	0.66	5.98	0.66	0.33
AIR COMPR, 250 CFM, 100PSI	742	8.16	1.48	13.36	1.48	0.74
AIR COMPR, 375 CFM,100PSI	81	0.89	0.16	1.46	0.16	0.08
AIR COMPR, 750 CFM, 100PSI	468	5.15	0.94	8.42	0.94	0.47
PAVING BREAKER, 86 LB	162	No Emissions				
AIR HOSE 1', 50', HARDROCK	906	No Emissions				
ASPHALT FIN, 10'SPW, PNEUM	42	No Emissions				
ASPHALT FIN, 5'-12'SPW, PNEUM	48	No Emissions				
SWEEPER,7", ADD TRACTOR, W/SPRINK	42	0.55	0.13	1.30	0.08	0.06
CHIPPER, 16" CAPACITY, TRLR-MID	287	5.74	0.86	5.74	0.57	0.43
COMPACTOR, VIBROPLATE, 22.8"	2	0.01	0.00	0.04	0.00	0.00
CONC PUMP, 117 CY/HR, 75' BOOM, TRK	11	No Emissions				
CONCRETE VIBRATOR, 2.5"	22	No Emissions				
CONCRETE VIBRATOR, 6.0"	1,622	No Emissions				
CRANE, HYD, SELF, 22 TON	65	0.59	0.20	1.50	0.13	0.10
CRANE, HYD, TRKMTD, 60TW/110' BOOM	1,965	17.66	5.90	45.20	3.93	2.95
CR, ME, CWLR, LIFTING, 65TW/180' BOOM	260	2.34	0.78	5.98	0.52	0.39
CRANE, TOWER, SK400 18500	320	2.88	0.96	7.36	0.64	0.48
DRILL, AIR TRACK, 2.5-4"DIAM, 12'FD	412	No Emissions				
DRILL, R-BLSTH, 6.75"-9.88", TRK	136	2.72	0.41	3.26	0.27	0.20
GRADER, MOTOR, CAT12-G, ARCTIC	231	1.85	0.70	4.85	0.46	0.23
HYD EXCAV, CRWLR, 1.4 CY BKT	4	0.04	0.00	0.10	0.00	0.00
HYD EXCAV, CRWLR, 2.35 CY BKT	7,378	81.16	7.38	177.07	14.76	11.07
HYD EXCAV, CRWLR, 1.5 CY BKT	287	3.16	0.29	6.89	0.57	0.43
PAVING STRIPER (INCL TRUCK)	12	0.24	0.04	0.29	0.02	0.02
LDR, FE, CRWLR, 3.75 CY, 973	289	4.34	0.87	6.36	0.58	0.29
LDR, FE, WH, 4CY, ARCTIC, 966-E	7,540	113.10	22.62	165.88	15.08	7.54
LDR, W/BH, WH, 1.0 CY FE CKT/24" DIP	1,023	15.35	3.07	22.51	2.05	1.02
LDR, W/BH, WH, 1.5 CY FE CKT/30"L, 27"H	292	4.38	0.88	6.42	0.58	0.29
HYDRA-PAK TAMPER, 21"W,30"L,27"H	7,392	No Emissions				
TRK, HWY, LINE TRK W/AERIAL, PLATFM	31	0.62	0.09	0.74	0.06	0.05
RIPPER, SING-SHNK BEAM, HYD, D-8	32	No Emissions				
RIPPER, MULTI-SHNK BEAM, HYD D-8	7,128	No Emissions				

TABLE 4-6
Projected Equipment Emissions
(continued)

Equipment[1]	Total Hours	Pounds of Emissions				
		CO	ROG	NO_x	SO_x	PM_{10}
ROLLER, STATIC, SELF, 15T, 11 TIRE	42	0.29	0.08	0.84	0.08	0.04
ROLLER, SM-DR, SELF, 12T, 3 WHL, 3" OVL	83	0.58	0.17	1.66	0.17	0.08
BLADE, STRAIGHT, HYDR, FOR D-8	7,200	No Emissions				
DOZER, CWLR, CT D-8N (ADD BLADE)	14,168	141.68	28.34	297.53	28.34	7.08
DOZER, WH, 824C W/STRAIGHT BLADE	2	0.02	0.00	0.04	0.00	0.00
DOZER, WH, 280C W/STRAIGHT BLADE	64	0.41	0.13	1.34	0.13	0.03
TRUCK OPT, REAR DUMP BODY,8CY	1,280	25.60	3.84	30.72	2.56	1.92
TRUCK OPT,REAR DUMP BODY,12 CY	18	0.36	0.05	0.43	0.04	0.03
TRUCK OPT, FLATBED, 8'X 9'	1,115	22.30	3.35	26.76	2.23	1.67
TRK, TRLR, END DUMP, 20CY, 24T	20,554	No Emissions				
WATER TANKER TRAILER, 5000 GAL	2	0.04	0.00	0.05	0.00	0.00
TRK, HWY, 4X4, F250, 0.75T, 8800 GVW	7,710	154.20	23.13	185.04	15.42	11.57
TRK, HWY, F600, 21000 GVW, 2 AXLE	42	0.84	0.13	1.00	0.08	0.06
TRK, HWY, 48,000/64,000 GVW, 3 AXLE	20,554	411.08	61.66	493.30	41.11	30.83
TRK, HWY, 4X2 3500 PICKUP, 8600 GVW	76	1.52	0.23	1.82	0.15	0.11
TRK, HWY, 2 AXLE, 24000 GVW, 4X2	1,115	22.30	3.35	26.76	2.23	1.67
TRK, HWY, 3 AXLE, 41000 GVW, 6X4	1,298	25.96	3.89	31.15	2.60	1.95
TRK, WTR, OFF HWY, 15000 GAL, CAT613C	7,232	13,017.60	1,374.08	30,157.44	3,254.40	1,880.32
WELDER, 200 AMP W/1 AXLE TRLR	52	0.57	0.10	0.94	0.10	0.05
MISC POWER TOOLS	1,817	No Emissions				
SMALL TOOLS	81,992	No Emissions				
SUBTOTAL	205,830					
NO EMISSIONS	129,329					
TOTAL[3]	76,501	13,825.40	1,550.90	31,747.50	3,393.20	1,965.50
1999 (15% OF TOTAL EMISSIONS)[3] lb/hr		1.65	0.19	3.78	0.04	0.23
lb/d		14.81	1.67	34.02	3.64	2.12
lb/wk		74.06	8.31	170.08	18.18	10.53
tons/yr		1.40	0.12	2.32	0.25	0.15
2000 (85% OF TOTAL EMISSIONS)[3] lb/hr		7.68	0.92	18.74	2.00	1.61
lb/d		69.16	8.23	168.66	18.03	14.45
lb/wk		345.78	41.20	843.29	90.00	72.26
tons/yr		5.53	0.66	13.49	1.44	1.16

[1] Calculated using diesel-fueled equipment emission factors (AP-42 Vol 2:Table A9-8-B) .
[2] Exhaust emission factors at 100% load for each criteria pollutant (AP-42 Vol 2:Table A9-8-B).
[3] Assume operation of all equip.nent simultaneously, 9 hours per day, 5 days per week, 28 weeks (year 1999) and 32 weeks (year 2000).

TABLE 4-7
Criteria Pollutant Emission Thresholds
and Proposed Project Equipment Emissions
(tons/year)

Pollutant	Federal Thresholds[1]	Local Thresholds[2]	Proposed Project Emissions	
			1999	2000
CO[3]	100	100	1.04	5.53
ROG	50	10	0.12	0.66
NO_X	50	10	2.32	13.49
SO_X	100	27	0.25	1.44
PM_{10}[4]	70	15	0.15	1.16

[1]Project emissions must not exceed these *de minimus* threshold levels. Environmental Protection Agency, 1994 Federal Clean Air Act section 176(c), General Conformity Rule (40 C.F.R. § 93.153.)
[2]Pollutant emissions which equal or exceed the San Joaquin Valley Unified Air Pollution Control District designated threshold levels are considered significant and need to be mitigated. These standards are equal to or more stringent than CEQA air quality standards.
[3]SJVUAPCD thresholds are for maintenance areas that are in attainment.
[4]SJVUAPCD is in nonattainment for California and serious nonattainment for Federal standards for these pollutants.

Construction activities would be limited to nine-hour days and five-day work weeks. During the summer months (June through August), construction would start at 6 a.m. and end at 3 p.m. During the remaining months, construction would start at 7 a.m. and end at 4 p.m.

Equipment operation during the construction of Horse Creek Bridge would consist of approximately 71 hours per day or a total of 11,359 equipment hours during the 1999 construction season. The construction of the dam would require approximately 358 equipment hours per day or approximately 64,369 equipment hours during the second construction season.

Air quality effects are expected to result from the construction phase of this alternative. Construction activities in the Kaweah Reservoir area would be restricted to the spillway and damsite area, and Horse Creek bridge on Highway 198. Air quality effects which would require mitigation would be direct, short-term and construction-related.

Construction effects on air quality would include fugitive soil PM_{10} produced from earth-moving activities and construction equipment on dirt access roads. Fugitive emissions generated by major land use improvement projects are generally localized and short-term; however, they often exceed the National Ambient Air Quality Standards. Although the project would be constructed over two years, which would minimize the magnitude of PM_{10} emissions, the proposed project may constitute a significant short-term effect on air quality.

In addition to fugitive soil PM_{10} emissions, the construction activities in the reservoir area would result in construction equipment emissions (CO, ROG, NO_x, SO_x and PM_{10}). Daily equipment emissions (pounds/hour) were determined from the total hours of operation for each type of equipment used. These emissions represent a worst-case scenario and assume operation of all equipment simultaneously, nine hours per day for seven months in 1999 and eight months in 2000.

The San Joaquin Valley air basin is in severe nonattainment for ozone and nonattainment for PM_{10}, resulting in emission standards that are more stringent than overall State and Federal standards for these pollutants. Emissions which equal or exceed the San Joaquin Valley Unified Air Pollution Control District (District) thresholds are considered significant and require mitigation. Regulation VIII requires that specific management measures be implemented for minimization of project-generated fugitive dust/PM_{10} (SJVUAPCD, 1995). In addition, Federal projects which result in emissions that equal or exceed *de minimus* threshold levels established by the General Conformity Rule of the Clean Air Act must prepare a Conformity Determination (EPA, 1994).

Projected emissions generated by construction equipment for the proposed project would not exceed the local or Federal thresholds for ozone precursors, ROG or SO_x, or PM_{10}. Given the worst-case scenario, equipment emissions would exceed daily and yearly local thresholds for the ozone precursor, NO_x, and would be subject to mitigation measures (Table 4-7). The rural location of the project improves the opportunity for dissipation of ozone precursors away from urban centers and sensitive receptors (Ornelus pers comm, 1995). It is expected that mitigation measures would reduce NO_x emissions to below the significant level.

Downstream Area

Project-induced air quality effects to the area downstream of Terminus Dam are expected to be short-term and less than significant. The rural location of the project improves the opportunity for dissipation of ozone precursors away from urban centers and sensitive receptors. Although construction activities would occur during the summer months when regional wind patterns typically flow from

the northwest toward the southeast, the localized rural nature of the project air quality impacts are not expected to result in downstream area effects (SJVUAPCD, 1994).

Tulare Lakebed

Air quality in the Tulare lakebed would not be adversely effected by the proposed project.

4.8.3 Alternative 3

Kaweah Reservoir

Under this alternative, project-related effects on air quality would be the same as described for Alternative 2.

Downstream Area

Project-induced air quality effects to the downstream area are expected to be short-term and less than significant as described for Alternative 2.

Tulare Lakebed

Air quality in the Tulare lakebed would not be adversely affected by the proposed project.

4.8.4 Mitigation

Kaweah Reservoir

The project alternatives may result in significant, direct, short-term construction-related emissions in the Kaweah Reservoir area that would require mitigation. Construction equipment emissions are conservative estimates, assuming a worst-case construction scenario. Mitigation measure reduction credits were not included in these calculated estimates. Implementation of the following measures would comply with the local air district's Regulation VIII Fugitive Dust/PM_{10} Synopsis and reduce project-related air quality impacts (SJVUAPCD, 1995).

The following mitigation measures are recommended to reduce direct, significant project-generated combustion emissions:

- Engine timing on diesel-powered equipment would be retarded to reduce NO_x emissions.
- Grading and construction equipment would be shut down when not in use.
- Contractor would develop a comprehensive construction activity management plan to minimize the pieces of construction equipment operating and the extent of the site area worked during any given time.
- Contractors would ensure that construction equipment and maintenance vehicles are properly maintained and direct-injection diesel engines or gasoline-powered engines are used if feasible.
- Vehicles would be fitted with emission reduction equipment where feasible.
- Pump station diesel engines would be equipped with the best available control technology to reduce combustion emissions to the greatest extent possible.
- Energy efficiency and best available control technology would be considered for the purchase of any new equipment for maintenance and operations.
- Contractors would implement a problem avoidance plan including curtailment of operations on ozone violation days.

Fugitive dust PM_{10} generated specifically from earth-moving and excavation activities have not been estimated and are not included in the calculated equipment emissions PM_{10} estimates. The San Joaquin Valley air basin is in non-attainment for PM_{10}; therefore, reduction of particulate emissions to below the significant level would be ensured through the implementation of best management practices and best available control technology where a net increase in particulate emissions is anticipated. The following mitigation measures are recommended to reduce direct significant project-generated particulate emissions:

- Watering trucks would be used throughout construction activities, as site conditions dictate, to reduce dust in excavation areas, on access roads, borrow sites, and overburden sites. Watering efforts would be proportionately increased as localized winds and areas of disturbance increase.
- All excavated material and materials transported offsite would be adequately watered or covered.

- Construction equipment and vehicular traffic on unpaved roads would be restricted to a 15-mile-per-hour speed limit.

Downstream Area

Mitigation for air quality impacts in the downstream area would not be required since there would be no adverse effects resulting from the NED plan or the locally preferred plan.

Tulare Lakebed

Mitigation for air quality impacts in the Tulare Lakebed area would not be required since there would be no adverse effects resulting from the NED plan or the locally preferred plan.

4.9 EFFECTS ON WATER QUALITY

This section will identify potential water quality effects and recommend mitigation measures.

The U.S. Environmental Protection Agency (EPA) and the California Department of Health Services regulate the primary water quality standards or MCL's in California's surface and ground drinking water (EPA, 1972; EPA, 1973; The Resources Agency, 1993). The State standards must at least equal federal standards but are often more stringent. Secondary standards (not health-based) are additional criteria used to determine urban, industrial, and agricultural water quality. Water intended for human consumption must be monitored routinely and conform with State and federal health standards. Project impacts in exceedance of these health standards would be considered significant and would require monitoring and treatment.

To determine the level of significance the proposed project would have on water quality, local experts were consulted to identify the existing conditions (Yee pers comm, 1995; Deffenbaugh pers comm, 1995; Melon pers comm, 1995). Existing water quality conditions were then compared with State and federal standards and the projected water quality conditions resulting from the proposed project.

4.9.1 Alternative 1

Under the no-action alternative, no federal action would be taken to increase flood control and water supply at Terminus Dam. There would be no adverse effects on the existing water quality in the project area as a result of this action.

Kaweah Reservoir

Surface and ground water quality in the Kaweah Reservoir area would not change as a result of this action.

Downstream Area

Surface and ground water quality in the downstream area would not change as a result of this action.

Tulare Lakebed

Surface and ground water quality in the Tulare lakebed would not change as a result of this action.

4.9.2 Alternative 2

This alternative would not have any long-term or short-term, direct or indirect adverse effects on ground water or surface water quality. Elevating Terminus Dam and increasing the holding capacity of the reservoir would not change the volume of surface water delivery. However, there are potential indirect beneficial effects that may result from the proposed action.

Kaweah Reservoir

This alternative would be divided into two areas of construction (Horse Creek Bridge and the Terminus Dam area) and two construction seasons.

In the Horse Creek Bridge area, construction activities would involve relocating the existing bridge structure and abutments during April through November. The new structure would have frame-poured piers with the new piers placed between the existing high-water mark and the new high-water mark to avoid potential for intrusion into existing wetlands. Impacts to wetlands would be avoided.

Construction activities at the Terminus Dam area would include enlargement of the existing structures and excavation to widen the spillway, and would occur the following June through August. No construction would occur in the Kaweah Reservoir waters.

The septic system currently operating in the Kaweah Reservoir recreation area would require mitigation to avoid surface water quality impacts when the lake water level is increased. To avoid adverse effects the facilities would be relocated,

or the existing facilities would be purged and capped (Deffenbaugh pers comm, 1995).

The Tulare County gasoline contamination site would require mitigation prior to raising the lake water level to avoid adverse effects to the lake water quality. Tulare County and KDWCD are currently considering a remediation plan using a flushing and vapor recovery treatment.

Remediating the gasoline tank site and septic site would reduce any direct or indirect adverse effects to ground or surface water to below the significant level.

Downstream Area

The downstream water quality would not be adversely effected by Alternative 2. This alternative would not create any "new" water for the downstream area; however, the increased storage capacity in the reservoir would both reduce downstream flooding and allow increased storage of water. Proper timing and regulation of releases would "convert" this additional potential floodwater into an irrigation supply. The additional average annual irrigation supply that could be stored is about 8,000 acre-feet. The members of Kaweah and St. Johns Rivers Association have rights to this water. Allocation of irrigation supply to the downstream area would continue to be based upon inflow, as computed by the Corps and measured at the dam. Although surface water delivery volume would not change, the increased lake water volume may have a beneficial recharge effect on ground water in the downstream area.

Downstream land use is predominantly agriculture with some urban and rural residential. Stored water in the increased reservoir, if used for irrigation purposes, is not expected to increase cultivated crops in the downstream area. The delivery of surface irrigation water later in the summer would replace the current practice of ground water pumping, which may indirectly improve ground water quality in this area.

Tulare Lakebed

The Tulare lakebed water quality would not be adversely affected by this alternative. There are, however, flood control potential benefits that may result from increasing the Kaweah Reservoir water levels. The NED plan would reduce the volume and duration of snowmelt flooding in the Tulare lakebed. The area flooded would decrease by 1,412 acres on an average annual basis, and the duration of flooding would decrease by five days on an annual basis. The lakebed would continue to receive floodwater from the Kaweah River and other major streams, including the Kings, Tule, and Kern Rivers, as well as local drainages.

4.9.3 Alternative 3

Kaweah Reservoir

Under Alternative 3, construction activities would occur as described for Alternative 2. There would be no adverse effects to surface or ground water quality in or around the reservoir area.

Downstream Area

Downstream water quality would not be affected with this alternative. Future conditions would be as described for Alternative 2.

Tulare Lakebed

Water quality at the Tulare lakebed would not be adversely affected by this alternative. Future conditions would be as described for Alternative 2.

4.9.3 Mitigation

Kaweah Reservoir

With Alternatives 2 and 3, construction activities would occur in areas adjacent to the reservoir and Horse Creek. Although no adverse effects are expected from implementation of the project alternatives, the following measures are recommended to avoid adverse water quality effects in these areas.

Horse Creek Bridge construction would avoid water quality impacts by implementing best management practices including the following recommended measures:

- Design and construction of the new Horse Creek Bridge would be coordinated with public transportation agencies and provide specifications for directing road surface storm runoff and sediments away from Horse Creek into sediment or infiltration basins.
- Construction equipment and materials would be excluded from activities in Horse Creek water to the extent feasible.
- No construction equipment or materials would be staged or stored in the streambed to avoid soil compaction and damage to vegetation.

- The contractor would prepare an erosion and sediment control plan incorporating a site drainage plan consistent with Regional Water Quality Control Board policies.

- Construction equipment would be maintained in proper operating condition to prevent leakage of oil or grease.

- A site-specific plan would be developed addressing proper disposal of silt, debris, refuse, or other pollutants associated with construction.

- All embankments and drainage areas of Horse Creek disturbed by construction activities would be stabilized or returned to the existing condition.

- Servicing and refueling of all equipment would be done only inside of a containment structure.

Terminus Dam construction would avoid water quality impacts by implementing best management practices including the following recommended measures:

- Design and construction of the new spillway would provide specifications for directing road surface storm runoff and sediments away from the reservoir and the downstream area into sediment or infiltration basins.

- Construction equipment and materials would be excluded from any activity in the reservoir.

- Construction equipment and material staging areas would be selected to minimize soil compaction and damage to vegetation to the extent feasible.

- The contractor would prepare an erosion and sediment control plan incorporating a site drainage plan consistent with Regional Water Quality Control Board policies.

- Construction equipment would be maintained in proper operating condition to prevent leakage of oil or grease.

- A site-specific plan would be developed addressing proper disposal of silt, debris, refuse, or other pollutants associated with construction.

- All soils disturbed by construction activities would be stabilized or returned to the existing condition.

- Servicing and refueling of all equipment shall be done only inside of a containment structure.

Downstream Area

Mitigation for water quality effects in the downstream area would not be required since there would be no adverse effects resulting from the project alternatives.

Tulare Lakebed

Mitigation for water quality impacts in the Tulare lakebed would not be required since there would be no adverse effects resulting from the project alternatives.

4.10 EFFECTS ON VEGETATION AND WILDLIFE

This section evaluates the effects of the project alternatives on vegetation and wildlife resources in the study area. Effects on vegetation are summarized in Table 4-8. Project effects on vegetation and wildlife resources were analyzed with the FWS during coordination under the Federal Fish and Wildlife Coordination Act. As part of the coordination, a Habitat Evaluation Procedures (HEP) analysis was conducted to determine project effects on fish and wildlife resources. This section includes a summary of the HEP analysis. The results of the HEP are included in the draft CAR in Appendix 1.

The analysis of project-related effects on vegetation and wildlife resources was based on the best information available to the Corps and FWS at the time. Mitigation site locations are presented in this report for analysis and represent suitable mitigation sites. If more accurate information that may affect the analysis of project effects and mitigation, becomes available during final design phase, coordination with FWS would be initiated. Based on this coordination, changes to the impact analysis and mitigation may be made where appropriate. If necessary, supplemental environmental documentation would be prepared and circulated for public review.

The significance of project effects to biological resources was evaluated by using the following significance criteria. U.S. Army Corps of Engineers 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 California Environmental Quality Act (California Office of Planning and Research, 1988) and local/regional plans and ordinances for the environmental issues analyzed in this report. Significance thresholds were based on the following:

- Conflict with adopted environmental plans and goals of the affected jurisdictions (appendix G (a) of CEQ guidelines).

- 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 habitat for fish, wildlife, or plants (appendix G (t)).

- Involve the use, production, or disposal of material 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.

4.10.1 Alternative 1

The no-action alternative assumes that the Federal government and the non-Federal sponsors would not participate in flood control or increased irrigation water supply efforts. Impacts to certain resources would occur without the proposed project.

TABLE 4-8
Summary Table of Effects on Vegetation

Cover Type and Location	Effects Alternative 1 (No Action)	Effects Alternative 2	Effects Alternative 3
Kaweah Reservoir			
Riparian Scrub-Shrub	no significant change	92 acres	92 acres
Riparian Forest	no significant change	70 acres	70 acres
Oak Woodland	no significant change	38 acres	38 acres
Oak Savannah	no significant change	132 acres	132 acres
Grassland	no significant change	98 acres	98 acres
Tulare Lakebed			
Wetlands/Agricultural lands	no significant change	1,412 acres	1,412 acres
Totals	no significant change	1,843 acres	1,843 acres

Kaweah Reservoir

Without the project, future reservoir operations over the proposed project life (2000-2100) would differ from the existing conditions. The remaining sediment storage space (about 1,000 acre-feet) in the reservoir would be filled prior to the year 2000. However, conditional storage during the rainflood season would be allowed when the ground is dry and the runoff minimal. Since the sediment pool was found to be at the 1,000 acre-foot level, the Corps and local sponsors have deviated from strict adherence to reservoir operations at low elevations using precipitation parameters and yearly reservoir deviations, and have never actually drawn the reservoir down to 1,000 acre-feet. These modifications have allowed some water to remain in the reservoir for fisheries and recreation. The water is used as a carry-over water supply in case of a dry year. Without the project, the conditional storage space would continue for about 50 years as the sediment would continue to build up in the reservoir. During the winter rainflood season, the reservoir could be drawn down at any time for flood control purposes.

Without the project, vegetation around the reservoir is not expected to undergo any significant changes. The change in hydrological conditions within the

reservoir over time would have a small effect on vegetation within the reservoir inundation zone. Currently, the riparian scrub habitat within the reservoir is inundated virtually every year. Inundation varies from 1 to 11 months. Over the project life (100 years), the riparian scrub existing at the lower elevations of the reservoir would be inundated less often (due to diminishing water supply and flood control space) and for shorter durations than under pre-project conditions. The reduced inundation would enable the riparian scrub habitat to have a longer growing season. The longer growing season would increase the value of the riparian scrub habitat for both terrestrial and aquatic resources. Additionally, the reduced inundation and longer growing season would result in conditions favorable to expanding the range of the vegetation within the reservoir.

Without the project, overall wildlife populations in and around the reservoir area would likely remain the same as under existing conditions. No significant change is expected, except that the willow scrub area within the reservoir may be of higher value to terrestrial organisms because it would be inundated less often than in the past.

Downstream Area

The reduction in flood control and storage capacity at the reservoir without the project would likely lead to reservoir releases occurring earlier in the season. Riparian habitat areas downstream of the dam would receive more water earlier in the season. However, these changes are expected to be small, and no overall differences in vegetation or wildlife populations are expected between existing and future without-project conditions.

Tulare Lakebed

Without the proposed project, it was assumed that no additional flood protection would be provided for the Tulare lakebed area. However, projects are currently being studied for reservoir enlargements on the Kings and Tule Rivers, both of which would have similar effects as this project on Tulare lakebed flooding. Should those projects be constructed, it is assumed that appropriate mitigation for their impacts would be implemented successfully.

Over the 100-year project life, flood protection for the lakebed would decrease slightly due to decreases in reservoir flood protection capacities in upstream reservoirs. The level of flood protection to the lakebed from the Kaweah River system would be reduced due to continuing sediment accumulation and flood control operations at Lake Kaweah. Hydrological simulations developed for this project by the Corps estimated that flood protection for the lakebed would be

reduced from 2.7 year protection to 2.2 year protection in the years 2000 and 2100, respectively.

Conditions for vegetation and wildlife are expected to remain about the same as existing conditions without the project. However, decreased capacities in upstream reservoirs may slightly increase the frequency of flooding in the lakebed. Thus, suitable waterfowl wintering and summer breeding habitat may be slightly more abundant.

4.10.2 Alternative 2

Alternative 2 would include widening the spillway and placing a concrete ogee section over the existing broadcrested sill to increase reservoir capacity. The existing bridge over the spillway would be lengthened, and the State Highway 198 bridge over Horse Creek would be relocated. A complete description of this alternative is in Chapter 2.

Kaweah Reservoir

With this alternative, reservoir operations would change over existing conditions because of the increase in storage capacity. Alternative 2 would increase the storage capacity by 42,000 acre-feet. This would increase inundation around the reservoir from the current 694-foot elevation level to 715 feet. With this alternative, there would be no additional space in the reservoir set aside for sedimentation. With the existing sediment storage space filled in by the year 2000, the precipitation parameters would allow up to 7,000 acre-feet of water in the conditional storage space during the rainflood season.

Based on data provided by DWR, FWS, and the Corps, construction and subsequent increased inundation at the reservoir would result in adverse effects to vegetation in and around the reservoir area. Construction and related activities such as staging areas would adversely affect 35 acres of grassland vegetation. Most of the construction activity is limited to the damsite where no significant areas of vegetation occur. There would be a 3-acre construction equipment staging area at the base of the dam which would also affect grassland vegetation. These construction impacts to grassland vegetation are short-term impacts, and the affected areas would be re-seeded after construction is completed. Due to their existing state of disturbance and public use, the effects to grassland vegetation around the damsite were not considered significant. Disposal of material removed to widen the spillway would be placed on the downstream dam face to avoid adverse effects to existing vegetation and wildlife losses at a disposal site.

Adverse effects due to increased inundation around the reservoir from this alternative include the loss of 36 acres of blue and live oak woodland, 125 acres of blue oak savannah, 63 acres of grassland, 10 acres of riparian forest, and 1 acre of riparian scrub habitat. These inundation effects would represent a total loss of habitat for wildlife that use the various vegetation types.

This alternative would also increase the inundation depth and duration of 60 acres of riparian forest which occur at higher elevations within the present inundation zone and 91 acres of riparian scrub, occurring mostly at lower elevations within the present inundation zone. The effects of increased inundation depth and duration would degrade the existing habitat quality. The habitat would still exist for wildlife use, but the habitat would be of reduced quality and quantity, decreasing its value for wildlife. The project would also affect 7 acres of river and stream habitat located within the new inundation zone. A total of 8 acres of "disturbed" areas (non-habitat areas such as roads and parking lots) would also be inundated. These adverse effects are shown in Table 4-9.

The riparian scrub habitat that exists within the inundation zone at the lowest reservoir elevations (570 to 585 feet) would be inundated for longer periods of time each year and at greater depths than current conditions. The trees surviving at these elevations within a reservoir are considered extremely unusual. The exact effect that this increased inundation duration, depth, and water pressure would have on these trees is unknown. The effects on these trees were analyzed by researching available data on similar habitats, consulting with local biological professionals familiar with the habitat, and analysis using professional judgement. The Corps and the FWS determined that about 30 percent of the current riparian scrub habitat would be adversely affected over the life of the project.

Riparian scrub vegetation at higher elevations (585 to 694 feet) within the inundation zone would be affected less than the vegetation located at lower elevations within the inundation pool. Overall, there would be a general decrease in habitat value and acreage of willow scrub vegetation. The magnitude of decrease would be inversely correlated to elevation within the reservoir.

The riparian forest vegetation which exists just below the 694 foot level would not likely survive in its present condition. The riparian forest vegetation in this area would be expected to be replaced gradually by more disturbance-tolerant species. A riparian scrub area would likely replace the riparian forest within the first 20 years of project construction. Other riparian forest areas occurring just below the 715-foot level are not expected to be adversely affected because inundation depth and duration would be less at this elevation.

The 9 acres of oak woodland/savannah vegetation below the 694-foot elevation within the reservoir would not likely survive the increased flooding. Therefore, this 9 acres of oak woodland/savannah habitat would be completely lost.

Any adverse effects (complete loss or degradation) on oak woodland/savannah habitat are considered significant due to the importance and loss of this habitat on a regional basis. Local interests have also considered this habitat significant as shown by local ordinances protecting oak trees and their habitats. Any adverse effects on riparian habitat are also significant due to its loss on a statewide, regional, and local basis. The loss of grassland habitat was not considered significant as it would be provided as a by-product of project implementation in areas where oak woodlands and savannah are removed.

Under with-project conditions, a significant amount of wildlife habitat (a total of 430 acres) would be lost. The loss of riparian, oak woodland, and grassland wildlife habitat would adversely affect all wildlife populations that inhabit these areas either permanently or seasonally. Certain wildlife populations inhabiting these areas would be directly lost because of the increased inundation. Some species would be displaced and eventually lost due to their inability to occupy other habitats. Others would be displaced to other areas where they would be forced to compete with other wildlife for scarce resources. Habitat suitability, distance to

TABLE 4-9
Inundation Impacts at Kaweah Reservoir

Cover Type	Inundation Impacts (acres)		Total Inundation Impacts
	<694 feet	694-715 feet	
Riparian Scrub-Shrub	91	1	92 acres
Riparian Forest	60	10	70 acres
Oak Woodland	2	36	38 acres
Oak Savannah	7	125	132 acres
Grassland	0	63	63 acres
Riverine (not included in analysis)	7	0	7 acres
Disturbed (not inclued in analysis)	0	8	8 acres
Totals	167	243	410 acres

suitable habitat, and carrying capacity of alternate habitats are all factors contributing to the eventual loss of wildlife. Rapidly fluctuating water levels in the new inundation zone would reduce reproductive success of burrowing mammals and reptiles in the spring. Consequently, the food base for higher trophic level species inhabiting areas near the reservoir would also be reduced.

Those species not directly lost due to increased inundation would be adversely affected as the quality of their habitat declines. Much of the riparian and riparian scrub habitat around the existing inundation zone is expected to be severely degraded. Degradation would result in reduced size of the habitat which affects the number of trees and shrubs available for cover, nesting, and food sources. This habitat degradation would affect a wide range of resident and migratory birds and small mammals that use the area.

Reservoir use by migratory waterfowl and other water associated birds at the reservoir would likely remain the same as without-project conditions in the spring/summer but would decrease in the winter. These species would probably continue to use the reservoir in moderate numbers. Although the increased inundation would increase the surface area of the reservoir, the corresponding drawdown area would also increase, offsetting any increase in open water habitat. Additionally, in years that the reservoir fills, it usually fills by the end of May and remains full for about 6-8 weeks. This short period of increased surface area is not expected to be significant enough to increase habitat for waterfowl or other water-associated species. In the future, as the sediment continues to accumulate in the reservoir, the potential for winter carryover water will decline as the reservoir would eventually be emptied for flood control.

So far, habitat loss due to this alternative has been quantified in terms of lost or degraded acres. 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 the Habitat Evaluation Procedures (HEP). HEP combines the quality and quantity of habitat to quantify project effects and mitigation requirements. HEP 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 (100 years). In a similar manner, compensation or mitigation needs for the project can be determined.

HEP 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 (HSI) which is multiplied by the area of available habitat to obtain Habitat Units (HUs). The HUs and Average Annual Habitat Units (AAHUs) over the life of

the project are then used in the comparisons described above. HEP results for the reservoir area are summarized in Table 4-10. A detailed discussion of the HEP analysis can be found in the draft CAR, Appendix A.

TABLE 4-10
HEP Data for Project Effects[1] at the Reservoir Area

Habitat Type and Evaluation Species	Acres Affected Construction/Inundation	AAHUs Lost
Riparian Scrub	92	18
Riparian Forest	70	11
Oak Woodland	38	31
Oak Savannah	132	125
Totals	333	185

[1] Grassland impacts 98 acres were not included in the HEP analysis

Downstream Area

There would be no direct construction or inundation effects in the downstream area due to this alternative. All of the project construction and inundation would take place in the reservoir area. However, some hydrological changes would occur in the Kaweah River flood plain due to the operation of this alternative. Water storage would be increased in the reservoir, and less water would be released downstream during the spring reservoir filling period. Consequently, water releases for irrigation would increase throughout the summer. Currently, irrigation releases usually end by August. Additional storage with the project would allow irrigation releases longer in the season. The increased storage space in the reservoir for additional irrigation water would decrease the intensity of spring and winter floodflows to the lakebed. The reduction of spring and winter floodflows to the lakebed would also decrease spring and winter flows in the downstream tributaries from Lake Kaweah to the lakebed. However, downstream tributaries would continue to receive flows from other sources including local runoff.

Significant riparian vegetation is typically confined to the stream channels in the downstream area. The only likely adverse effects due to this alternative would be decreases in peak flows and winter and spring flows from Lake Kaweah. Since these decreased flows are expected to be minor, no significant adverse effects are expected. Consequently, no significant adverse effects are expected to wildlife in the downstream area.

Tulare Lakebed

Alternative 2 would reduce periodic Kaweah River floodflows from reaching the Tulare lakebed. According to hydrological simulations prepared by the Corps, small-sized flood events (less than 3.2 year events) would no longer reach the lakebed. Larger events would be decreased in magnitude. Floodflows to the Tulare lakebed would still occur from the Tule, Kings, and Kern Rivers.

Actual differences between with- and without-project conditions are quite complex for any given water year. The differences depend in part upon the flood magnitude and duration, time of year, upstream water storage capabilities, and hydrology of neighboring watersheds like the Kings, Kern, and Tule Rivers. Therefore, the hydrological simulations must be regarded as a reasonable estimation of hydraulic changes. The impact analysis for the Tulare lakebed used the hydrologic simulations prepared for this project by the Corps. A reduction of about 1,412 flooded acres would occur in the lakebed on an average annual basis over the life of the project. Appendix A which contains the draft CAR has a complete description of the impact analysis used for the lakebed area.

The reduction in flooding from the Kaweah River system due to this alternative would have little impact on native vegetation in the area since little to no native vegetation remains The Tulare lakebed is primarily an agricultural area. However, summer resident shorebirds, waterfowl, and other waterbirds that use both the intermittently flooded agricultural areas in the lakebed and other wetted areas such as the Wilbur and Hacienda flood storage areas would be adversely affected by the project. The reduction in flooding associated with the NED plan would generally occur from February to June, the spring snowmelt season.

These effects were quantified by analyzing how flooding frequency, duration, and timing would be altered by the project. For this analysis, the Corps and the FWS determined that primary project impacts resulted from reductions in frequency, acreage, and duration of the relatively frequent, smaller flood events occurring in the lakebed. Although larger flood events would also be reduced, the effects of these more infrequent events would largely be compensated by providing perennial mitigation for the smaller events.

Existing data included estimates of project-induced changes in flooding in the lakebed for four different historical water years, ranging from a 5.1-year flood event to a 10.5-year event (see attachment 1, page B-11 in Appendix A). It was determined that the flood events with less than a 10 percent exceedence frequency would provide the most accurate prediction of the project effects. Thus, these analyses are based on the assumption that project impacts can be fully expressed by evaluating the effects of the more frequently occurring events. The

average of 2 years of data (1978 and 1982), which shows changes between with- and without-project conditions, was used to calculate "annual acres affected" for the Wilbur and Hacienda flood detention areas. Both 1978 and 1982 represented 6-year flood events. Therefore, project related effects in the south flood areas basins would be an average annual acreage and duration loss of 1,139 acres for 45 days.

Similar calculations were done for the agricultural areas in the lakebed using the 4 years of data. All 4 years of data showed changes between predicted with- and without-project flooding in the lakebed. Results indicated an average annual flood reduction area of 273 acres and duration of 16 days for the agricultural lands. Therefore, the total area affected due to the project would be 1,412 acres on an average annual basis. These numbers were used in the HEP impact assessment. Due to the historical loss of wetland habitat on a local and regional basis, these adverse effects were considered significant.

The summer waterbird guild HSI model was specifically developed for this project to evaluate the inundated agricultural areas and seasonal wetlands of the Tulare Basin. This model was developed to reflect the fact that when standing water is present or soils are saturated on agricultural lands or seasonal wetlands, the habitat is of high value to various waterbirds. Existing data on waterbird abundance in the Tulare Basin support this assumption. Although the model is greatly simplified, it is appropriate for the types of project effects in the Tulare lakebed, where habitat quality would be affected primarily by the presence or absence of water. The total adverse effects in the lakebed are 1,412 acres and 366 AAHUs lost.

4.10.3 Alternative 3

Kaweah Reservoir

With Alternative 3, the adverse effects to vegetation and wildlife resources in the Kaweah Reservoir area would not be significantly different to those described for Alternative 2. Construction activities and effects would be the same as those described for Alternative 2. The addition of up to 12,000 acre-feet of conditional winter carryover space in the reservoir would not change the inundation of vegetation within the reservoir. Inundation of reservoir inundation occurs as the reservoir is filling after the winter rainflood season. Therefore, anticipated conditions would not change significantly from those described for Alternative 2.

Downstream Area

With Alternative 3, anticipated conditions for vegetation and wildlife in the downstream area would be as those described for Alternative 2.

Tulare Lakebed

With Alternative 3, there would be no significant change from Alternative 2 in flooded area effected in the lakebed for the smaller more frequent flood events. Hydrological simulations were used to illustrate future conditions in the study area with the project alternatives. According to the simulations, flows to the lakebed with Alternative 3 would not be statistically different over the simulated flows to the lakebed for Alternative 2. The duration of flooding remained the same as the NED plan. Therefore, there would be no significant change in the project-related effects to the lakebed with Alternative 3.

4.10.4 Mitigation

Mitigation was developed in coordination with FWS and based on recommendations from the FWS draft CAR and an incremental mitigation analysis (Appendix A). Under the Fish and Wildlife Coordination Act, 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. Mitigation sites and compensation increments were developed and are discussed below. Mitigation requirements are summarized in Table 4-11.

Mitigation Sites

A total of 7 mitigation sites were evaluated for this study. Potential sites were identified and evaluated in coordination with FWS and KDWCD. Corps regulations state that mitigation lands should be evaluated in the following sequence: project lands, public lands, and private lands. Project, public and private lands were considered along with availability of lands and biological suitability. One source that was especially helpful in evaluating potential mitigation sites was a recent study prepared for the City of Visalia and the KDWCD. The report titled "Kaweah River Delta Corridor Enhancement Study," May 1993, evaluates the environmental restoration potential of 14 sites along the Kaweah and St. John's Rivers downstream of Terminus Dam. The information developed for

this study was useful in evaluating sites in the downstream portion of the study area.

The HEP was also used to analyze these mitigation sites. The sites were evaluated for baseline conditions and expected conditions in the future. The evaluation species used for this portion of the HEP were the same as those used for the areas potentially affected by the project. The comparison between baseline and future conditions determines the size of the area needed for mitigation. For example, if the baseline habitat values for a potential mitigation site are low (degraded due to cattle grazing or farming practices) and are expected to remain that way in the future, there is more room for habitat values to be recovered on that site than a site where baseline values are high and are expected to remain high in the future. If there is less room for habitat improvement on a site, a larger area would be needed to replace the same values than on a degraded site.

The following sites were evaluated for mitigation:

Kaweah Reservoir - Site A - Existing project lands surrounding the reservoir were considered for mitigation. Suitable lands exist within the existing reservoir for replacing riparian scrub habitat lost due to the project. Suitable areas were determined by observing the location and inundation frequencies of the existing riparian scrub habitat. Potential replacement areas for willow scrub are generally located in areas with similar hydrology to existing habitats. The best areas would generally be at higher elevations within the reservoir. The Greasy Creek arm of the reservoir would be suitable for revegetation. Currently, it has little habitat value due to cattle grazing. The campground area near Horse Creek would also be suitable due to soil saturation from creek flow.

Two more sites were evaluated for riparian scrub mitigation. Site B was included in the Kaweah River corridor study and is located north of the lower Kaweah River and immediately east of Road 188 and is referred to as the Lindsey Strathmore Irrigation District (LSID) Northeast site. Currently, this site is used for cattle grazing, and there are two areas of existing riparian vegetation that could support additional riparian scrub plantings.

Site C is also located downstream of Terminus Dam. It is located along the north bank of the St. John's River about 4,000 feet downstream of its juncture with the Kaweah River at McKays Point. This site is currently used for sand and gravel extraction by the Kaweah River Rock Company. This site does support some significant stands of willow/cottonwood riparian forest and freshwater emergent marsh adjacent to abandoned pits. Riparian scrub vegetation could be added to these areas. The gravel mining operations at this site are scheduled to be discontinued within the next few years. However, mitigation at this site may not

be possible for several reasons. First, the existing riparian scrub habitat at the site is of high value; therefore, the area needed for mitigation would be greater than the acreage available at this site. Second, mining sites such as Kaweah River Rock usually have reclamation plans which require the owners to return the land to its pre-mining state. Therefore, further habitat improvements would likely be made, leaving little room for mitigation measures associated with this project.

Downstream Area - Project lands were also evaluated for oak woodland/savannah and riparian forest mitigation. Nearly all of the uplands surrounding the reservoir consist of oak woodland, oak savannah, and some grasslands. However, these lands would not be suitable for oak woodland/savannah and riparian forest mitigation.

Like other oak woodlands located in foothill areas, tree densities on south-facing slopes are typically much less than those on the north-facing slopes, primarily because of the typically dry nature and poor water-retention capacities of lands with southern exposures and steep slopes. However, some exceptions do occur. For example, south-facing slope tree densities on the north side of the lake, where water moisture is retained in the soils, are about the same as those areas which have north-facing slopes.

Many of the areas on the north side of the reservoir are presently subject to cattle grazing, which reduces habitat values and the ability for oak tree regeneration. However, cattle grazing impacts to the oak woodlands are less important than effects due to poor soil water retention. When soil moisture characteristics are assumed to be about the same, grazed woodlands on the north side of the reservoir have densities about equal to ungrazed densities on the south side. Also, young oak trees appear to be similarly abundant in both grazed and ungrazed areas at Lake Kaweah, although these data have not yet been quantitatively assessed. Also, the lack of soil moisture retention would be a problem in riparian forest mitigation.

Exclusion of cattle grazing on the north side of the reservoir could improve oak tree recruitment in the area, but such enhancement measures would not provide sufficient benefits to offset all impacts to oak woodlands. Tree plantings would also be needed, and on the drier south-facing slopes, plantings would likely require watering for many years. The persistence of replantings on the south-facing slopes could also be a problem. It may be possible to plant more trees in the area, but future natural recruitment rates would continue to be low because of the lack of water in the soils. Furthermore, the increment of benefit which can be derived from enhancement of existing oak woodlands is relatively low. Consequently, compensation acreages would be high, and additional lands would need to be purchased to meet compensation requirements. Because this site could not

provide complete compensation for project induced effects, it is not included in the mitigation analysis.

Areas other than project lands were identified for oak woodland/savannah and riparian forest mitigation. Site D is a combination of two sites referred to in the "Kaweah River Delta Corridor Enhancement Study" as LSID Southwest and LSID Northwest. These sites include disturbed grazing land with scattered valley oaks and narrow riparian areas along the river. Significant riparian corridor expansion and oak tree regeneration opportunities are available at this site.

Site E is also made up of two sites, one at the Kaweah River Rock gravel operation and the Kaweah Oaks West site. The Kaweah River Rock gravel operation was previously discussed for riparian scrub mitigation. This site would be suitable for riparian forest mitigation, but oak tree regeneration may be more difficult due to the highly disturbed land surfaces. Oak plantings may be possible with extensive grading and recontouring and the addition of topsoils. Soil and water quality testing would need to be done prior to the site's use as a compensation area. Additionally, the reclamation plan for the gravel mining operations would likely improve the habitat quality at the site prior to any mitigation actions.

The Kaweah Oaks West site was discussed in the "Kaweah River Delta Corridor Enhancement Study." A portion of this site is already within the Kaweah Oak Preserve. The majority of this site is agricultural lands and rural residences. The natural lands within the Kaweah Oaks West site consist of extensive valley oak riparian woodland and a large area of non-native grassland. The forest canopy along Deep Creek on this site is historically very dense and currently ranges from dense to fairly open. The currently habitat quality at this site is good. Therefore, there may not be enough area at this site to adequately mitigate for adverse project effects.

Tulare Lakebed - The project-related adverse effects in the Tulare lakebed are not related to vegetation habitat but the presence or absence of water for habitat. Therefore, the mitigation for these impacts generally relate to water application and management. Two sites were evaluated for mitigation for project induced adverse effects occurring at the Tulare lakebed. Site F is located 3 miles southeast of the Kern National Wildlife Refuge in an area of active and inactive Duck Clubs called the Kern-Wasco area. The clubs are grouped near Poso Creek between Corcoran Road and Gun Club Road. The inactive clubs may be available for purchase although existing facilities for water management are poor. Some sites have wells that are in various states of disrepair. A long-term source of uncontaminated water would have to be secured for this site.

Site G is located within KWDCD district sphere of influence in Kings County between Highway 43 and the Santa Fe Railroad, south of Lansing Ave. This area is north of Corcoran Irrigation District well field and ground water recharge ponds. privately owned ditches run through this parcel. The site is available for sale and has working wells and water management facilities. Currently, this site is in agricultural production.

Compensation Increments

After identification of mitigation sites, strategies to regain the habitat values lost due to the project alternatives were identified. Generally, to regain the lost habitat values at a mitigation site things such as fencing, removal of cattle grazing, planting, irrigation, and monitoring are done. For each habitat type, riparian scrub, oak woodland/savannah, riparian, and wetlands, these kind of actions were developed. As part of the incremental mitigation analysis required by Corps regulations, various mitigation alternatives or compensation increments are compared on a cost basis to develop the most cost effective mitigation plan that meets the mitigation goals. The incremental mitigation analysis for the project alternatives is included in Appendix B.

Compensation increments were developed for each habitat type, and these increments were evaluated for each site using a HEP based analysis. An incremental analysis was performed which included a cost effectiveness analysis and an incremental cost analysis. Results of the incremental cost analysis are shown in Table 4-11. Mitigation sites are shown on Plate 2.

4.11 EFFECTS ON FISHERIES

This section evaluates the effects of the project alternatives on fishery resources in the study area. Effects on fishery resources were analyzed qualitatively in conjunction with the FWS during coordination under the Federal Fish and Wildlife Coordination Act. The draft CAR is included as Appendix A. The same significance criteria were applied to the analysis of fisheries as presented in the vegetation and wildlife section.

4.11.1 Alternative 1

This alternative assumes that the Federal Government and the non-Federal sponsors would not participate in flood control or increased irrigation water supply efforts. Existing conditions that adversely affect fishery resources such as flow and water quality problems would continue without the project.

Kaweah Reservoir

Future conditions for fishery resources within Lake Kaweah would likely decline in the future without the project. Because no sediment space would remain in the reservoir by the year 2000, increased pressure to drain the reservoir for flood control and water supply may occur. However, conditional space would remain (for about 50 years) in the reservoir during the rainflood season when the ground is dry and runnoff minimal. The fishery resources in the reservoir would be destroyed if the reservoir is emptied. Any increase in water supply needs from Lake Kaweah may also increase the likelihood of a complete or nearly complete reservoir drawdown.

Under without project conditions, recruitment of young gamefish into the adult population would decrease due to predation and reduced spawning related to increased drawdown rates. Fish kills from poor water quality or lack of water

Table 4-11
Project Mitigation

Habitat Type	Location and Acres	Compensation Increment
Riparian Scrub	Site A - Existing project lands around Lake Kaweah, 21 acres.	Medium Intensity - including land acquisition, fencing, remove grazing, plant willow at 177 plants per acre, irrigation and monitoring for 3 years.
Oak Woodland/Savannah Riparian Forest	Site D - LSID Southwest and Northwest sites, 440 acres. This includes 14 acres of riparian habitat, 320 acres of oak savannah, and 99 acres of oak woodland habitat.	Medium Intensity - including land acquisition, fencing, removing grazing, planting riparian at 144 plants per acre, oak woodland at 78 plants and acorns per acre, and oak savannah 33 plants and acorns per acre, grading for overland flooding, monitoring for 3 years.
Tulare Lakebed Wetlands	Site G - Kings County near Corcoran Irrigation District, 366 acres.	Medium-high Intensity - including land acquisition, apply surface water and well water 1,130 acre-ft for 152 days each year from Feb. to July, construct 15 islands per 100 acres and border dikes to divide the site into 7-20 to 150 acre "checks" for shorebird habitat.

would also increase. Thus, the existing population of gamefish would decrease in the future. If the reservoir is emptied, the existing fishery would at least

temporarily be eliminated. The DFG or local interests could stock additional warmwater gamefish in the reservoir when adequate water conditions return. Due to financial constraints, restocking gamefish in Lake Kaweah is not guaranteed, especially if the lake is emptied frequently. Existing fishery enhancement measures put into place by DFG would continue to function as long as water remains in the reservoir.

Downstream Area

Conditions for fish downstream of Lake Kaweah are not likely to change in the future.

Tulare Lakebed

Future conditions for fish are not expected to change in the Tulare lakebed. Differences in fish species composition and densities would be likely, but any downward or upward trends are not predictable.

4.11.2 Alternative 2

Reservoir conditions with this alternative would be similar to those without the project. With Alternative 2 there would be no additional space in the reservoir set aside for sedimentation. With the existing sediment storage space filled in by the year 2000, the precipitation parameters for Alternative 2 would allow up to 7,000 acre-feet of water in the conditional storage space during the rainflood season for the life of the project.

Kaweah Reservoir

Conditions for fish resources in the reservoir would be similar to the without-project conditions. As with the without-project conditions, the reservoir may be emptied at any time during the winter for flood control purposes. The water available during the rainflood season is highly variable from year to year and cannot be depended on for fish habitat. Additionally, existing summer conditions in the reservoir would continue to adversely affect the fishery.

Under the expected conditions with this alternative, the existing warmwater fishery would probably not remain self-sustaining. Summer drawdown increases would severely stress adults and juvenile largemouth bass and other centrarchids. Also, juveniles would be susceptible to predation. Unsatisfactory water quality conditions would adversely affect spawning and juvenile recruitment. Many of the existing spawning structures and willow plantings constructed and planted by local fishermen's groups and the DFG would not be functional under with-project

conditions. Existing water level fluctuations and poor water quality conditions in the summer would continue with the project. Therefore, the long-term viability of the fishery is expected to worsen with or without the project.

Downstream Area

With Alternative 2, little change to the fishery would occur in the downstream area. The irrigation releases would not change with this alternative, and the river would continue to be dewatered periodically in response to changing seasonal irrigation needs. Therefore, habitat conditions for fish in the downstream area are not expected to change significantly from current conditions.

Tulare Lakebed

With this alternative, the effects to fishery resources would probably be minimal. This is largely because conditions for fish in the lakebed are currently only poor to fair.

4.11.3 Alternative 3

Kaweah Reservoir

With Alternative 3, conditions for fish resources in the reservoir would likely improve over existing conditions and anticipated conditions with Alternative 2. The proposed water control diagram and basin wetness parameter associated with Alternative 3 would allow for increased conditional water storage in the reservoir over the winter rainflood season. Up to 12,000 acre-feet may remain in the reservoir during the rainflood season. This alternative may stabilize winter conditions for the reservoir fishery. However, summer conditions would continue to adversely affect the fishery.

Downstream Area

With Alternative 3, fishery conditions would be the same as described for Alternative 2. Habitat conditions for fish in the downstream area are not expected to change significantly from current conditions.

Tulare Lakebed

With Alternative 3, effects to fishery resources in the lakebed would be minimal as described for Alternative 2.

4.11.4 Mitigation

Conditions for fishery resources in the reservoir with Alternative 2 are not likely to be significantly worse than the without-project conditions. Therefore, no mitigation would be necessary. Alternative 3 would improve winter conditions for the reservoir fishery although summer conditions would still be poor. No fishery mitigation is proposed for Alternative 3.

4.12 EFFECTS ON ENDANGERED SPECIES

Endangered and threatened species and species of special concern may be adversely affected by the loss of habitat and disturbances associated with the project alternatives. In addition, several habitats of potential value to endangered and threatened species would be affected by the project alternatives. These include riparian scrub, riparian forest, oak savannah and oak woodland habitats.

Surveys were performed by the DWR under contract to KDWCD in early 1995. The surveyed species are discussed in Section 3.3.11. The surveys included the area around Lake Kaweah between the existing maximum inundation level and the proposed post-project maximum inundation level, the area around Terminus Dam where spillway and bridge modifications would occur, and areas associated with construction such as staging areas, the areas around Horse Creek bridge, and the Tulare lakebed area which would receive less floodwater in some years due to the increased storage capacity in Lake Kaweah. The incremental loss of floodwater would occur mainly in the floodwater storage areas in the southern portion of the lakebed. The remainder of the lakebed is currently an intensive agricultural operation. The surveys indicated that the three species would likely be affected by the project: valley elderberry longhorn beetle, spiny sepaled coyote thistle, and Kaweah brodiaea. The survey report is included with the BDR in Appendix C. The survey results for each species are discussed below.

For this section, 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 adverse affect. For the VELB, the only listed species adversely affected by the project, a significant effect would occur if project alternatives directly or indirectly resulted in the partial or complete destruction of any elderberry shrubs in the project area. (These significance criteria are consistent with the provisions of the FESA.)

A biological assessment was sent to FWS in March 1996, a biological opinion is expeced in October 1996. Preliminary informal consultation with the FWS indicates that consultation will likely concur with the findings and mitigation proposed.

4.12.1 Alternative 1

With the no-action alternative, no Federal action would be taken to improve flood control and water supply conditions at Terminus Dam. The storage behind Terminus Dam would remain at its present size. Flood protection would remain at the 46-year level for the downstream communities. Periodic flooding would continue downstream of the dam and in the Tulare lakebed, resulting in loss of agricultural production and damage to homes, businesses, and public facilities. Water supply for agriculture would remain at its current level, and ground-water overdraft problems would continue.

Without the project, conditional storage space in the reservoir during the winter months when the ground is dry and runoff is minimal would remain for about 50 years. However, sediment would continue to build up in the reservoir, eventually diminishing conditional carryover space. The foraging habitat for the bald eagle would be adversely affected in some years.

4.12.2 Alternative 2

This section contains information on potential effects to the listed, proposed, and candidate species surveyed by DWR. Mitigation measures for the VELB are also included in this section.

Blunt-nosed Leopard Lizard. The Tulare lakebed is the only portion of the study area that would be in the range of this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of Alternative 2 would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Bald Eagle. This species is known to winter in the area around Lake Kaweah and forage in the reservoir. Currently, there is about 1,000 acre-feet of sediment storage space left in the reservoir. With the existing sediment storage space filled in by the year 2000, the existing precipitation parameters would allow up to 7,000 acre-feet of water stored in the conditional space during the winter rainflood season. Although the conditional storage of water in the winter is not guaranteed, forage habitat for the bald eagle would likely improve in some years.

Swainson's Hawk. The project area is at the southern portion of the hawk's range. Known nests in the vicinity are few and scattered. This alternative would not adversely affect areas where suitable habitat may exist downstream of Terminus dam. Therefore, no adverse effects are anticipated.

San Joaquin Kit Fox. This species could occur throughout the valley, primarily in dry, scrub habitats on the valley floor. However, based on FWS range maps, the Tulare lakebed is the only portion of the study area that currently lies within the kit fox's range. The species would only inhabit areas in the lakebed that are not flooded. Since the effect of this alternative would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Tipton Kangaroo Rat. Tipton kangaroo rats originally occupied a range that included the Tulare Lake Basin in portions of Fresno, Kings, Tulare, and Kern counties. The kangaroo rat requires friable soils in desert and alkaline playa communities that are free from flooding. Currently, the Tulare lakebed is the only portion of the study area where suitable habitat exists for the kangaroo rat. Since the only effect from Alternative 2 in the lakebed would be an incremental reduction in flooded acreage, and suitable habitat does not exist in flooded areas, no adverse effects to this species are anticipated.

Valley Elderberry Longhorn Beetle. This species occurs both above and below Lake Kaweah. Every potentially affected elderberry bush around the lake was surveyed for the beetle or signs of its presence. No beetles were seen during the surveys; however, beetle exit holes were identified in two potentially affected elderberry bushes at the east end of the lake. A total of three elderberry bushes would be inundated by this alternative. Additionally, two elderberry bushes would be affected during the construction of Horse Creek bridge. The elderberry bushes do not occur in areas with associated native vegetation.

Preliminary informal consultation with FWS was initiated for the 5 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. Although FWS usually prefers transplanting imperiled shrubs, the three shrubs in danger of inundation should be left where they are due to the difficulty of moving them successfully. The two shrubs at Horse Creek would be transplanted prior to construction. The 5 elderberry shrubs have a total of 92 stems over 1 inch. At a mitigation ratio of 3:1, 276 seedlings/cuttings would have to be planted to provide habitat for the beetle. Elderberry plantings must have an 80 percent survival ratio after 10 years, if the 80 percent survival criteria is not met, additional shrubs would have to be planted. The seedlings/cuttings would be planted on 2.1 acres of Corps property in the Horse Creek portion of the study area. The mitigation plantings would be planted in areas of existing riparian vegetation. The mitigation and monitoring would likely be done by lake personnel. Mitigation measures would be implemented using the FWS beetle mitigation guidelines.

California Jewelflower. This species is highly unlikely to occur in the study area since suitable habitat consists of sandy, grassland soils on the valley floor. A NDDB search indicated no recorded occurrences of this species in Tulare County since 1960. Since this species is unlikely to occur in the study area, no adverse effects are anticipated.

San Joaquin Adobe Sunburst. This species requires heavy adobe soils and is unlikely to occur in the project area based on Natural Resources Conservation Service (Soil Conservation Service) soil survey maps which indicate that no suitable habitat exists in the study area. Since this species is unlikely to occur in the study area, no adverse effects are anticipated.

Foothill Yellow-legged Frog. This species historically occurred in the study area where Lake Kaweah now lies. Ongoing, extensive surveys have been performed in the Kaweah watershed to the town of Three Rivers. This species is currently found only at high elevations in Sequoia National Park. Therefore, the project would have no adverse effects on this species.

Tricolored Blackbird. This species is known to occur in the Tulare lakebed when flooding promotes cattail growth. However, water management decisions in the lakebed probably have a greater influence on this species than the amount of flooded acreage. Therefore, a reduction in flooded acreage due to this alternative may not have a direct effect on the species. The wetland mitigation plan for the project may indirectly provide suitable habitat for this species.

White-faced Ibis. This species occurs in the Tulare lakebed and nest there when habitat conditions are favorable. A reduction of floodwater to the lakebed with this alternative is expected to have an incremental effect on this species. To compensate for this loss, the wetlands mitigation plan for the project would provide suitable habitat for this species.

Mountain Plover. This species winters in the San Joaquin Valley on the west side where it forages in dry, upland sites such as grasslands and agricultural fields. Since the effect of this alternative would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Western Snowy Plover, Interior Population. This species is an obligate salt water species known to use the evaporation ponds near the Tulare lakebed. Alternative 2 would not affect any saltwater habitat; therefore, no adverse effects are anticipated.

Heartscale. This species is an annual herb found in alkaline habitat on the valley floor. The Tulare lakebed is the only portion of the study area that may

contain suitable habitat for this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of this alternative would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Brittlescale. This species is an annual herb found in alkaline habitat on the valley floor. The Tulare lakebed is the only portion of the study area that may contain suitable habitat for this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of this alternative would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Lesser Saltscale. This species is an annual herb found in alkaline habitat on the valley floor. The Tulare lakebed is the only portion of the study area that may contain suitable habitat for this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of this alternative would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Lost Hills Saltbush. This species is an annual herb found in alkaline habitat on the valley floor. The Tulare lakebed is the only portion of the study area that may contain suitable habitat for this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of this alternative would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Kaweah Brodiaea. A new population of this species was discovered during DWR surveys in May 1995 at the east end of the reservoir. The elevation of this population was estimated to be 720 feet. This elevation is very close to the new proposed inundation level of 715 feet. About five plants were located at this site. A topographic survey would be needed to determine if this population would be inundated by this alternative. Since this species is a candidate species, no mitigation is required by Federal law, but if inundated, removal of the population to an appropriate location may be done. Relocation could be done by lake personnel. This site should be protected from human disturbances with measures such as exclusionary fencing.

Recurved Larkspur. This species favors poorly drained, fine, alkaline, grassland soils. The only portion of the study area with potential habitat would be the Tulare lakebed. An NDDB search did not show any records for the lakebed area. Since this alternative would reduce flooded acreage in the lakebed, no adverse effects to this species are anticipated.

Spiny-sepaled Coyote-thistle. This species was discovered during surveys in 1989. Surveys in May 1995 relocated this population but with a smaller number of plants. Currently, this population is about 50 plants down from 300 in 1989. This population is located directly adjacent to the Kaweah brodiaea population. If inundated, this population can be relocated along with the Kaweah brodiaea population. This site should receive protection from human disturbances with measures such as exclusionary fencing.

Southwestern Pond Turtle. This species favors a variety of permanent and intermittent waters with large amounts of numbers sites. No specific surveys were done for this species, and no pond turtles were seen during other surveys. Additionally, there are no NDDB records for this species in the study area. However, the turtles are believed to occur at Lake Kaweah based on previous sightings by lake personnel. Based on the habitat description, the greatest potential for habitat for the turtle would be in the Horse Creek area. Before construction begins in the Horse Creek area, the site would be examined by a biologist to determine if turtles are present. Then, a plan for avoiding impacts to the turtles would be developed with the FWS and the DFG for any turtles found in the construction area.

4.12.3 Alternative 3

With Alternative 3, anticipated effects to the following listed, proposed, and candidate species would be as described for Alternative 2: blunt-nosed leopard lizard, Swainson's hawk, San Joaquin kit fox, valley elderberry longhorn beetle, tipton kangaroo rat, California jewelflower, San Joaquin Adobe Sunburst, foothill yellow-legged frog, tricolored blackbird, white-faced ibis, mountain plover, western snowy plover, interior population, heartscale, brittlescale, lesser saltscale, lost hills saltbush, Kaweah brodiaea, recurved larkspur, spiny-sepaled coyote-thistle, and southwestern pond turtle. However, habitat conditions for the bald eagle would improve with Alternative 3. Winter foraging habitat would improve due to the new water control manual and precipitation parameters. Up to 12,000 acre-feet would remain in the reservoir during the winter rainflood season. This would provide more foraging habitat than anticipated conditions with the no-action alternative or NED plan.

4.13 EFFECTS ON CULTURAL RESOURCES

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, CEQA guidelines direct public agencies to avoid damaging effects on archeological resources whenever possible.

Consideration will be given to measures that would avoid impacts to and preserve cultural resources within the area of potential effect. These measures could include relocation of roads and borrow sites, stabilization of banks with a potential for sloughing, and covering sites with protective caps or fill.

In those cases where avoidance preservation is not possible, impacts to cultural resources are determined under the "criteria of effect" as defined in 36 CFR 800.9, "Protection of Historic Properties." These are the regulations implementing 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 EIS/EIR, these adverse effects, or impacts, are considered 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, 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, as amended, forms the underlying structural basis of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our 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 possesses exceptional value 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 (16 USC 461). Acts of Congress and Executive Orders may also create historic areas of the National Park System, all or portion 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 (16 USC 470), 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 Part 60).

The National Register was designed to be and is administered as 36 CFR 60.4 Criteria for Evaluation. There are four criteria applied to evaluate properties for the National Register of Historic Places. 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). The Charter Oak SHL 410 is located in the downstream area.

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 organization. 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 USC 470aa-11), as amended. Protection must be afforded to these resources regardless of whether they have been listed or determined eligible for the National Register.

4.13.1 Alternative 1

Impacts to certain cultural resources on a regional basis would occur even without a flood control project. Urban expansion and agricultural practices would continue to destroy prehistoric and historic sites. Flooding in excess of the current level of protection could cause significant damage to some cultural resources along the Kaweah River. Natural processes such as erosion, root and rodent intrusion, and grazing are known to affect archeological sites. Vandalism, through deliberate looting and collecting, is a national problem and is expected to continue.

Sites below gross pool at Lake Kaweah are currently affected by fluctuation in the reservoir pool during normal reservoir operations, significant levels of vandalism, and recreational activities.

4.13.2 Alternative 2

Kaweah Reservoir

Only one prehistoric archeological site, CA-Tul-1042, is located between the existing gross pool elevation of 694 feet and the proposed increased elevation of 715 feet. This site is an isolated bedrock mortar. The site is less than 1 meter in diameter with four mortar holes. The bedrock mortar is not associated with a prehistoric midden or other habitation. The site was determined to be ineligible for the National Register of Historic Resources. Concurrence on that determination has been received from the State Historic Preservation Officer (SHPO).

Downstream Area

No effects on cultural resources are anticipated from Alternative 2 in this area.

Tulare Lakebed

No effects on cultural resources are anticipated from Alternative 2 in this area.

4.13.3 Alternative 3

Kaweah Reservoir

Under Alternative 3, effects to cultural resources would be as described for Alternative 2.

Downstream Area

No effects on cultural resources are anticipated from Alternative 3 in this area.

Tulare Lakebed

No effects on cultural resources are anticipated from Alternative 3 in this area.

4.13.4 Mitigation

Kaweah Reservoir

Only one prehistoric archeological site, CA-Tul-1042, is located between the existing gross pool elevation of 694 feet and the proposed increased elevation of 715 feet. This site is an isolated bedrock mortar. The site is less than 1 meter in diameter with four mortar holes. The bedrock mortar is not associated with a prehistoric midden or other habitation. The site was determined to be ineligible for the National Register of Historic Resources. Concurrence with that determination has been received from the State Historic Preservation Officer (SHPO).

Downstream Area

No effects on cultural resources are anticipated from the proposed alternatives in this area.

Tulare Lakebed

No effects on cultural resources are anticipated from the proposed alternatives in this area.

CHAPTER 5.0

OTHER REQUIRED DISCLOSURES

Fish habitat improvements in drawdown zone

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 IMPACTS

NEPA regulations and CEQA guidelines require that an EIS/EIR discuss project impacts that, when combined with the impacts of other projects, result in significant cumulative effects (40 CFR 1508.25). The NEPA regulations define a cumulative impact 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).

CEQA Guidelines require that an EIR discuss cumulative impacts "when they are significant" (Guidelines Section 15130). CEQA Guidelines define cumulative impacts as "two or more individual effects which, when considered together, compound or increase other environmental impacts" (Guidelines Section 15355). Additionally, the 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 reasonably foreseeable actions" (Guidelines Section 15355).

The discussion of cumulative impacts must reflect the severity of the impacts and their likelihood of occurrence; however, the discussion need not evaluate cumulative impacts to the degree of specificity required for project-specific impact analysis. CEQA guidelines state that the discussion of cumulative impacts should ultimately be guided by standards of practicality and reasonableness (Guidelines Section 15130).

5.2.1 Methodology

The cumulative impact discussion addresses potential water resources projects in the San Joaquin Valley drainage basin including the San Joaquin, Kings, Kaweah, Tule, and Kern Rivers. Cumulative impacts were assessed by listing projects which, in addition to the selected plan, could produce significant cumulative impacts in the Kaweah Reservoir area, downstream, or in the Tulare lakebed. The discussion includes a summary of the expected environmental effects of the individual projects or actions and a reasonable analysis of all of the relevant projects' cumulative impacts, with an examination of reasonable options for mitigating or avoiding such effects.

Two general types of impacts are discussed in this section. First are the direct impacts of water resource projects that provide flood protection and control water supply while adversely affecting the remaining natural habitats in the study area. Included in this category are recent environmental enhancement projects that are designed to restore wetlands, wildlife habitat, and other natural resources to the study area. Second are the indirect impacts of increased development encouraged by water resource projects in combination with local zoning decisions and construction of infrastructure projects required to support growth.

5.2.2 Related Water Resources Projects

There are many flood control and diversion projects proposed and ongoing in the San Joaquin Valley. These projects are sponsored by Federal, State, and local water entities. The individual project effects may be mitigated on a project by project basis, but the cumulative basin-wide environmental effects of these project may take a decade or more to fully assess (DWR,1994).

Previous and proposed projects that could have had significant adverse environmental effects in the region include the State Water Project, Central Valley Project, Los Banos Grandes, and the Interim Standard Operating Procedures for the Arroyo Pasajero System. Most effects from these projects were sustained at

the time of construction and implementation. However, these projects have also contributed to cumulative effects in the study area.

The following proposed projects may, together with the proposed project, have cumulative effects in the Kaweah study area. Mitigation for individual project effects would be proposed for each of these projects to reduce the adverse environmental effects to below the level of significance.

Tule River Basin Feasibility Investigation, Corps

The Tule River Feasibility Investigation was initiated in 1988. This investigation was suspended in 1992 pending the outcome of seismic safety studies of the dam. An interim report was produced for the feasibility investigation in March 1992. This report represented a compilation of project information, technical studies, analysis, and mitigation proposals to the date the study was suspended. Technical studies, analysis, and mitigation proposals are incomplete for the area downstream of the reservoir and the Tulare lakebed.

The feasibility investigation addressed local concerns about flood control and availability of agricultural irrigation water. The locally preferred alternative would raise the gross pool elevation of Success Reservoir by 10 feet, inundate about 700 additional acres behind the dam, and reduce average annual flooding in the Tulare lakebed by about 2,800 acre-feet (DWR,1992). Best available studies indicate the proposed alternative may result in significant adverse effects to wildlife, wetland habitats, and endangered species. However, analysis of project impacts are described for the immediate reservoir area only and are incomplete, as are estimates of any needed mitigation.

The seismic safety studies, to date, indicate that seismic safety would be independent of pool elevation. Therefore, the feasibility investigation could proceed once a modified study cost sharing agreement is executed and the required Federal and non-Federal funds become available. Currently, there is no schedule to restart the study.

Pine Flat Dam Section 1135 Projects, Corps

Two Section 1135 restoration projects have been proposed for Pine Flat Dam. One project, the turbine bypass is expected to be completed in 1999. The second project, restoration of Avocado Lake has been proposed and is waiting for approval to proceed. The turbine bypass project would allow Pine Flat Dam to release water from the reservoir when the power plant is not running. The bypass would improve water temperature management for fish habitat in the lower Kings River. The second project, restoration of Avocado Lake, would improve trout

habitat by implementing weed control measures and constructing a spawning channel. The proposed projects would restore fish habitat on the Kings River which was degraded by the construction of Pine Flat Dam.

Short-term direct adverse effects would result from construction activities which would be minimized to below the level of significance through implementation of best management practices. No long-term adverse effects would occur as a result of these actions.

Pine Flat Dam Fish and Wildlife Habitat Restoration Feasibility Study, Corps

This Feasibility Study will evaluate the potential to improve fish, wildlife, and habitat in the Pine Flat Dam area and the lower Kings River system. The study area extends from the Kings River immediately upstream from Pine Flat Dam, downstream to Mendota Pool along the Kings River North tributary, and the Tulare lakebed along the Kings River South tributary. The study will evaluate the effects of constructing a multilevel intake structure designed to benefit fish and wildlife. Habitat projects and water exchanges will also be investigated. The study is expected to be completed in 1998.

Short-term direct adverse effects may result from the construction of this project which would be minimized to below the level of significance through the implementation of best management practices. No long-term adverse effects are likely to occur from this project.

Kaweah River Delta Corridor Enhancement Study, City of Visalia, 1993

This study addresses the potential for integrating riparian habitat and water resources along the Kaweah River downstream of Terminus Dam and east of the city of Visalia. Three sites have been selected along the Kaweah River with the greatest potential for providing multiple benefits for ground-water recharge, emergency flood control, and environmental habitat enhancement. The Phase I investigation is complete and would be followed by Phase II implementation and completion by 1998.

5.2.3 Evaluation of Cumulative Impacts

The following three areas were evaluated for adverse project cumulative impacts:

Kaweah Reservoir

With the project alternatives, significant direct, long-term adverse cumulative impacts would occur to vegetation, habitat, and wildlife. The loss of riparian scrub, riparian forest, oak savannah, and oak woodland vegetation in this area is significant in the context of the greater San Joaquin Valley. Less than 10 percent of California's riparian and native oak woodland habitat remains so any impacts to the remaining fragments of these habitats are significant. However, the mitigation measures for riparian and oak woodland habitats would mitigate these losses to below the level of significance. As a result, no adverse cumulative effects would result from the proposed project.

Downstream Area

No adverse cumulative effects would result in this area from the project alternatives.

Tulare Lakebed

Tulare lakebed is a closed basin with no natural drainage outlet and four major sources of inflow. The sources of major inflow are the Kern, Kings, Tule, Kaweah Rivers. Additional water can be delivered in flood years from the San Joaquin River. Therefore, proposed projects on either the Kern, Kings, Tule, or Kaweah Rivers that would decrease seasonal flows to the lakebed would contribute to the cumulative adverse environmental effects in the lakebed.

The project alternatives would result in significant adverse environmental effects in the Tulare lakebed. Individual project effects would be mitigated to less than significant. Of the proposed projects listed above, none are expected to have significant long-term cumulative effects at the lakebed. However, further analysis is needed to assess the cumulative losses this area would sustain if additional related, proposed water projects are implemented. Adequate data are unavailable or incomplete to collectively evaluate the long-term cumulative environmental effects of implementation of all the proposed water management projects in the San Joaquin Valley. The best available data suggest that direct, significant, long-term, adverse, basin-wide alteration and loss of wetland resources in the region may result from additional projects.

The Kern River is not a contributing source of water supply to the Tulare lakebed. In average water flow years, water from the Kern River is delivered upstream of the Tulare lakebed. In 50- to 100-year flood events, Class II water from the Kern River can be directed south to the intertie or into designated recharge basins south of the Tulare lakebed. Therefore, water supply projects on

the Kern River would not contribute to cumulative environmental effects in the lakebed.

Deer Creek is a seasonal drainage that historically supplied inflow into the Tulare lakebed. This creek is not a significant contributing source of water into the lakebed except in a 50- or 100-year flood event. No actions are proposed for Deer Creek that would result in significant adverse cumulative effects in the Tulare lakebed.

The San Joaquin River water resources do not have a significant effect on the Tulare lakebed. In flood years, the water flows into the San Francisco Bay Delta, and only in flood years irrigation water may be diverted from the San Joaquin River into the Friant-Kern Canal. The Friant-Kern water is used within Kaweah River Service Area, which is used for agricultural purposes. No adverse cumulative effects would result in the Tulare lakebed from actions on the San Joaquin River or its tributaries.

5.2.4 Conclusions

Direct Project Impacts

Individual projects have direct impacts associated with construction and implementation of the projects. However, individual project effects would be expected to be mitigated sucessfully thereby reducing project impacts to a less than significant level. Of the proposed projects listed above, none are expected to have significant long-term cumulative effects at the lakebed.

Cumulative adverse effects to wildlife, wetland habitat, and endangered species may occur in the Tulare lakebed due to the collective effects of other future projects in the San Joaquin Valley. There is a great potential for basin-wide adverse environmental effects resulting from the many smaller proposals for localized water diversions. Further studies are needed to address water management effects in the San Joaquin Valley in a basin-wide plan. Wetland mitigation implementation in the San Joaquin Valley depend on a variety of factors, especially the use of good quality water that is delivered at the appropriate time for wildlife management.

Indirect Project Impacts

The flood control projects would reduce flood-related restraints from the Tulare lakebed; however, this action alone would not encourage land use changes, local zoning decisions, or infrastructure decisions. Land use studies for the

proposed projects do not anticipate any associated indirect impacts as a result of implementing the individual projects.

5.3 GROWTH-INDUCING IMPACTS

The growth-inducing section of this draft EIS/EIR is required by CEQA. Under CEQA, a growth-inducing impact is one that could foster economic or population growth or directly or indirectly bring about construction of additional housing in the surrounding environment (CEQA Guidelines, Section 15126[g]). This section addresses existing population growth and densities within the study area and examines existing and with-project growth-inducing conditions. Information in this section is consistent with the information in the Land Use Appendix.

5.3.1 Existing Conditions/No Action

Kaweah Reservoir

As indicated in the Land Use Appendix, the project alternatives and their area of influence from Lake Kaweah to the Tulare/Kings County line falls within the planning authority of the Tulare County General Plan. The remaining western portion of the project area falls within the planning authority of the Kings County General Plan. General plans regulate the nature and extent of land development within their jurisdictions. Any land use changes, such as a change of designation from agricultural to residential use, must undergo a public review process and be approved by the Board of Supervisors for the appropriate county.

The Tulare County General Plan contains several smaller planning elements that address specific regions of the County. The Foothill Growth Management Plan (FGMP) has an area of influence which extends westward from Lake Kaweah to the base of the Sierra Nevada. The FGMP describes the goals of the region which includes Lake Kaweah and the surrounding land. Under existing conditions, some of the land within this corridor is suitable for development. However, 90 percent of the land around Lake Kaweah and the Kaweah River is already under intensive agricultural production and is mostly used for grazing. Limited parcels upstream of the dam are zoned as general commercial. Approximately 3,071 acres of land have been acquired by the Corps for Terminus Dam and Lake Kaweah. Land uses by the Corps for Terminus Dam and Lake Kaweah are allocated for project operations, intensive recreation, low-density recreation, and wildlife management. The area immediately adjacent to the gross pool elevation of Lake Kaweah is federally owned and is protected from private development. A few single family homes are located along the Kaweah River as it enters the reservoir.

Downstream Area

Existing and potential land uses on the valley floor extending to the western edge of the project area are addressed in a second component of the Tulare County General Plan. This component is known as the Rural Valley Lands Plan (RVLP) which has an area of influence from the foot of the Sierra Nevada westward to the Tulare/Kings County line. The primary objective of the RVLP is to preserve the agricultural viability of rural lands that are not currently zoned for urban expansion.

Land use downstream of Terminus Dam is closely tied to agriculture, especially as the land flattens and opens onto the San Joaquin Valley floor. Land use within the Kaweah River channels is designated open space and supports a variety of native and non-native riparian vegetation. Historically, riparian vegetation was distributed along the main waterways and secondary channels. Agricultural, urban, and industrial encroachment have eliminated the riparian corridors along most of the secondary channels, and have reduced the corridor to a narrow band along the main waterways. Most of the land bordering the stream channels is used for agricultural-related purposes.

Land within the city limits of the municipalities in the study area has either been developed for commercial use or supports dense and low-density residential housing. Any remaining open space within the city limits has been significantly disturbed by the surrounding community. The communities of Visalia, Tulare, and Hanford are rapidly expanding into the outlying agricultural areas. This trend will continue with or without the project.

Tulare Lakebed

The Tulare lakebed is located within the Kaweah River floodplain. The majority of the land within the lakebed is developed for agriculture. Flooding in the lakebed can occur from four major rivers in the area, the Kaweah, Kern, Kings, and Tule. Local flooding that occurs independently of, or simultaneous to, river flooding can also inundate the Tulare lakebed.

From the north, floodwater is conveyed from Lake Kaweah to the Tulare lakebed from the St. John's River into Cross Creek, then into the lakebed. Floodflows are also conveyed through the lower Kaweah River distributaries to Elk Bayou, then through the Tule River and into the Tulare lakebed. Once in the lakebed, floodwater is pumped into the south flood areas. These flood water storage areas encompass approximately 20,000 acres and have an aggregate storage capacity of 100,000 acre-feet. Flood water stored in these areas is later

used for crop irrigation. Land within the Tulare lakebed has minor irrigation rights to water behind Terminus Dam.

5.3.2 Alternatives 2 and 3

Kaweah Reservoir

The total land required for construction of the project alternatives would be 618 acres. This includes 243 acres between elevation 694' and 715'. This area would not be cleared prior to construction. Six residences and one motel would be relocated prior to project construction. Because most of the land around Lake Kaweah is already designated for intensive agricultural production or has been acquired by the Corps for project operations, recreation, and wildlife management, and because under with-project conditions the gross pool elevation will rise 21 feet, the proposed project would not cause growth-inducing impacts in the Kaweah Reservoir area.

The project alternatives would result in an increase in the extent of the floodplain around Lake Kaweah, the removal of existing structures and the transfer of private land with development potential to federal ownership. None of these factors would cause growth-inducing impacts in the Kaweah Reservoir area.

Downstream Area

The project alternatives would not bring additional water into the Kaweah River Basin; however, the increased storage capacity in the reservoir could be used to store additional water for irrigation during non-flood seasons. Under existing conditions, this additional water would eventually be flood water in the Tulare lakebed. The enlarged reservoir would reduce downstream flooding, and allow increased water storage. Proper timing and regulation of releases would convert the additional stored flood water into an irrigation supply. The additional average annual irrigation supply is estimated at 8,400 acre-feet. The members of Kaweah and St. John's Rivers Association own the rights to this water. The flow of the Kaweah River would continue to be allocated at the dam to each of the water right holders based on diversion, storage, and water right schedules. Allocation of irrigation supply would be based on inflow as measured at the dam and computed by the Corps. Operation of the dam and reservoir under the selected plan would decrease flows in the downstream distributaries, thereby decreasing flooding of adjacent agricultural lands and residential properties.

As of January 1, 1995, the population of Tulare County was 355,185 and the population of Visalia was 91,792. The State of California projects a population growth rate of 2.26 percent per year for Tulare County for the years 1990-2005,

and the City of Visalia 2020 General Plan projects a population of 165,000 by the year 2020. These population projections apply to both with and without project conditions. To accommodate the population increase within the project area, it is assumed that some conversion of agricultural and grazing land to urban development would occur. Such conversions would be regulated by the appropriate general plan.

Approximately 14 percent of the land within the water service area is urban, commercial and industrial, farmsteads and feedlots, roads, channels, and canals. Growth in Tulare County will continue both with and without the project. Currently, development is not prohibited in the floodplain, but it is restricted. One restriction is that properties must be elevated above the 100-year floodplain. The proposed project would provide flood protection to the urban area of Visalia to approximately the 70-year event. With-project conditions probably would not significantly increase subdivision development in what is now the current 100-year floodplain; however, development by individuals may increase due to the removal of the expense of satisfying FEMA requirements.

Comments from interested parties concerning the projections for the future of the study area based on increased water storage in Lake Kaweah, and a reduction in the downstream 100-year floodplain, indicate that implementation of the selected plan would not influence the growth rate, nor would it provide sufficient flood protection to encourage significant development of land removed from the existing 100-year floodplain.

Tulare Lakebed

The project alternatives would reduce the volume and duration of flooding in the Tulare lakebed, mostly from snowmelt flooding. The area flooded would decrease by 1,412 acres on an average annual basis, and the duration of flooding would decrease. The lakebed would continue to receive flood water from other major streams including the Kern, Kings, and Tule Rivers. The frequency of major flooding in the lakebed would remain the same; therefore, there is no incentive to develop land due to a reduction in flood frequency. At this time, all land in the lakebed that is suitable for agricultural conversion has been converted.

The Kaweah River contributes excess flood water to the lakebed only during flood events. Lakebed interests have a system of flood water storage; however, any excessive flood water inundates productive land. The proposed project offers no water supply benefits to the lakebed. Consequently, the proposed project would have no growth-inducing impacts in the Tulare lakebed area.

No adverse effects to land use, socioeconomics, transportation, air and water quality, fish and wildlife, vegetation, and endangered species would be caused by growth-inducing impacts, because implementation of the project alternatives does not involve growth-inducing effects.

5.4 SIGNIFICANT ADVERSE IMPACTS 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. Alternatives 2 and 3 would have significant unavoidable effects on the environment in the Kaweah Reservoir area and the Tulare lakebed.

At the reservoir, implementation of Alternatives 2 and 3 to raise the spillway by 21 feet would result in significant unavoidable impacts to vegetation and wildlife. Construction and subsequent increased inundation along the shoreline would result in the loss of 38 acres of oak woodland, 132 acres of blue oak savannah, 70 acres of riparian forest, and 92 acres of riparian scrub habitat. The loss of riparian, oak woodland/savannah, and wildlife habitat would adversely affect all wildlife populations that inhabit these areas either permanently or seasonally. Wildlife populations inhabiting these areas would be lost or displaced because of the increased inundation. Mitigation developed in coordination with FWS includes 21 acres for riparian scrub, 14 acres for riparian forest, 320 acres for oak savannah, and 99 acres for oak woodland.

One listed endangered wildlife species, the valley elderberry longhorn beetle, would be adversely affected around the reservoir by both alternatives. Three elderberry bushes would be inundated due to the project alternatives. Seasonal rains would cause water levels to rise, inundating the shrubs within the new gross pool area. Additionally, two bushes would be removed due to construction at Horse Creek. Therefore, the elderberry longhorn beetle habitat would be lost. Mitigation measures for the beetle are discussed in Section 4.

The primary impact of the project alternatives on traffic flow would be related to construction delays resulting from heavy equipment on project access roads during reconstruction of Horse Creek Bridge. Travelers would be delayed by the movement of construction materials and workers. Alternatives 2 and 3 would also significantly affect some recreation facilities. These facilities would be periodically inundated in the spring and summer months when the reservoir has reached gross pool. Approximately 75 percent of the visitation areas including

boating, camping, picnic areas, and parking access around Lake Kaweah would be affected by both project alternatives.

In the Tulare lakebed, 1,412 acres would be affected due to reduction in flooding in the lakebed. The adverse effects in the Tulare lakebed are related to the presence or absence of water for habitat. The volume of flood water that is stored in the flood storage areas and in the lakebed would be reduced due to the project alternatives, affecting critical habitat for migratory birds. Wetland mitigation would be done on 366 acres, which would be seasonally flooded.

5.5 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

In accordance with CEQA sections 21083 and 21087, 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 of effects should include 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 inundate about 410 acres at the reservoir to accommodate the additional storage space. This land would be permanently affected, and the beneficial use of the environment would change. Instead of providing terrestrial habitat for a variety of species, the land would now provide temporary habitat for aquatic organisms. Also, the additional storage space would be used for flood control and water supply, which is considered a beneficial use for the areas downstream of the reservoir. The areas that would be affected by construction alternatives would also undergo long-term changes in their environmental uses. These changes would also be associated with providing additional flood control and water supply. There would be no adverse effects that would pose a long-term risk to health and safety.

Project alternative effects at the Tulare lakebed include an incremental loss of flooded habitat. This loss would not constitute a change in beneficial use of the environment because the south flood storage areas would still receive floodwaters from the Kings, Tule, and Kern Rivers.

The need for additional flood protection and water supply has been documented in the Feasibility Report and Chapter 1 of this document. A full range of alternatives were analyzed for this study. The NED plan and locally preferred plan produced economic benefits in excess of project costs. On this basis, it can be concluded that both alternatives for flood control and water supply would be

feasible and a project should be implemented soon to avoid the risk of future flooding.

5.6 SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES ASSOCIATED WITH THE PROJECT

In accordance with CEQA 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 both alternatives which may be irreversible since a large commitment of these resources makes future removal or nonuse unlikely.

The primary irreversible commitment or resources associated with the Kaweah River Basin project alternatives would be the changes in land use around the reservoir. The land around the reservoir below the increased gross pool elevation would be inundated during the spring and winter. In addition, there are currently two selected mitigation areas that would change land use to wetlands and riparian woodland. There are no irreversible commitments associated downstream in the flood plain and/or detention basins in the Tulare lakebed.

Construction activities would involve the consumption of nonrenewable natural resources such as rock for rip rap at the new bridge, structural steel for bridge construction, aggregate and asphalt for road construction, concrete at the dam, and petroleum as fuel. The resources used in site preparation, material transportation, excavation, and disposal of excess excavated materials for dam construction 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 including the mitigation areas.

However, since the consumption or use of nonrenewable resources is relatively low for the project alternatives, no significant adverse impacts 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 improvement and other actions required to 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, including land acquisition and vegetative plantings, would be accomplished prior to or concurrent with construction. Mitigation measures are summarized in Chapter 2 and are presented in detail in Chapter 4.

Project effects associated with construction such as temporary effects to transportation, noise, air quality, and water quality would be mitigated by best management practices implemented during construction. No long-term monitoring is needed for best management practices, which are detailed in Chapter 4. The SHPO has confirmed the Corps' finding that no mitigation is needed for cultural resources. HTRW sites affected by the project must be remediated to meet the requirements of the EPA and applicable state regulatory agencies. The non-Federal sponsor is responsible for ensuring that the development and execution of HTRW actions are accomplished at 100 percent non-project cost. The mitigation and monitoring plans for vegetation, wildlife and endangered species are discussed in detail in Sections 5.7.1 and 5.7.2.

5.7.1 Mitigation

Mitigation would take place on 3 sites within the project area. Mitigation for vegetation and wildlife includes, 21 acres of riparian scrub-shrub habitat, 14 acres of riparian habitat, 419 acres of oak woodland/savanna habitat, and 366 acres of wetland habitat. The Corps and the non-Federal sponsor, would be jointly responsible for ensuring the implementation and success of the entire mitigation plan.

- **Riparian scrub-shrub** - this mitigation would provide 21 acres of riparian scrub-shrub habitat. The mitigation would take place on about 3 acres of land in the Greasy Creek area and 18 acres in the Horse Creek area at the reservoir. The mitigation would take place on Corps owned land within the reservoir boundaries. Plantings in the Greasy Creek area would be done adjacent to existing riparian areas and would be fenced to protect them from cattle grazing in this area. Plantings in the Horse Creek area would be in higher terrace areas of the reservoir. Habitat value in the Greasy Creek area is relatively low due to cattle grazing and reservoir fluctuations. Habitat values are moderate in the Horse Creek area since there are some existing stands of willow scrub in the area.

  These two sites were chosen for their ability to support riparian scrub vegetation. Suitable areas at the reservoir were determined by observing the location and inundation frequencies of existing riparian scrub. Land slope, elevation, and hydrology were also considered. Typical lands suitable for riparian scrub plantings have a relatively flat slope, occur at somewhat higher elevations at the reservoir, and have soils which are typically moist or

close to a perennial water source. The Greasy Creek area would consist of 2,200 lineal feet within the inundation zone of the reservoir (from about elevation 580 feet to 694 feet, m.s.l.). At Horse Creek, the area near the campground has suitable soil saturation from creek flow, and some stands of willows already occur in the area.

No site preparation would be necessary at either site. The mitigation areas would be planted with willow scrub (black willow) pole cuttings at the density of 177 per acre. The Greasy Creek site would be fenced to protect the plantings from cattle grazing. Supplemental irrigation such as pumping water from the reservoir would be used for the 3-year monitoring period. Additionally, mulching and/or weed fabric would be used, and there would be a plant survival success criterion of not more than 30 percent mortality in the first 2 years.

- **Riparian, Oak Woodland/Savanna** - this mitigation would provide 14 acres of riparian forest habitat and 419 acres of oak woodland/savanna habitat. The mitigation would take place on 433 acres of land adjacent to the Kaweah River downstream of Terminus Dam. The proposed site for the mitigation is currently owned by Lindsey-Strathmore Irrigation District and is made up of two parcels referred to as LSID Northwest and LSID Southwest. Currently, these sites are used as grazing land. Riparian plantings would be done adjacent to the river and oak plantings would be done on the upland portions of the study area.

The environmental restoration potential of these sites was evaluated in a recent study for the city of Visalia. Evaluation parameters included location within the flood plain, presence of alluvial soils current and historical habitat quality, and management (site preparation, planting, and maintenance) costs. Each site contains fine sandy loam soils and is located areas subject to relatively frequent flooding events. Existing habitat quality on each of the sites is similar and each site supports a narrow but significant corridor of riparian vegetation bordering the lower Kaweah River. Farther from the river, scattered oak trees grow at each site. Both sites are subject to cattle grazing, and all grassland and riparian understory vegetation show signs of disturbance from the grazing. At the time of analysis, it was uncertain whether these sites would be used for future restoration by the city of Visalia. Therefore, it was assumed they would remain in their present use.

The sites were chosen because significant riparian corridor expansion and oak tree regeneration opportunities are available at each site. The sites were rated as fair to good for restoration in the City's study, and

management costs would be low. Lands would be graded to increase overland flooding, and a channel would be created to connect with existing sloughs. Planting schemes include riparian - 141 plants per acre, oak woodland - 78 acorns and seedlings per acre, and oak savanna - 33 acorns and seedlings per acre. Typical species for the riparian plantings include box elder, oregon ash, black walnut, Fremont cottonwood, California Sycamore, red willow, arroyo willow, mule fat, California wild rose, and California blackberry. The plantings would be a combination of seedlings and pole cuttings.

Oak planting schemes would include planting both acorns and seedling plantings. Acorns would be harvested from local trees and planted the same year as harvesting. Species would include blue, valley, and interior live oak. Additionally, screen cages, weed fabric, and fertilizer tablets would be used for each planting. A detailed oak maintenance plan with remedial measures flexible to the requirements of the site would be developed, including a plant survival criterion of not more than 30 percent mortality during the first 2 years. Supplemental summer irrigation (pumped from the river) would also be needed for the 3-year monitoring period.

- **Wetland Mitigation** - this mitigation would provide 366 acres of seasonally flooded habitat. The mitigation would take place at a site within the KDWCD area in Kings County near the Corcoran Irrigation District. This site is currently in agricultural production and at the time of this analysis was available for sale. The ownership is unknown. Because of the current agricultural activities, there is no existing habitat value. This site was chosen because of its location within KDWCD sphere of influence, proximity to Corcoran Irrigation District recharge basins (within 1 mile), and the existing water delivery system and pumps. Additionally, the historical presence of two sloughs on the property indicate a potential that this land once supported seasonal wetland conditions. The non Federal sponsor expressed an interest in having potential mitigation land located within the KDWCD area, and this site fits that criterion. This site is located within 1 mile of the Corcoran Irrigation District ground water recharge basins. Consultation with DFG field personnel indicated that the southern pond is usually full of water and provides good shorebird habitat. When the north pond is full, it also provides habitat. Therefore, the potential mitigation site would be close to an area of existing waterfowl and shorebird habitat. Existing pumps and water delivery canals exist at this site, which means that these facilities will not have to be constructed. Historical conditions indicate that this area may have supported seasonal wetland habitat.

The plan for this mitigation site was based on a plan prepared by H.T. Harvey and Associates (1994) for Westlake Farms. The plan's designs include pond areas with islands for loafing and nesting, and open water areas for feeding. Water management has been designed to minimize water use. There would be 15 islands constructed for every 100 acres at the site. The islands would be 6 to 120 feet wide and vary in length up to several hundred feet. The island slope would be 8H:1V to 10H:1V with zero crown. Border dikes would also be constructed to divide the site into seven 20-150-acre "checks." The border dikes would also have 8H:1V to 10H:1V slopes, following the natural contours of the land. The site would be flooded with clean water (about 1,130 acre-feet) for 152 days each year from February to July. Average water depth would be 3 inches. Water control structures would be included for water recirculation. Cover would not exceed 20 percent iodine bush, and periodic maintenance for cattails and levees would be done when the ponds are dry. Monitoring would be done for 6 years.

- **Endangered Species** - the project alternatives would adversely affect one listed threatened species, the valley elderberry longhorn beetle. Five elderberry plants (the host plant for the beetle) would be adversely affected by the project. Three would be lost due to inundation and two would be removed before constructing the new Horse Creek bridge. Preliminary informal consultation with FWS was initiated for the 5 elderberry shrubs affected by the project. Mitigation was determined as described in the "General Compensation Guidelines for the Valley Elderberry Longhorn Beetle" dated February 26, 1993 prepared by the FWS. Mitigation would consist of 276 seedlings/cuttings planted on 2.1 acres of Corps property in the Horse Creek portion of the study area.

5.7.2 Monitoring

Mitigation for adverse project-related effects to vegetation and wildlife would be monitored after the mitigation measures have been implemented. Monitoring activities are shown in Table 5-1. The Corps and the non-Federal sponsor are responsible for performing maintenance activities during the monitoring period and for preparing the monitoring reports. Mitigation monitoring and monitoring reports will be based on the performance variables and success criteria described below. After the mitigation monitoring is completed, the non-Federal sponsor will prepare annual reports documenting the status of the mitigation sites. These reports will be provided to the Corps. For endangered species, mitigation planting and monitoring would be done as described in the "General Compensation Guidelines for the Valley Elderberry Longhorn Beetle" , Appendix C.

Performance Variables

The performance variables are based on the variables used in the HEP analysis to determine compensation needs for each habitat type. A monitoring report will be prepared in years 2 and 3 for the riparian scrub and riparian/oak mitigation. Reports will be prepared in years 2, 4, and 6 for the wetland mitigation. An additional monitoring report will be prepared in year 10 for all habitats. The monitoring report will address the variables listed below, and will provide an assessment of the progress of the mitigation site.

- Riparian scrub-shrub - number of tree/shrub species, percent canopy closure, average stand width.
- Riparian forest - average tree height, average canopy width, percent canopy closure, number of tree/shrub species, understory density.
- Oak woodland - tree diameter, trees per acre, percent oak trees, percent herbaceous ground cover, distance to cover, density of shrub understory, number of grey fox den sites per acre.
- Oak savannah - percent herbaceous ground cover, distance to cover, tree diameter, trees per acre, percent oak trees, height herbaceous vegetation, percent herbaceous cover, soil type, presence of logs and other cover.
- Tulare lakebed wetlands - duration of ponding, presence of edge habitat, water circulation.

Final Success Criteria

These criteria are provided to measure the success of the mitigation sites. When these criteria are achieved as a whole, the mitigation will be deemed successful.

- Riparian scrub-shrub - number of tree/shrub species - 1.25, percent canopy closure - 40 percent, average stand width - 50 feet.
- Riparian forest - average tree height - 45 feet, average canopy width - 100 feet, tree canopy closure - 35 to 65 percent, number of tree/shrub species greater than 4, understory density - 30 to 35 percent.
- Oak woodland - tree diameter - 6.43 inches, trees per acre - 57, percent oak trees - 100 percent, percent herbaceous ground cover - 88.3 percent,

distance to cover - 50 feet, density of shrub understory - 12.5 percent, number of grey fox den sites per acre - greater than 4.

- Oak savannah - percent herbaceous ground cover - 84.6 percent, distance to cover - 75 feet, tree diameter - 9.78 inches, trees per acre - 18, percent oak trees - 100 percent, height herbaceous vegetation - 7.9 inches, percent herbaceous cover - 92 percent, soil type - loam, presence of logs and other cover - yes.

- Tulare lakebed wetlands - duration of ponding - 152 days, presence or absence of edge habitat - presence, water circulation at the site - yes.

Monitoring methods

Line transects will be established at various areas through the mitigation sites. Performance variables such as height herbaceous vegetation, density of shrub understory and percent canopy closure will be measured from these transects. Photograph stations will also be established at various points in the mitigation site to document the progression of the mitigation site.

Annual Reports

Bi-annual reports documenting the performance variables and progress towards attaining the success criteria will be prepared jointly by the Corps and the non-Federal sponsor. Thereafter, the local sponsor will submit an annual report documenting the status of the mitigation site to the Corps.

Table 5-1
Monitoring Activities for Mitigation

	Riparian Scrub	Riparian and Oak Mitigation	Wetland Mitigation
Year 1	Initial planting, weed control, fencing, and irrigation.	Initial planting, screen cages, weed control, fencing, grading, supplemental summer irrigation.	Initial grading and planting, apply water.
Year 2	Plant replacement plantings as needed, weed control, irrigation.	Plant replacement plantings as needed, weed control, irrigation.	Maintain area.
Year 3	Plant replacement plantings as needed, weed control, irrigation.	Plant replacement plantings as needed, weed control, irrigation, remove screen cages.	Maintain area.
Year 3-6			Maintain area.

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 is in compliance with all laws, regulations, and Executive orders. Federal policy and legislative authorities governing Corps participation in recreation at civil works projects and how their application to the Lake Kaweah project are also included in Section 5.8.1.

5.8.1 Federal Requirements

National Historic Preservation Act of 1966, as amended (16 USC SEC. 470 ET SEQ.), Historic and Archeological Resources Protection Act (16 USC SEC.470AA ET SEQ.), Protection of Historic Properties (36 CFR 800), Abandoned Shipwreck Act (43 USC SEC. 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 area of potential effect 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 (Council) to develop alternatives or mitigation measures.

The Corps conducted archeological surveys of Corps lands at Lake Kaweah. The area of potential effect for the project alternatives contains one prehistoric site that the Corps has determined is not eligible for the National Register of Historic Places. The Corps has sought concurrence with that finding from the SHPO for the purpose of making a determination of no effect to historic properties from this action. The reply from the SHPO will be included in the final EIS/EIR.

Clean Air Act (42 USC SEC. 1857 ET SEQ. (1990), as amended and recodified, 42 USC SEC 7401 ET SEQ. (SUPP II 1978))

Coordination has been conducted with the California Air Resources Board, San Joaquin Air Management District, and local City and County air quality authorities. The EIS/EIR summarizes the project's effects on local and regional air quality in Section 4.8. The section discusses the issues relative to the project's compliance with the State Implementation Plan for air quality. The project will provide mitigation for direct effects. No mitigation for indirect effects is needed.

Clean Water Act 33 USC SEC. 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 USC SEC 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 and indicated that the only listed species adversely affected by the proposed project would be the valley elderberry longhorn beetle. Preliminary consultation with FWS was initiated. Mitigation for impacts to the beetle was formulated according to FWS guidelines and is included in the BDR/BA. Mitigation includes 276 elderberry shrub plantings on 2.1 acres of Corps property at the Horse Creek area. A biological opinion is expected from the FWS in 1996.

Federal Water Project Recreation Act (16 USC SEC. 460L-5, 460L-12 ET SEQ., 662)

This act requires Federal projects to consider features which would lead to enhancement of recreational opportunities.

Fish and Wildlife Coordination Act (16 USC SEC 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 and non-Federal sponsor 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 or modify or supplement plans for previously authorized projects. 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 Coordination Act Report prepared by FWS is included in Appendix A. The incremental analysis prepared by the Corps describing the justifiable mitigation measures is in Appendix B.

National Environmental Policy Act (42 USC SEC. 4321 ET SEQ.)

This act requires the full disclosure of the environmental impacts, alternatives, potential mitigation, and environmental compliance procedures of the selected project. The draft EIS/EIR provides partial NEPA compliance. The final EIS/EIR will provide responses to public comments on the draft EIS/EIR. A Record of Decision will complete the environmental documentation required by the act.

Wild and Scenic Rivers Act (16 USC SEC. 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 (100-year) flood plain (unless such development is the only practicable alternative); (2) reduce the hazards and risk associated with floods; (3) minimize the impact 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 Kaweah River Basin Investigation is in compliance with this Executive Order.

The project provides 100-year flood protection to a portion of the Visalia area downstream of Terminus Dam. Currently, any flooding that occurs downstream is shallow (1 to 2 feet) sheet flooding. A standard foundation currently elevates buildings above the 100-year flood plain. Current growth projections for Visalia were determined to be the same for with- and without-project conditions. Therefore, the project would not be inducing any development in the base flood plain. Local entities with oversight of development activities downstream comply with State-mandated resource protection including the State's

Endangered Species Act. Accordingly, the natural and beneficial values of the downstream 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. This project is in compliance with this Executive Order.

Construction of either of the project alternatives would not adversely affect any wetlands in the reservoir area. By providing flood protection to the agricultural areas at Tulare Lakebed, an incremental loss of floodwater occurs. Floodwaters from the Kern, Kings, Tule, and Kaweah Rivers that reach the Tulare lakebed provide habitat for wetland species such as waterfowl and shorebirds. These habitat areas are not considered jurisdictional wetlands as defined by the Corps regulatory guidelines. Mitigation is provided for the incremental loss of floodwater from the Kaweah River due to the project. The mitigation is described in Sections 4.10.3 and 5.7.

Farmland Protection Policy Act (7 USC Section 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 Natural Resources Conservation Service (U.S. Soil Conservation Service) with project maps and descriptions to assess impacts on prime and unique farmlands. The Natural Resources Conservation Service completed its analysis and responded with a Farmland Conversion Impact Rating letter. A discussion of the analysis and impact is included in Section 3.2.5.

Recreation

Legislation

Flood Control Act of 1944 (P.L. 534), Section 4

As amended by the 1962 Flood Control Act, this act authorized the Chief of Engineers "... to construct, maintain and operate public park and recreational facilities at water resources development projects under the control of the Secretary of the Army, and to permit the construction, maintenance and operation of such facilities." This act has been viewed as a continuing authority, and provided the basis for construction of lake access points, parking areas, picnic sites, and similar recreation improvements at all older (pre-1960's) Corps projects.

However, the act did not provide guidance or directive for evaluating the economics of recreation as a project purpose. The Corps has since recognized long-term recreational development as a full-scale project purpose on an equal basis with other established purposes of water resources development.

Federal Water Project Recreation Act of 1965 (P.L. 89-72), as amended

This act reestablished recreation as a full project purpose, directing that "... in investigating and planning any Federal navigation, flood control, reclamation, hydroelectric, or multipurpose water resource project, full consideration shall be given to the opportunities, if any, which the project affords for outdoor recreation." The act also placed additional requirements on recreation as a project purpose, defining the basis for sharing the financial responsibilities in joint development, enhancement, and management of recreation and fish and wildlife resources of Federal water projects.

National Environmental Policy Act (P.L. 91-190)

This law requires that full consideration be given for the entire range of impacts of a Federal project on man's environment, including opportunities for healthful outdoor recreation. This includes both opportunities foregone as well as those enhanced to preserve a high quality of life for current and future generations.

Water Resources Development Act of 1986 (P.L. 99-662)

This act basically reinforces previous law, particularly P.L. 89-72, regarding recreation cost sharing.

Other

Examples of legislation indirectly affecting Corps and Federal involvement in recreation development include the Fish and Wildlife Coordination Act, Clean Water Act, Endangered Species Act, Wild and Scenic Rivers Act, Americans with Disabilities Act, and various historic preservation acts.

Corps and Federal Recreation Policy

Principles, Standards and Procedures, 1979

In December 1979, procedures to evaluate the National Economic Development benefits for recreation were published by the Water Resources Council. Benefits for recreation should generally be based on a willingness-to-pay principle using the established procedures. Only net benefits, or the value of the

gains minus the value of losses, can be considered. Evaluation methods included Travel Cost, Contingency Valuation, and Unit Day Value. The Travel Cost and Contingency Valuation methods were preferred, with the Unit Day Value method acceptable on small projects, which include those with estimated annual visitation less than 500,000 and specific recreation costs less than 25 percent of the total project cost. Site specific use estimating models are quite involved and very expensive. The Unit Day Value method is less complex and relies on assigning points to various recreation criteria, including quality of the experience, accessibility, and competing opportunities. The 1979 report of standards was replaced in 1983 by Principles and Guidelines.

Principles and Guidelines, March 1983

This update of Principles, Standards, and Procedures made only a few significant changes in the recreation evaluation procedures. The projected visitation range was raised to 750,000 to apply Unit Day Values.

National Economic Development Procedures Manual - Recreation, Volumes I through IV

The primary purpose of the reports is to provide an expanded description of the recreation evaluation procedures recommended in Principles and Guidelines. The manual describes methodologies for valuing changes in recreation use values quantitatively and qualitatively.

ER 1105-2-100, Policy and Planning, 28 Dec 1990

Chapter 4, Section VI, of this regulation discusses recreation as a project purpose at civil works projects. The regulation cites the various legal authorities and supplements these laws with current Corps interpretation and policy.

Recreation developments may be cost shared on project lands acquired by the local sponsors for the project without recreation. Only additional lands for access, parking, sanitation, and health and safety are eligible for recreation cost sharing.

Chapter 6, Section VIII, of this regulation establishes forth the current procedures for evaluating the beneficial and adverse effects of a water resources project on recreation and national economic development. The section describes evaluation methods and provides instructions on using the latest accepted methodologies for determining recreation use and values for with- and without-project conditions.

ER 1165-2-400, Water Resource Policies and Authorities - 9 Aug 1985

This regulation cites historic legislation and authorities applying to recreation development at Corps civil works projects. The regulation points out that participation in recreation should be limited to features that take advantage of opportunities created by the Corps project. The regulation further states that it is a Corps program objective to fully consider and capitalize on the recreation potential for the benefit and enjoyment of the public on a sustained basis. Plans will respond to the public needs, consistent with local and regional plans, and be fully coordinated with the local sponsor.

EP 1165-2-1, Corps of Engineers Policy Digest - 15 Feb 1989

This policy digest restates most of the authorities, policies, and guidance discussed previously. Paragraph 17-4 states that use projections should follow the methods contained in Principles and Guidelines, and benefits be measured in terms of willingness-to-pay.

Memorandum For: Chief of Engineers, 2 June 1976, Policy for Recreation Facilities at Local Flood Protection Projects

This policy statement emphasized that P.L. 89-72 requires that full consideration be given to recreation at local flood control projects when a non-Federal sponsor is willing to meet cost-sharing requirements. The policy pointed out the desirability to capitalize on the day use recreation opportunities of public lands in urban areas.

Memorandum For: Major Subordinate Commands and District Commands, 21 October 1992, Policy Guidance Letter No. 36

Current budget constraints and the intense competition for Federal funds dictate austerity in the planning and design of recreation facilities at civil works projects. The guidance further states the philosophy that if the benefits are vendible (the type usually provided by private enterprise), then the facility should be provided by others.

5.8.2 State Laws, Regulations, and Policies

This section discusses the relationship of the selected plan to applicable California environmental requirements. Many of the following requirements were identified by the Office of Planning and Research as potential project clearance points (Nunenkamp, November 1990). Others were obtained via personal communications with agency personnel.

California Environmental Quality Act

This document will be adopted as a joint EIS/EIR and will fully comply with NEPA and CEQA requirements.

Kaweah Delta Water Conservation District

As the representative non-Federal sponsor of the Kaweah River Basin Investigation, KDWCD has primary responsibility for the CEQA review process and project review. KDWCD will likely contract with a State agency such as the DWR/Reclamation Board for the primary responsibility for the CEQA review process and project review.

Department of Water Resources, Division of Safety of Dams

As the responsible agency for ensuring the safety of non-Federal dams and reservoirs, the DWR's dam safety division approves plans and specifications to construct dams and reservoirs after completion of the appropriate environmental documentation and review process.

The DWR's jurisdiction extends to artificial barriers impounding or diverting water that are or would be (1) capable of impounding at least 50 acre-feet of water and (2) at least 25 feet high (measured from the bed of the watercourse at the downstream toe of the barrier to the maximum water storage elevation for natural stream channels and from the lowest outside elevation to the maximum water storage elevation for barriers not constructed across stream channels).

Permits or Approvals Required

The Division of Safety of Dams issues a Certificate of Approval for any dam construction or enlargement plans after a determination that the selected project could safely impound water. Because Terminus Dam is a Federal dam, it is not within the State's jurisdiction and would not require a Certificate of Approval from the Division prior to construction. Nonetheless, Division engineers and geologists would review plans and specifications for proposed dam construction to determine whether the design meets acceptable modern engineering practices and Division dam safety standards.

State Water Resources Control Board, Division of Water Quality, and the California Regional Quality Control Board, Central Valley Region

The State Water Resources 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

No permits for the proposed project would be needed because none of the project activities would adversely affect water quality.

State Water Resources Control Board, Division of Water Rights

This agency issues permits for the appropriation of water resulting from storage or diversion. The appropriation must be related to a beneficial use.

Permits or Approvals Required

Currently, all of the water from the Kaweah system is fully appropriated. Since no "new" water is being developed by the project, no new permits for the appropriation of water would be needed.

California Department of Fish and Game, Region 4

Generally, the DFG administers the State laws providing protection of fish and wildlife resources. The DFG administers the California Endangered Species Act 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 DFG requires a Stream Alteration Agreement for any activity that will change the natural state of any lake river, or stream in California. The agreements are issued by the DFG's regional offices and are intended to minimize impacts, protect fish and wildlife habitat, and ensure the best operation practices (for example, erosion control and revegetation). Since the selected plan will be a Federal project authorized by Congress, there is no need to obtain a Stream Alteration Agreement. However, protection of fish and wildlife resources will continue to be coordinated with the DFG.

KDWCD as the non-Federal sponsor has initiated coordination with the DFG as required under the State Endangered Species Act. This coordination is being done through the DWR, San Joaquin District. Completion of the biological

resources analysis to the satisfaction of the DFG will satisfy this requirement. The analysis is included in Section 4.12 and Appendix C.

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, Div. 2, Chapter 9, Sec. 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 the Surface Mining and Reclamation 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. KDWCD 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 4.13.

Permits or Approvals Required

Actions ensuring compliance with Section 106 of the National Historic Preservation Act of 1966, are detailed in Section 4.13.

State Lands Commission

In addition to such State-owned lands as parks and State highways, the State Lands Commission has exclusive jurisdiction over all ungranted tidelands and submerged lands owned by the State and the beds of navigable rivers, sloughs, and lakes (Public Resources Code, Section 6301). State ownership extends to lands lying below the ordinary high-water mark of tidal waterways and below the low-water mark of nontidal waterways (Civil Code, Section 830). The area between the ordinary high and low water on nontidal waterways is subject to a "public trust easement."

Permits or Approvals Required

A project cannot use these State lands unless a lease is first obtained from the State Lands Commission. Projects such as bridges, transmission lines, and pipelines fall into this category. The Commission also issues separate permits for dredging. The KDWCD will coordinate with the State Lands Commission for any necessary leases.

California Department of Transportation (Caltrans), District 6

Caltrans is responsible for ensuring the safety and integrity of the State of California's highway system.

Permits or Approvals Required

Under California law, any relocation or realignment of a State highway must be approved by the California Transportation Commission. The non-Federal sponsor of the proposed project will coordinate the realignment of State Highway 198 with Caltrans.

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 jurisdiction of the Tulare and Kings County 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 San Joaquin Air Quality Management District. The District determines whether project emission sources and levels significantly affect air quality, based on Federal standards established by EPA, and the California Air Resources Board. The District would first issue a permit to construct, followed by a permit to operate, which would 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 FWS RECOMMENDATIONS

The FWS submitted a draft CAR for the Kaweah River Basin Investigation in January 1996. The entire Conclusions and Recommendations section from that CAR is presented below, and Corps' responses to the general recommendations follow each recommendation.

> It is the Service's view that this project would significantly impact fish and wildlife resources in the immediate vicinity of Lake Kaweah, and in areas downstream. We project that habitat values for fish and wildlife would be reduced as a result of reduced flooding, and increased availability and use of water for agriculture. Most adverse impacts appear to be mitigable should either the NED or locally-preferred plans be implemented.
>
> The Service's Mitigation Policy defines mitigation as including the following elements: avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts. The Service considers these elements to represent the most desirable sequence of steps in the mitigation planning process. In determining when to move from any one element to the next in the sequence, success or failure of particular techniques or approaches in the past under similar circumstances (as reflected in the results of previous mitigation evaluation studies) are taken into account.
>
> The recommendations to offset impacts from the project contained within this section constitute what the Service believes, from a fish and wildlife resource perspective and consistent with our Mitigation Policy, to be the best present recommendations for the project, based on the information presently available to us. Nevertheless there are some clear deficiencies. For example, the hydrological information, particularly for the Tulare Lakebed area, is likely to be inaccurate simply because it is based only on hydrological simulations, which likely do not adequately reflect the complex actual hydrological conditions in the Tulare Basin. Therefore, we may later update and refine our analyses and mitigation recommendations if and when additional or alternative date (or comments on this draft report) are received.

Moreover, the outcome of any new or renewed consultations, as required under Section 7 of the Endangered Species Act, could also affect the recommendations given herein. thus, the Service will not be issuing its final CAR until the Corps has demonstrated full compliance with Section 7.

The Service's preferred and most-sought choice for mitigation of impacts from this project is to avoid them altogether. Such avoidance mitigation could be accomplished as follows: 1) constructing new water storage areas and flood diversions structures in the Kaweah Basin and Tulare Lakebed; and 2) providing for full use of existing flood storage areas, including the Creighton Ranch and South Wilbur and Hacienda areas. These water storage areas could provide multiple-use benefits as warm-water fisheries and migratory waterfowl and shorebird habitats. The water storage areas would not provide as much flood protection the city of Visalia; however, the proposed alternatives also both provide relatively low (about 70-year) levels of flood protection.

5.9.1 General Recommendations

FWS Comment

Reevaluate fully both the need for the project and the type of alternatives considered for achieving the intended objectives. Because of the magnitude and extent of fish and wildlife losses and problems in the region, a broader, more integrated approach to flood control and water management within the Tulare Basin, such as the Kaweah River Corridor study, may be appropriate.

Corps Response

The Corps and the non-Federal sponsors of the project, KDWCD, City of Visalia, Tulare County, and Kings County, have thoroughly considered all alternative plans. The project proponents have selected the NED plan to provide additional flood control and irrigation water supply. Flooding problems downstream of Terminus Dam still exist due to revised hydrological information, unexpectedly high amounts of precipitation and sediment that have entered the reservoir. Additionally, the Kaweah ground water basin experiences ground water overdraft, and additional flexibility to manage the water supplies in the basin is needed. A full range of alternatives has been examined throughout the reconnaissance and feasibility phases of the project. Full mitigation, to the extent practicable, has been provided for the NED plan. Therefore, the non-Federal sponsors and the Corps believe that the NED plan would meet the purpose and need for the project, that is, additional flood control and water supply.

FWS Comment

Conduct a basin-wide review of cumulative impacts of the Kaweah, Lake Success, and Pine Flat projects to determine: a) impacts currently imposed by water projects on fish and wildlife resources of the Tulare Basin, San Joaquin River, and Sacramento-San Joaquin Delta; and b) potential cumulative impacts of the various proposed major water development projects in the southern San Joaquin Valley. Or, at a minimum, provide for the Service to complete such cumulative impacts analyses, detailed data describing the hydrological changes expected to occur downstream of the Corps' proposed Success and Pine Flat Dam projects. Such data must include changes expected in the Tulare Lakebed and Basin.

Corps Response

Cumulative effects of the project are described in Section 5.2 of the EIS/EIR. The Tule River Feasibility Investigation was initiated in 1988 and was suspended in 1992 pending the outcome of seismic safety studies of the dam. Currently, there is no schedule to restart the study. Two environmental restoration projects have been proposed for Pine Flat Dam. One project would allow water releases from the reservoir when the power plant is not running and the other project would restore Avocado Lake. Neither of these projects is expected to adversely affect flows to the Tulare lakebed. The Pine Flat Dam Fish and Wildlife Habitat Restoration Feasibility Study will evaluate the potential to improve fish and wildlife habitat in the Pine Flat Dam area and the lower Kings River System. No long-term adverse effects are likely to occur from this feasibility study. Therefore, the Corps does not expect significant cumulative effects from the Tule River or Pine Flat studies. However, if during the environmental studies for Tule River and Pine Flat, cumulative effects are identified, appropriate studies would occur at that time.

FWS Comment

Include in any report of the Corps of Engineers for this project the conservation and development of fish and wildlife resources among the purposes for which the project is to be authorized.

Corps Response

The Kaweah River Basin Investigation was authorized by the 1964 Congressional Resolution of the House Committee on Public Works. Conservation and enhancement of fish and wildlife resources is not an authorized project purpose. However, according to WRDA 1986, the Corps does have authority to

add environmental restoration as a project purpose. A non-Federal cost-sharing partner is required for all environmental restoration projects. For the existing Kaweah River Basin Investigation, the Corps and non-Federal sponsor would provide mitigation for all significant environmental impacts including fish and wildlife resources.

FWS Comment

Incorporate the following language in the recommendations of any report of the of the Corps of Engineers for the project:

> "Additional studies of fish and wildlife resources affected by the project be conducted, as necessary after the project is authorized, in accordance with Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.); and such reasonable modifications be made in the authorized project facilities and operations as may be agreed upon by the Director of the U.S. Fish and Wildlife Service and the Chief of Engineers for the conservation, improvement, and the development of these resources."

Corps Response

Section 2 of the Fish and Wildlife Coordination Act has been complied with in the coordination and preparation of this EIS/EIR. Compliance with the Fish and Wildlife Coordination Act would continue through the preconstruction and engineering and design phase of the project as necessary. If there are significant changes in the features of the project that would necessitate a supplemental environmental document, coordination would be initiated with the FWS.

FWS Comment

To protect reservoir fishery resources, implement the Locally Preferred Plan instead of the NED plan.

Corps Response

Current Corps Headquarters policy is that the plan that maximizes the net flood control benefits will be selected for project authorization. Therefore, the NED plan will be recommended for authorization.

FWS Comment

Address any impacts (to listed and non-listed species) resulting from project-induced agricultural or urban development within the appropriate environmental documentation for this project. Initiate the appropriate consultation with the Service, as required under the Endangered Species Act, for such potential effects on listed species.

Corps Response

The EIS/EIR evaluates project effects to listed and non-listed species. This evaluation includes direct and indirect effects. Section 4.2 analyzes potential land use changes due to the project and concludes that urban expansion is currently proceeding without the project and would continue in the future with or without the project. Endangered species coordination has been initiated for direct project-related effects to listed species.

FWS Comment

Avoid impact to any riparian and other wetland vegetation at the currently proposed disposal and staging areas.

Corps Response

The disposal site has been changed from its original location. Material would be disposed on the downstream dam face to avoid riparian vegetation impacts. The construction staging areas are located in non-native grassland areas which would be reseeded after use.

FWS Comment

Mitigate the degradation of 70 acres of riparian forest habitats by replanting 14 acres of native woody riparian species as described earlier in this report at the LSID compensation areas, or equivalent sites approved by the Service.

Corps Response

Riparian forest mitigation would take place on 14 acres as described in the EIS/EIR at the LSID compensation areas or equivalent sites coordinated with FWS.

FWS Comment

Mitigate the losses of 10 acres of riparian scrub habitat by replanting 21 acres with willow pole and cottonwood pole cuttings within the inundation zone of the reservoir, as described earlier in this report.

Corps Response

Mitigation for riparian scrub habitat losses would take place on 21 acres as described in the EIS/EIR on Corps owned reservoir lands.

FWS Comment

Mitigate the losses of 38 acres of oak woodland and 132 acres of oak savannah by replanting 99 and 320 acres of oak woodland and savannah, respectively, at the LSID compensation areas, or equivalent sites (s) approved by the Service, as described earlier in this report.

Corps Response

Oak woodland habitat would be mitigated on 99 acres and oak savannah habitat would be mitigated on 320 acres as described in the EIS/EIR at the LSID sites or at equivalent area(s) coordinated with FWS.

FWS Comment

Mitigate losses of waterbird habitats in the Tulare basin by creating 366 acres of new spring/summer wetlands habitat as described earlier in this report. These wetlands must function from February 15 to July 15 annually and be supplied with appropriate contaminant-free water.

Corps Response

Mitigation for losses of waterbird habitats in the Tulare lakebed would done by creating similar waterbird habitat on 366 acres in the vicinity of the lakebed as described in the EIS/EIR. Site selection for the mitigation would be coordinated with FWS.

FWS Comment

Develop detailed mitigation, monitoring and remedial action plans for each mitigation action and site. Coordinate all phases of mitigation plan development and implementation with the Service and California Department of Fish and Game.

Corps Response

A mitigation and monitoring program has been developed and is included in the EIS/EIR. A final mitigation and monitoring plan would be developed in conjunction with the non-Federal sponsors and coordinated with FWS and DFG after project authorization.

FWS Comment

Seek and initiate a cooperative restoration effort, as agreed upon by the Secretary of the Army and the Secretary of the Interior, for this and other Corps projects (Success Reservoir and Pine Flat Dam) to further the goals of the North American Waterfowl Management Plan of May 14, 1986.

Corps Response

The Corps can participate in environmental restoration projects as outlined in WRDA 1986. Environmental restoration projects require a non-Federal cost-sharing sponsor. If an environmental restoration project with a non-Federal sponsor is formulated in the preconstruction engineering and design phase of this project, the Corps could consider participating.

FWS Comment

Provide guaranteed, adequate annual water supplies to the Kaweah Oaks and Creighton Ranch Preserves at the appropriate time of year to maintain riparian, wetland, and oak woodland habitats.

Corps Response

The proposed project does not adversely affect water supplies to the Kaweah Oaks or Creighton Ranch Preserves. Therefore, the project would not include providing annual water supplies to either site.

FWS Comment

All trees (especially oaks) removed from the new inundation zone should be used to enhance wildlife habitat. The limbs should be retained for brush piles in areas where cover is limited for smaller wildlife species. The trunks should be retained for cavity nesting birds, or perching and basking sites in riparian pond areas for species such as western pond turtle and cormorant. No trees should be harvested for human uses.

Corps Response

The proposed new inundation zone would not be cleared of vegetation before the project is implemented. The trees would be left in place to provide habitat for cavity nesting birds and as perching and resting sites near the water. No trees would be harvested for human uses.

FWS Comment

The loss of bald eagle roost trees should be mitigated by the installation of artificial roosts scattered around the reservoir site.

Corps Response

The trees in the new inundation zone would not be removed and would provide roosting habitat for bald eagles and golden eagles.

5.10 PUBLIC INVOLVEMENT

Throughout the study, the Corps has coordinated closely with the non-Federal cost-sharing sponsor, the KDWCD. During the reconnaissance phase of study, a study management team was formed, which consisted of representatives from the cost-sharing partners. This team met about once a month. 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.

5.10.1 Scoping

An initial public workshop in March 1986 was followed by a public meeting in March 1987 to inform people of the progress and results of the reconnaissance phase of the study. A notice of initiation of the feasibility study was circulated in

March 1988 to solicit public comments on the study. A public meeting was held following circulation of the draft report for public comment.

5.10.2 Comments on the DEIS/EIR

The notice of availability for the draft EIS/EIR was published in the Federal Register on June 28, 1996. Public workshops and opportunities to provide comments included:

- A public workshop in Three Rivers, California on July 22, 1996
- A public workshop in Visalia, California on July 23, 1996
- A public hearing in Visalia on July 23, 1996

Both verbal and written comments could be provided at these meetings. All comments received by August 27, 1996, were incorporated into this final EIS/EIR in Appendix G.

The major issues and concerns identified during the comment period included:

- Support of the LPP over the NED plan
- Inundation of the recreation facilities by the project
- Addition of a permanent minimum pool to the reservoir
- Continual buildup of sediment in the reservoir
- No replacement of recreation facilities affected by the project
- Evaluation of dredging as a project alternative
- Use of Federal funds for flood control and irrigation water supplies

The comments received at the public meetings and during the public comment period are addressed in Appendix G.

5.10.3 Intended Uses of the Final EIS/EIR

In April 1987, the Corps completed an Environmental Assessment of the project study area. Several potentially significant adverse effects were identified, and an environmental impact statement was deemed necessary, pursuant to CEQA regulations for implementing NEPA procedural provisions [40CFR 1502.4, 1508.18, and 1508.28]. The KDWCD, as the non-Federal lead agency for the study, required preparation of an environmental impact report, pursuant to CEQA [Section 21200]. The draft EIS/EIR was prepared to satisfy both Federal and State environmental reporting requirements, pursuant to Section 40 CFR 1506.2(b) of NEPA implementation regulations and Section 21083.5 of CEQA.

Other Required Disclosures

Under CEQA, an Initial Study is prepared to determine whether to prepare a negative declaration or an EIR and to identify impacts to be analyzed by an EIR. The Environmental Assessment, 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 impacts, feasible mitigation measures, and additional public notices. Under NEPA, economic impact analysis, particularly benefit-cost studies, are required, but these studies are optional under CEQA. Additionally, 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 final EIS/EIR is an informational document. Its purpose is to inform public agency decision-makers 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 NEPA Regulations, Section 1502.1). Under 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."

The draft EIS/EIR was circulated for agency and public review and comment in June 1996. Comments and responses have been incorporated into Appendix G of the final EIS/EIR. The final EIS/EIR will be circulated for agency and public review and comment in September/October 1996.

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 KDWCD, which functions as a "responsible agency" [CEQA Guidelines, Section 15381] and which represents the interests of the affected city and county governments. The KDWCD may contract with a State agency such as the California Department of Water Resources to act, for CEQA purposes, as the project's "lead agency" [CEQA Guidelines, Section 15367] and to 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 the California Department of Transportation and State Water Resources Control Board, Division of Water Rights, may be necessary to obtain permits or approvals. The non-Federal sponsor of the proposed project would coordinate an approval with the California Department of Transportation for the realignment of State Highway 198. The State Water Resources Board, Division of Water Rights, issues permits for the appropriation of water resulting from storage or diversion.

5.10.4 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 scoping 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 Calvin Dooley
- Honorable George P. Radanovich
- Honorable William M. Thomas

California Senate
- Honorable Dick Monteith

Honorable Ken Maddy
Honorable Jim Costa
California Assembly
Honorable Cruz Bustamante
Honorable Trice Harvey
Honorable Charles Poochigian
Honorable Brian Setencich

UNITED STATES GOVERNMENT DEPARTMENTS AND AGENCIES

Department of Energy
Federal Energy Regulatory Commission
Division of NEPA Affairs
Department of the Interior
Bureau of Indian Affairs
Fish and Wildlife Services, Division of Ecological Services
Fish and Wildlife Services, Endangered Species
Geological Survey
Office of Environmental Project Review
Bureau of Reclamation
Bureau of Land Management
Sequoia and Kings National Parks
Advisory Council of Historic Preservation
Department of Agriculture
Natural Resources Conservation Service
(Soil Conservation Service)
Agricultural Stabilization and
Conservation Service
Forest Service
Department of Labor
Manpower Administration
Department of Transportation
Federal Highway Administration
Council on Environmental Quality
Environmental Protection Agency
Federal Emergency Management Agency

STATE OF CALIFORNIA GOVERNMENT AGENCIES

State of California
Office of Historic Preservation
Office of Attorney General
Department of Justice

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 Forestry and Fire Protection
  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 Boards of Supervisors
  Kings County
  Tulare County
Mayor of Visalia
Mayor of Tulare
Chamber of Commerce
County Flood Control District
County Public Works Administration
Public Utility District
Visalia City Hall
County Planning Department
County Water Advisory Committee
County Library
Irrigation and Water Districts

ORGANIZATIONS

American Whitewater
Audubon Society
California Native Plant Society
California Wildlife Federation
Kaweah Marina
Kaweah Flyfishers
Kaweah Rollers Kayak Club
San Joaquin Paddlers
Sierra Club
The Nature Conservancy
Tulare County Farm Bureau
Trout Unlimited

CHAPTER 6.0

LIST OF PREPARERS

Name/Expertise	Experience	Role in Preparation
Felicia Altamimi Biological Science Environmental Manager	4 years environmental planning, Corps of Engineers	Report preparation and editing
Thomas Bonetti Biological Science Environmental Manager	3 years environmental and recreational planning, Corps of Engineers	Recreation analysis
Clu Cotter Environmental Specialist III	3 years environmental planning, DWR	Endangered species survey
Chris Davis Environmental Planner	7 months environmental planning, Corps of Engineers	Report preparation
Elizabeth Davis Social Science Environmental Manager	10 years environmental planning, Corps of Engineers	Socioeconomic analysis
Jerry Fuentes Historian/Social Science	5 years environmental planning, cultural resources management, Corps of Engineers	Historical and cultural resources analysis and coordination
Paula Landis Associate Engineer	8 years water management and planning, Department of Water Resources	Report preparation
Jenny Marr Environmental Specialist	4 months environmental specialist, Department of Water Resources, 3 years environmental planning, California Department of Transportation	Report preparation
Sannie Osborn Chief, Environmental Analysis Section	13 years environmental planning, cultural resources management, Corps of Engineers	Report review and editing
Mark Pelz Ecology Environmental Manager	2 years environmental planning, Corps of Engineers	Cartography and report review
Jane Rinck Biological Science Environmental Manager	8 years environmental planning, Corps of Engineers	Report preparation and editing
Lynne Stevenson Technical Writer/Editor	9 years planning studies, Corps of Engineers; 10 years professional librarian	Report review and editing

CHAPTER 7.0

REFERENCES

Beaufort, Dan. June 22, 1995. Personal Communication. Wildlife biologist, U.S. Fish and Wildlife Service. Sacramento, CA.

California Air Resources Board. 1993. California Air Quality Data: Summary of 1993 Air Quality Data Gaseous and Particulate Pollutants. Sacramento, CA.

_____. 1995. Air Designations for State and National Ambient Air Quality Standards: Designation and Classification, San Joaquin Valley Air Basin Federal and State Criteria Pollutants. Fresno, CA.

California Code of Regulations. Title 22, Environmental Health, Chapter 15, Articles 4-8.

California Department of Fish and Game (DFG). 1985. Information Leaflet: Bald Eagles in California.

California Department of Fish and Game. 1990. California's Wildlife: Vol. II Mammals. Sacramento, CA.

_____. 1991. Department of Fish and Game's record and files. Sacramento, CA.

California Department of Food and Agriculture. 1985. Agricultural Sources of DDT Residues in California's Environment. Sacramento, CA.

California Department of Water Resources (DWR). 1989. Draft Los Banos Feasibility Report. State Water Project. Sacramento, CA.

_____. 1991. Report on Geology and Mining Activity Studies for Kaweah River Basin Feasibility Investigation. Sacramento, CA.

_____. 1991. Vegetation Report Dry Creek Reservoir Site and Enlarged Kaweah Reservoir.

References

_____. 1992. Hydrology Studies for Tule River Basin Investigation. Unpublished data.

_____. 1994. California Water Plan Update: Bulletin 160-93. Vol 1 & 2. Sacramento, CA.

California Employment Development Department. 1989. Annual Planning Information, Tulare County, CA.

_____. 1989. Annual Planning Information, Kings County, CA.

California Environmental Quality Act (CEQA) Statutes and Guidelines. 1986. Office of Planning and Research. Sacramento, CA.

Camp, Dresser, and McKee in association with KAS Consultants. 1993. Kaweah River Delta Corridor Enhancement Study, Part One-Water Resources.

CEQA Air Quality Handbook. 1992. South Coast Air Quality Management District. Diamond Bar, CA.

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Plants of California.

Cogswell, Howard L. 1977. Water Birds of California. University of California Press. Berkeley, CA.

Cook, Sherburne F. 1955. "The Epidemic of 1830-1833 in California and Oregon." University of California Publications in American Archeology and Ethnology".

Deffenbaugh, P. 1995. Park Manager, Lake Kaweah Terminus Dam, U.S. Army Corps of Engineers. Visalia, CA.

Department of Water Resources. 1990. Vegetation Report: Dry Creek Reservoir Site and Enlarged Kaweah Reservoir. California Department of Water Resources. Sacramento, CA. April.

ECOS. 1990. Final Biological Data Report: Kaweah River Basin Project, Tulare County, California. Prepared for the California Department of Water Resources. Sacramento, CA.

Elsasser, A. B. 1960. "The Archeology of the Sierra Nevada in California and Nevada." University of California Archaeological Survey Reports. 51.

Federal Register. 1993. Rules and Regulations 58(228): 63249.

Federal Emergency Management Agency. 1986. Flood Insurance Rate Map, Tulare County, CA.

Fenenga, Franklin F. 1948. Appraisal of the Archaeological Resources of Terminus Reservoir, Tulare County, California. Pacific Coast Area, River Basin Surveys. Smithsonian Institution, Washington, DC.

Fish and Wildlife Service (FWS). 1986. Recovery Plan of the Pacific Bald Eagle.

_____. 1995. Fish and Wildlife Service species files and records. Sacramento, CA.

Gifford, E. W. and W. Egbert Schenk. 1926. Archeology of the Southern San Joaquin Valley, California. University of California Publications in American Archaeology and Ethnology 23(1). Berkeley, CA.

Gudde, Erwin G. 1960. California Place Names. University of California Press, Berkeley.

Hewes, Gordon W. 1941. "Archaeological Reconnaissance of the Central San Joaquin Valley." American Antiquity 7(2): 123-133.

Hickman, James. 1993. the Jepson manual: Higher Plants of California. University of California Press. Los Angeles, CA.

Hoover, M., et al. 1990. Historic Spots in California. 4th ed. revised by Douglas E. Kyle. Stanford University Press, Stanford, CA.

Hurlbutt, Thomas. December 27, 1993. Personal Communication. J.G Boswell Corporation. Tulare, CA.

Jackson, T., et al. 1990. Kaweah River Basin Investigation Survey, Tulare County, California: Cultural Resources Inventory and Evaluation. Report on file. Sacramento District, Corps of Engineers.

Kings County Planning Department. 1993. Kings County General Plan. Kings County, CA.

Kolzow & Associates. 1989. Economic Development Strategies for Tulare County, CA. Prepared for Tulare County Planning and Development Department.

References

Kroeber, A. L. 1925. Handbook of the Indians of California. Bulletin 78, Bureau of American Ethnology. Reprint ed. 1967, Berkeley, CA.

Meighan, C., et al. 1988. Lake Kaweah Intensive Cultural Resources Survey, Tulare County, California. The Institute of Archeology, University of California, Los Angeles. Report on file Sacramento District, Corps of Engineers.

Melon, R. 1995. General Manager. Three Rivers Community Services District. Three Rivers, CA.

Mitchell, Dave. 1995. Senior Environmental Planner. San Joaquin Valley Unified Air Pollution Control District. Fresno, CA.

Moratto, Michael J. 1972. A Study of Prehistory in the Southern Sierra Nevada Foothills, California. Ph.D. dissertation. University of Oregon, Eugene, OR.

____. 1984. California Archeology. Academic Press, Orlando, FL.

Munz, P.A. and D.D. Keck. 1973. A California Flora and Supplement. Berkeley: University of California Press.

Office of Historic Preservation (OHP). 1990. California Historic Landmarks. Department of Parks and Recreation, Sacramento, CA.

Ornelus, Les. 1995. Air Quality Planning Manager. Sacramento Metropolitan Air Quality Management District. Sacramento, CA.

Parker L. 1995. Telephone Conversation. U.S. Army Engineer District, Sacramento Park Office, Lemoncove, CA.

Peterson, Roger. 1990. A Field Guide to Western Birds. Houghton Mifflin Co. Boston, MA.

Powers, Stephen. 1977. Tribes of California. University of California Press, Berkeley, CA.

San Joaquin Valley Unified Air Pollution Control District. 1994 Serious Area PM_{10} Plan. Fresno, CA.

____. 1994. Adopted Ozone Attainment Demonstration Plan. Fresno, CA.

_____. 1995. Rules and Regulations. Rules 2301, 8010, 8020, 8030, 8070. Fresno, CA.

Smith, Jedediah S. 1977. The Southwest Expedition of Jedediah S. Smith: His Personal Account of the Journey to California, 1826-1827. Edited and with an introduction by George R. Brooks. Reprinted by University of Nebraska Press, Lincoln, NE.

Spier, Robert F. G. 1978. "Foothill Yokuts." In Handbook of North American Indians, Volume 8, California. ed. Robert Heizer. Smithsonian Institution, Washington, D.C.

State of California. 1992. Central Valley Project Improvement Act (PL 102-575). State Water Project.

Stebbins, R.C. 1972. California Amphibians and Reptiles. University of California Press, Berkeley, CA.

_____. 1991. Status survey of two endemic to the San Joaquin Valley. Unpublished report prepared for the U.S. Fish and Wildlife Service.

Terres, J.K. 1980. The Audubon Society Encyclopedia of North American Birds.

The Resources Agency. 1993. Quality Assurance Technical Document 3: Compilation of Federal and State Drinking Water Standards and Criteria. Sacramento, CA.

_____. 1995. Draft Confirmatory Environmental Site Assessment, Lake Kaweah Water Resource Improvement Feasibility Study. Sacramento, CA.

Theodoratus Cultural Research, Inc. and Archaeological Consulting Research Services, Inc. 1984. Cultural Resources Overview of the Southern Sierra Nevada. Report on file. U.S. Forest Service, Bishop, CA.

Tulare County Association of Governments. 1993. Census Data Book. Tulare County, CA.

Tulare County General Plan, Foothill Growth Management Plan. 1981. Tulare County, CA

U.S. Army Corps of Engineers. 1987. Annual Water Quality Report. Sacramento, CA.

References

_____. 1989. Lake Kaweah Project Water Quality Study. Sacramento, CA.

_____. 1990. Environmental Resources Branch Endangered Species Reference Files.

_____. 1992. Kaweah River Basin Investigation, California: Draft Integrated Feasibility and Environmental Impact Statement. Sacramento, CA.

_____. 1993. Annual Water Quality Report. Sacramento, CA.

U.S. Department of Agriculture (USDA), Soil Conservation Service. 1982. Soil, Tulare County, California, Central Part.

U.S. Department of Commerce. 1992. Census of Agriculture, California State and County Data. Vol. 1 Part 5.

U.S. Environmental Protection Agency. 1972. Clean Water Act. 40 CFR § 232-233.

_____. 1973. Water Quality Criteria. EPA-R3-033. March.

_____. 1985. AP-42 Report v2: Table A9-8-A & B.

_____. 1994. General Conformity Rule. Federal Clean Air Act. Title 40 C.F.R., Part 50, Section 176(c).

U.S. Fish and Wildlife Service (FWS). 1994. Preliminary Draft Fish and Wildlife Coordination Act Report.

Wallace, W.T. 1978. "Northern Valley Yokuts." Handbook of North American Indians, Volume 8, California. ed. Robert Heizer. Smithsonian Institution, Washington D.C.

Williams, D.F. 1979. Distribution and Population Status of the San Joaquin Antelope Squirrel and Giant Kangaroo Rat. Nongame Wildlife Investigations, Wildlife Management Branch, California Department of Fish and Game. Sacramento, CA.

Yee, B. 1995. California Regional Water Quality Control Board, Central Valley Region. Fresno, CA.

Zeiner, D.C., et al. 1990. California's Wildlife, Volume III - Mammals. California Department of Fish and Game, Sacramento, CA.

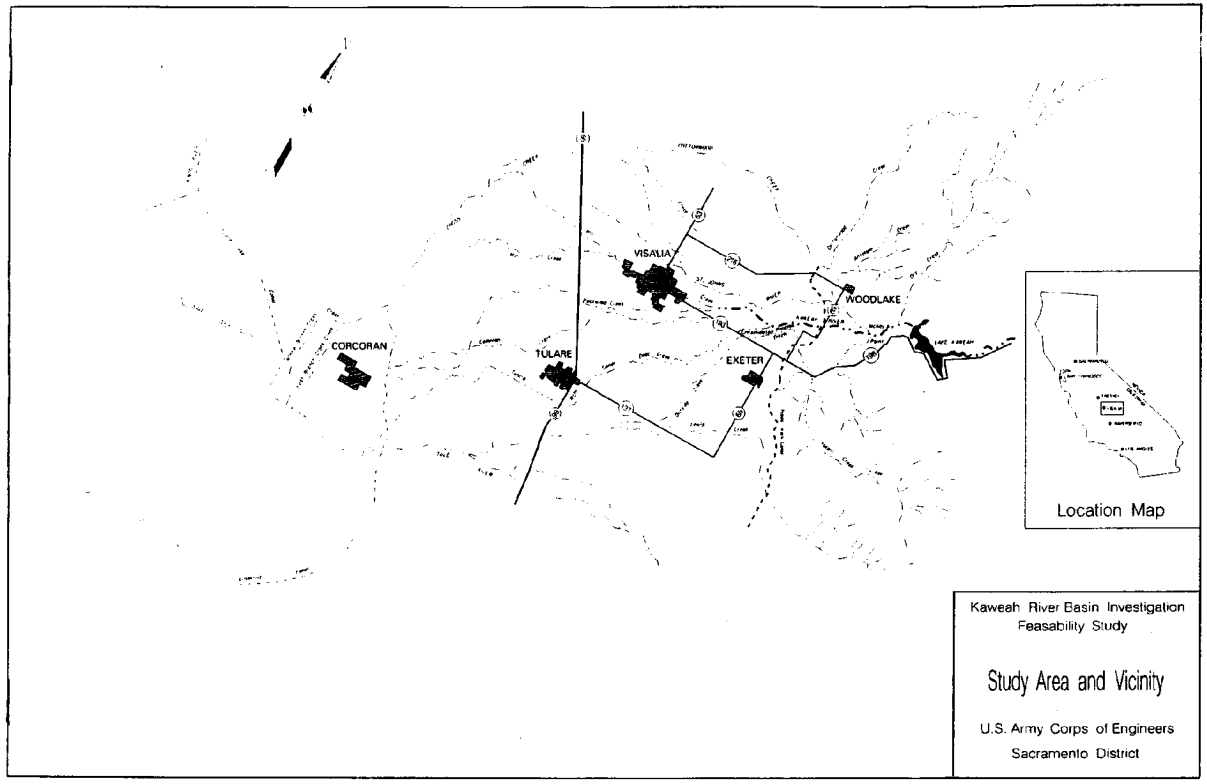
CHAPTER 8.0

INDEX

SUBJECTS	EIS/EIR
Affected Environment	FEIS 3-1, 3-7
Acronyms and Abbreviations	vi
Air Quality	FEIS 3-25, 4-32
Agriculture, Prime and Unique Farmlands	FEIS 3-6
Alternatives	FEIS 2-1, 2-6
Climate	FEIS 3-1
Comparative Impacts of Alternatives	FEIS 2-12
Compliance with Laws, Policies, and Plans	FEIS 5-20
Cultural Resources	FEIS 3-57, 4-69
Cumulative Impacts	FEIS 5-1
Distribution List	FEIS 5-41
Endangered Species	FEIS 3-47, 4-64
Environmental Commitments	FEIS 2-13
Environmental Consequences	FEIS 4-1
Environmental Effects	FEIS 2-14, 2-15
Environmental Setting	FEIS 3-1
Federal Requirements	FEIS 5-20
Fisheries	FEIS 3-42, 4-60
Geology	FEIS 3-2
Growth Inducing Impacts	FEIS 5-7
Hazardous, Toxic, and Radiological Waste	FEIS 3-16, 4-14
Hydrology	FEIS 1-3
Intended Uses of EIS/EIR	FEIS 5-39
Introduction	FEIS 1-1

Index

Land Use	FEIS 3-7, 4-1
List of Preparers	FEIS 6-1
Local Plans and Policies	FEIS 5-30
Mitigation	FEIS 2-16, 5-13
Monitoring	FEIS 5-13, 5-17
Need for Action	FEIS 1-4
Noise	FEIS 3-24, 4-26
Nonstructural Alternatives	FEIS 2-5
Other Required Disclosures	FEIS 5-1
Plan Formulation	FEIS 2-1
Project Description	FEIS 2-6
Project Objectives	FEIS 2-6
Public Involvement	FEIS 5-38
Purpose of Study	FEIS 1-4
Recreation	FEIS 3-13, 4-10
References	FEIS 7-1
Scoping	FEIS 5-38
Short-Term/Long-Term Uses of the Environment	FEIS 5-12
Significant Adverse Impacts	FEIS 5-11
Significant Irreversible Environmental Changes	FEIS 5-13
Significant Issues	FEIS 1-8
Socioeconomics	FEIS 3-11, 4-8
Soils	FEIS 3-4
State Laws and Regulations	FEIS 5-26
Study Area	FEIS 1-1
Study Authority	FEIS 1-1
Summary	1
Table of Contents	i
Topography	FEIS 3-2
Transportation	FEIS 4-19
Vegetation and Wildlife	FEIS 3-36, 4-45
Water Quality	FEIS 3-27, 4-40
Wetland Mitigation	FEIS 5-16

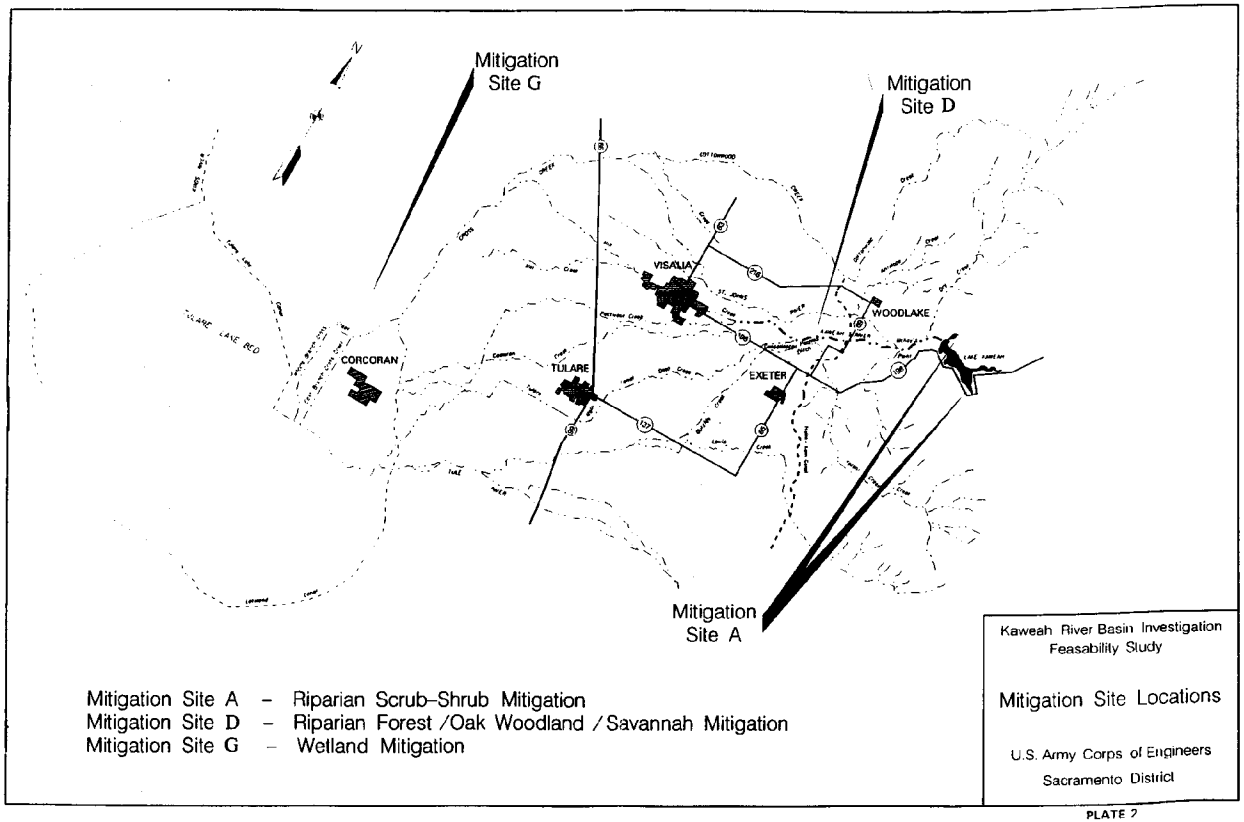


Kaweah River Basin Investigation
Feasability Study

Study Area and Vicinity

U.S. Army Corps of Engineers
Sacramento District

PLATE 1



Mitigation Site A - Riparian Scrub-Shrub Mitigation
Mitigation Site D - Riparian Forest /Oak Woodland / Savannah Mitigation
Mitigation Site G - Wetland Mitigation

Kaweah River Basin Investigation
Feasability Study

Mitigation Site Locations

U.S. Army Corps of Engineers
Sacramento District

PLATE 2

APPENDIX A

COORDINATION ACT

REPORT

KAWEAH RIVER BASIN
INVESTIGATION
DRAFT EIS/EIR

431

DRAFT

FISH AND WILDLIFE COORDINATION ACT REPORT

FOR THE

KAWEAH RIVER BASIN INVESTIGATION

PREPARED FOR THE

U. S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

U. S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
ECOLOGICAL SERVICES
SACRAMENTO FIELD OFFICE
SACRAMENTO, CALIFORNIA

JANUARY 1996

TABLE OF CONTENTS

I. INTRODUCTION 434

II. PROJECT DESCRIPTION 434
A. CORPS RECOMMENDED ALTERNATIVE (NED PLAN) 434
B. LOCALLY PREFERRED ALTERNATIVE 436

III. AREA DESCRIPTION 436
A. HISTORICAL CONDITIONS 436
B. PRESENT CONDITIONS 438

IV. METHODOLOGIES 440
A. INFORMATION SOURCES 440
B. HEP ANALYSES 440

V. RESULTS 440
A. LAKE KAWEAH 440
1. Existing Fish and Wildlife Resources 440
a. Vegetation 440
b. Fish 441
c. Wildlife 443
2. Future Without-Project Conditions (No-action alternative) . . 444
a. Vegetation 444
b. Fish 444
c. Wildlife 445
3. Future With-Project Conditions (NED plan) 445
a. Vegetation 445
b. Fish 446
c. Wildlife 447
4. Future With-Project Conditions (Locally Preferred Plan) . . . 447
B. KAWEAH RIVER BASIN 447
1. Existing Fish and Wildlife Resources 447
a. Vegetation 447
b. Fish 448
c. Wildlife 449
2. Future Without-Project Conditions 450
a. Vegetation 450
b. Fish 450
c. Wildlife 450
3. Future With-Project Conditions (NED Plan) 450
a. Vegetation 450
b. Fish 451
c. Wildlife 451
4. Future With-Project Conditions (Locally Preferred Plan) . . . 452
C. TULARE LAKE BASIN 452
1. Existing Fish and Wildlife Resources 452
a. Vegetation 452
b. Fish 453
c. Wildlife 453
2. Future Without-Project Conditions 455
a. Vegetation 455
b. Fish 455
c. Wildlife 455
3. Future With-Project Conditions (NED and Locally Preferred Plans) 456
a. Vegetation 456
b. Fish 456
c. Wildlife 456
D. THREATENED AND ENDANGERED SPECIES 458
1. Listed Species 459

2. Proposed Species 462
E. MITIGATION 463
1. Mitigation Planning Goals 463
a. Riparian forest and riparian scrub 464
b. Seasonal/intermittent wetlands 464
c. Agricultural/Upland areas 464
d. Oak Woodlands 465
e. Lacustrine areas 465
f. Riverine areas 465
2. Mitigation Site Descriptions 466
a. Existing Lake Kaweah Project Lands 466
b. Kaweah River Corridor Study Sites 468
c. Kaweah River Rock Site 468
d. Dry Creek Gravel Mining Site 469
e. Wetland Mitigation Sites 469
3. HEP Analyses Results 469

VI. DISCUSSION 469
A. RIPARIAN FOREST 470
B. RIPARIAN SCRUB 470
C. GRASSLANDS 470
D. OAK WOODLANDS/SAVANNAH 470
E. FISHERY MITIGATION 472
F. TULARE BASIN WETLANDS 473
G. INDUCED DEVELOPMENT IMPACTS 473
H. CUMULATIVE IMPACTS 473

VII. CONCLUSIONS AND RECOMMENDATIONS 473

VIII. LITERATURE CITED 476

IX. APPENDICES 477
A. APPENDIX A - HEP REPORT 477
B. APPENDIX B - CE HYDROLOGY DATA 477
C. APPENDIX C - ENDANGERED SPECIES INFORMATION 477
D. APPENDIX D - VEGETATION MONITORING PLAN 477
E. APPENDIX E - WESTLAKE FARMS WETLAND DEMONSTRATION PROJECT 477

I. INTRODUCTION

The Kaweah River Basin Project, comprising Terminus Dam and Reservoir, was authorized by the Flood Control Act of 1944 (Public Law No. 534, 78th Congress, 2d Session). Construction was completed and the reservoir began filling in 1962. The purpose of the project was flood control and water supply, primarily for agricultural irrigation.

The general authority for this investigation comes from the 1964 Congressional Resolution of the House Committee on Public Works as follows:

> *"Resolved by the Committee on Public Works of the House of Representatives, United States, that the Board of Engineers for Rivers and Harbors is hereby requested to review the report on Sacramento-San Joaquin Basin Streams, California, published as House Document No. 367, 81st Congress, 1st Session, and other reports, with a view to determining whether any modification of the recommendations contained therein are advisable at this time, with particular reference to further coordinated development of the water resources in the San Joaquin River Basin, California."*

The presently proposed project's purposes are to increase flood protection and agricultural water supply storage. Anticipated benefits, as determined in the 1992 Administrative Draft Integrated Feasibility Report and Environmental Impact Statement (ADFR/DEIS, USACOE 1992) are divided as follows: 53 percent towards providing 3.3-year flood protection for Tulare Lakebed agricultural lands, 26 percent towards providing 70-year flood protection for the city of Visalia, 8 percent towards increased water supplies for agriculture or marketing, 7 percent towards temporary increased employment, and 6 percent towards reduced flooding in other towns and farmlands of the Kaweah River Basin.

II. PROJECT DESCRIPTION

Two alternatives, excluding the no-project alternative, are described within this section.

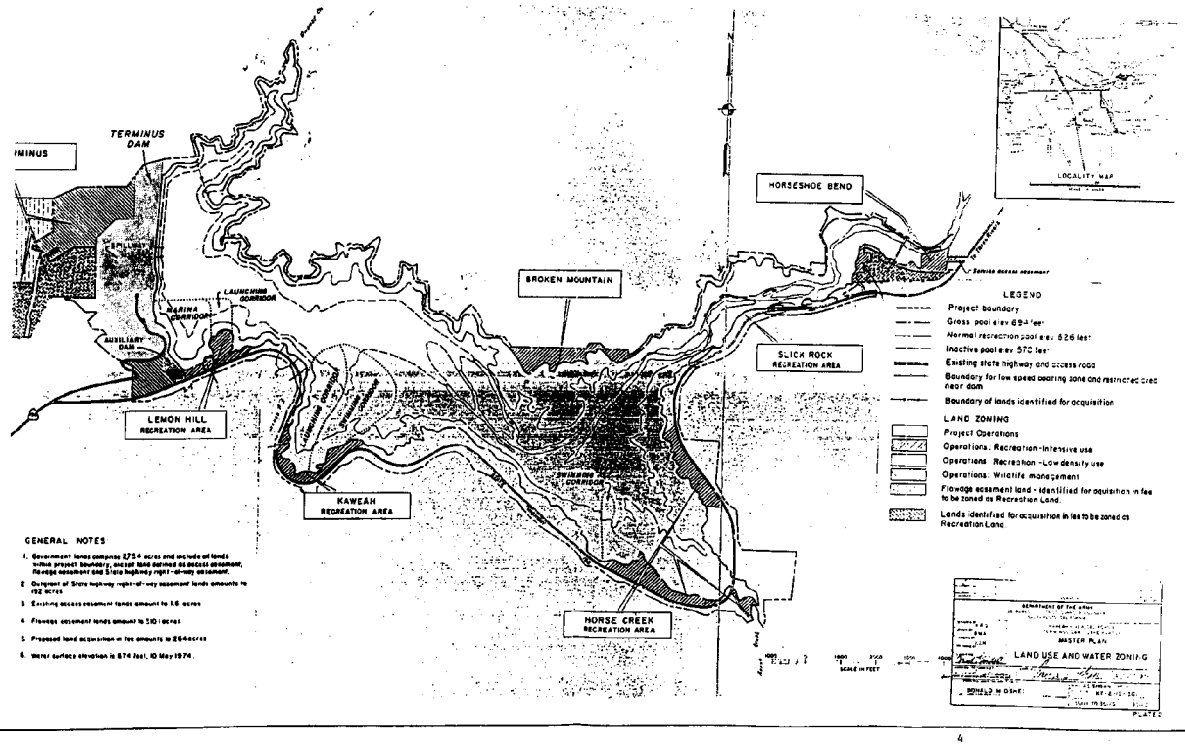
A. CORPS RECOMMENDED ALTERNATIVE (NED PLAN)

The recommended project alternative (USACOE 1994) would include raising the elevation of the existing Terminus Dam spillway from 694 feet mean sea level (msl) to 715 feet msl. Reservoir storage capacity would be increased from 143,000 to 185,600 acre-feet (AF), and reservoir surface area from 1,913 acres to 2,156 acres. The existing spillway would also be widened from 307 to 455 feet in order to pass the spillway design flood at the increased gross pool level. Rock excavation would be required at the spillway abutments; most excavation would occur on the south side of the spillway. The existing bridge over the spillway would be lengthened by adding two 70-foot concrete spans to the bridge.

A 3-acre staging area, located at the base of the dam, would be used to assemble equipment and materials during construction. Materials excavated during construction would be disposed of on the dam face (Figure 1).

Nearly all existing woody vegetation (primarily oak tree species) located between the perimeters of the existing and proposed gross pool elevations (243 acres) would be cleared during project construction. However, no clearing of vegetation would be necessary on the Greasy Creek arm of the lake, nor in the upper reservoir area above Slick Rock.

Figure 1. Map of Lake Kaweah



To accommodate the rise in gross pool elevation, a new State Highway 198 bridge over Horse Creek would be constructed about 100 feet south of the existing bridge. Construction of the bridge would also require new 1,500-foot-long sections of Highway 198 to be constructed on both sides of the bridge. A construction staging area of about 5 acres would be located just south of the bridge.

B. LOCALLY PREFERRED ALTERNATIVE

The locally preferred alternative consists of raising and widening the spillway at Terminus Dam as described for the Corps' preferred alternative. However, the locally preferred alternative would modify the flood control diagram for Lake Kaweah. With the Corps preferred alternative and the no-action alternatives, which both utilize the existing flood control diagram, water releases for winter rainfall floodspace would be required, which would nearly empty the reservoir during many water years. This is because during the rainflood season, there is a limited amount of conditional reservoir space available, which is emptied when precipitation exceeds a threshold amount.

The locally preferred alternative modifies the flood control diagram and threshold precipitation parameters to allow storage of up to 12,000 acre-feet during the rainflood season. Benefits of this alternative include the preservation of fishery resources and recreation at Lake Kaweah. Although this alternative does not establish a guaranteed minimum pool, the chances that the reservoir would be completely drained for flood control are significantly reduced over the no-action plan and the Corps preferred alternatives.

III. AREA DESCRIPTION

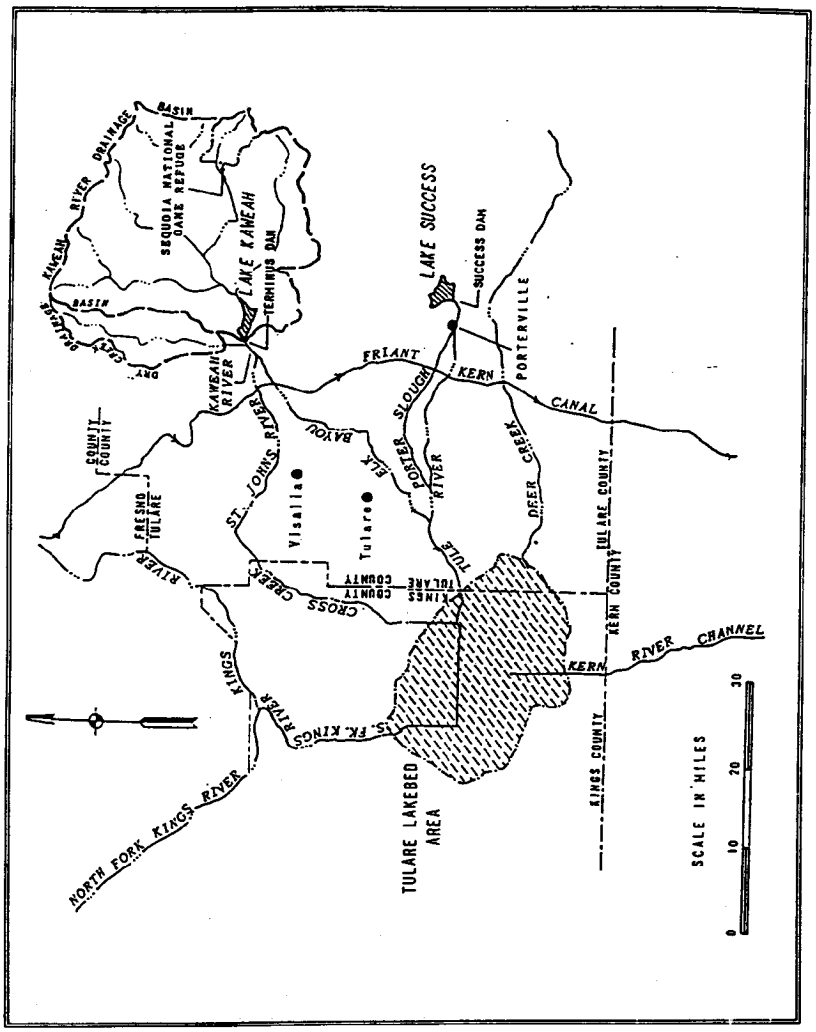
The Kaweah River Basin is located in the southeastern San Joaquin Valley, occupying portions of Tulare and Kings Counties, California (Figure 2). The Basin and supporting watershed stretch from an elevation of 12,500 feet msl in the Sierra Nevada, down the west slope of the Sierra foothills to the floor of the San Joaquin Valley, and ultimately into the Tulare Lakebed. Bordered on the north and south by the Kings River and Tule River Basins, respectively, the Kaweah River Basin below Terminus Dam and exclusive of the Tulare Lakebed, covers an area of approximately 531 square miles. The region has a semi-arid Mediterranean climate of hot, dry summers and cool, wet winters. The Kaweah River is fed by rain and snow runoff with average annual runoff near Three Rivers of 406,100 AF. Typically, 89 percent of the runoff occurs from November through April. Accumulated snowpack at higher elevations contributes to the river flow during the spring melt.

The hydrographic region referred to as the Tulare Basin comprises the southernmost portion of the San Joaquin Valley, an area of about 12,500 square miles. It is bounded on the east by the crest of the Sierra Nevada, by the Tehachapi Mountains on the south, and on the west by the Temblor and Diablo subranges of the south coast range. It is separated from the San Joaquin Basin to the north by a low transvalley ridge formed by the coalesced alluvium of the San Joaquin and Kings Rivers to the east (USACOE 1979) and Los Gatos Creek to the west (Burcham 1982, Cone 1911).

A. HISTORICAL CONDITIONS

Historical conditions of the southern San Joaquin Valley have been described in several recent works (e.g., Preston 1981; Reisner 1986; SJVDP 1990; Haslam 1993). Historically, Tulare, Buena Vista and Kern Lakes, together with extensive surrounding marshes and riparian vegetation, provided the single largest block of wetlands west of the Mississippi River. Tulare Lake was a natural receiving basin for the flows from the Kaweah, Kings, Tule and Kern

Figure 2. Map of the entire project area.



Rivers. During extremely heavy precipitation, flood waters rose within Tulare Lake to a point where they flowed north through Fresno Slough to the San Joaquin River. Conversely, during extremely dry years, the lake might have evaporated completely.

The rivers fed by melting snow from the Sierra Nevada Mountains and periodic rainstorms flowed into the Tulare Basin to form a vast shallow lake bordered by a great expanse of marshes. These areas and other wildlife habitats in the region provided highly valuable habitat for a diverse and abundant assemblage of fish and wildlife species.

With the coming of the Spanish and Anglo-American settlers, however, the Tulare Basin and surrounding region began a transformation from a naturally sustaining and productive wetland ecosystem to an intensively managed agricultural system. Natural biological communities were extensively altered as water was diverted from the multitude of waterways emptying into the basin. Trees were felled, fields were plowed and fenced, and roads were built and towns established. In fact, the transformation was so great that by 1860 Tulare County far surpassed Fresno County, its only San Joaquin Valley competitor, in population, livestock numbers and agricultural production (Preston 1981).

With the expansion of irrigation, primarily from water diverted from the Kings, Kaweah and Tule Rivers and, to a lesser extent, Deer Creek, rapid growth of agriculture and diversification of crops occurred. Herds of cattle and sheep and dryland wheat were replaced by dairying and large expanses of irrigated alfalfa, irrigated grains, field crops such as cotton, and orchards. These uses were at first supported by cheap and plentiful development of surface water resources. As demand increased, the irrigation water supply was augmented by groundwater resources. However, as demand outpaced supply, groundwater levels dropped drastically as withdrawals quickly exceeded the recharge capacity. Soon, groundwater pumping was beyond the financial reach and technical knowledge of most basin farmers. To alleviate this problem, the California Water Plan was approved in 1933; construction commenced soon thereafter by the U.S. Bureau of Reclamation (USBR), and one part of the Plan, the Friant-Kern Canal, was completed in 1950 (Preston 1981).

The Friant-Kern Canal brought San Joaquin River water into the southern Central Valley to sustain intensive agriculture threatened by drought and falling groundwater levels. This water supply was further supplemented by the construction of Success Dam on the Tule River, Pine Flat Dam on the Kings River, and Terminus Dam on the Kaweah River, completion of the California Aqueduct, and the completion of the San Luis Canal of the USBR's Central Valley Project (CVP).

B. PRESENT CONDITIONS

The Kaweah River Basin (Figure 2) drains an area of about 360 square miles above Terminus Dam. Population within the basin is concentrated in and adjacent to the city of Visalia.

From its headwaters in the Sierra Nevada Mountains, the Kaweah River flows down its western slope, and enters the foothills before flowing into Lake Kaweah. From Lake Kaweah, the river flows west for one mile, where it reaches the San Joaquin Valley floor. At this point, a major tributary, Dry Creek, joins the Kaweah River from the north. Two miles below this tributary, at McKay's Point, the river is divided into two channels. The northerly channel, known as the Saint John's River, flows westerly for approximately 23 miles, passing just north of the city of Visalia, unites with Cottonwood Creek to form Cross Creek which flows into the Tulare Lakebed area. The southerly channel retains the name Kaweah River, and flows westerly for approximately 4 miles before dividing into numerous distributaries. Mehrten and Yokohl Creeks

are tributaries that drain from the south and empty into the Kaweah River and several distributaries below McKay's Point. One of these distributaries, Mill Creek, is carried through the city of Visalia in a closed conduit, while the other distributaries pass south of Visalia. From these distributaries, flows that are not diverted for irrigation unite to form Elk Bayou, which eventually joins the Tule River and culminates in the Tulare Lakebed area.

Presently, San Joaquin River water is discharged from the CVP's Friant-Kern Canal into the Kaweah River for irrigation. The Tulare Irrigation District in the Kaweah River Basin are entitled to Class 2 water from the Friant-Kern Canal. Class 2 water is defined as the supply of water which can be made available on an intermittent basis, after the commitments to Class 1 ("firm" water) contractors have been met. Class 2 water is typically available in all years except critical dry years, and is used either for irrigation or groundwater recharge.

However, since Class 2 water is primarily available only during storms or high run-off periods, irrigation districts within the basin often cannot take their full entitlement from the Friant-Kern Canal. This is due to a variety of factors, including discharges that must be made from Terminus Dam into the lower Kaweah River to maintain flood capacity at Lake Kaweah.

Terminus Dam, completed in 1962, provides flood control and water for irrigation. The flood control space is evacuated during November through March for flood control. A minimum pool is normally maintained on a conditional basis during this period for recreational benefits such as fishing and skiing; however, no minimum pool requirement exists. The reservoir fills in the spring and water is delivered for irrigation shortly thereafter. The Kaweah Irrigation District controls the delivery of the irrigation water.

Currently, project-related controversy surrounds the lack of a minimum pool and the loss of wetlands and flood plain functions in the Tulare Lake Basin. The 8,000 acre-foot sedimentation pool which was established is expected to be completely filled by the year 2000; an estimated 1,000 acre-feet of sediment space remains. The lack of a minimum pool at Lake Kaweah is a severe detriment to the maintenance of a reservoir fishery. In turn, the cumulative effects of Terminus, Success, Isabella and Pine Flat Dams have severely reduced flooding and floodplain functions and wildlife values in the Tulare Lake Basin. Migratory waterfowl and other water-associated birds of the Pacific Flyway and State and Federally listed endangered and threatened species are among the affected species.

Numerous irrigation diversions occur on the Kaweah River and its distributaries downstream of Terminus Dam. These diversions virtually dry up the river during the summer months. Only water not completely diverted (which is rare) or flood flows reach the Tulare Lakebed. Only during extremely wet years, when the lakebed fills with water, does water flow out of the Tulare Lake Basin, via the Kings River North, into the San Joaquin River through the Fresno Slough.

The economy of the Kaweah River Basin is primarily based on agriculture and the processing of agricultural products. Agricultural activities in the basin consist mainly of (1) growing oranges, cotton, alfalfa, grapes, olives, peaches, plums, walnuts, and vegetables, (2) the raising of dairy cattle, livestock, and poultry. In the Lake Kaweah vicinity, cattle grazing and the growing of oranges, lemons, and plums are the major agricultural activities.

Most of the 200,000-acre Tulare Lake Basin is under intensive irrigated agriculture, primarily cotton. The basin has been drained and reclaimed by agricultural interests. Much of the remaining lake basin has been divided into cells with levees to control and contain flood waters. Even with these flood control measures, about 82,000 acres flooded to an average depth of 10

feet in 1982 and 1983 (CDFG 1987) and a similar size area was flooded in 1969 and 1970. The area continues to flood during wet years. Levees were built in the basin to maximize farming and to contain flood waters; the water is used for irrigation.

Most of the land in the Tulare Lakebed is privately owned, primarily by the J.G. Boswell Company and Salyer American Company.

IV. METHODOLOGIES

A. INFORMATION SOURCES

All hydrological data used in this analysis were provided by the Corps (USACOE 1992, 1994), and is the same as that used for the economics analyses, except in some instances where data were developed specifically for the environmental impacts analyses. For example, for economic impacts in the Tulare Lakebed area, the Corps assumed that floodwaters reaching the Lakebed were equally divided between agricultural lands and flood detention areas, until the flood detention areas are filled to capacity (100,000 acre-feet in flood detention areas; 100,000 acre-feet in agricultural areas). Thereafter, all flood water is diverted into agricultural areas. However, during most years, floodwaters are diverted to flood storage areas prior to agricultural use; agricultural lands have been taken out of production only twice since 1966 (1969 and 1983; TLBWSD 1994) due to flooding. Thus, the fish and wildlife impact analysis assumes a 75/25 flood detention area/farmland split for flows less than or equal to 200,000 AF. The Corps, on the other hand, in calculating the flood-frequency information for the Service, maintains that an equal (i.e. 50/50) split of floodwaters is appropriate for the economic impacts analyses, and considers the 75/25 split to be the "post-flooding" scenario.

Other information regarding fish and wildlife habitats, endangered species locations, and existing reservoir operations were provided by a variety of sources. Specific references are provided within the report, as appropriate.

Detailed land use information of the type required to assess specific future development has not been incorporated into this report. From floodplain maps, we estimated the amount of lands which would be removed from the 100-year floodplain. Nearly all lands were of marginal value to fish and wildlife resources, being in orchards, or containing existing developments. Other induced development in the floodplain was not assessed. Thus, potential project-induced land use changes were not quantitatively assessed within this current draft. Reviewers with specific knowledge of any land use changes which would result from this project should provide this information to the Service or Corps for consideration.

The life of the project is 100 years. For our analyses, the project is assumed to be implemented by the year 2000.

B. HEP ANALYSES

A full description of the Habitat Evaluation Procedures (HEP) analyses are provided within the HEP report, enclosed as Appendix A.

V. RESULTS

A. LAKE KAWEAH

1. Existing Fish and Wildlife Resources

a. Vegetation

Plant communities of the Lake Kaweah area are typical of the lower western slopes of the Sierra Nevada mountain range. Grasslands, live and blue oak woodlands, riparian forest, and riparian scrub are the dominant plant communities. Oak woodlands exist on all sides of the reservoir; denser forests exist on north-facing slopes and along drainages of south-facing slopes. Oak woodland habitats exist around the reservoir at all elevations above the maximum gross pool elevation of 694 feet msl. Several large blue oaks scattered on the steep north-facing hillsides near the edge of the reservoir are used as roosting and resting trees for bald eagles, golden eagles, and possible osprey.

Most riparian vegetation around Lake Kaweah exists below the present inundation level of 694 feet. Within the inundation area of the lake, riparian vegetation largely consists of riparian scrub-shrub habitat types. The scrub-shrub habitat almost exclusively is composed of willows and scattered buttonbush. Some of the willows were planted from 1988 to 1990 by California Conservation Corps crews and various other volunteers. Along the Kaweah River and the tributaries feeding the reservoir, well-developed stands of riparian forest exist, dominated by black willow (*Salix gooddingii*), black cottonwood (*Populus trichocarpa*), Fremont cottonwood (*Populus fremontii*), and California sycamore (*Platanus racemosa*). Cattails (*Typha latifolia*) occur in some pools along the channels and along the streambanks. Some plant communities surrounding Lake Kaweah, particularly on the northeast side of the lake, are frequently in a disturbed or degraded condition due to cattle grazing and movement.

The grassland cover is composed of a mixture of wild oats (*Avena fatua*), pine bluegrass (*Poa scabrella*), California needlegrass (*Stipa californica*), foxtail brome (*Bromus rubens*), soft chess (*B. mollis*), common foxtail (*Hordeum murinum*), stork's-bill (*Erodium cicutarium*), and six-weeks fescue (*Festuca octoflora*) (USACOE 1992). Besides the willow stands discussed above, the repeated annual cycle of inundation and exposure of the lakeside precludes formation of significant perennial plant cover below gross pool elevation. Some common broadleaf plant species that are present on the exposed lakebed are stork's-bill (*Erodium cicutarium*, *E. botrys*, and *E. moschatum*), and the common cocklebur (*Xanthium strumarium* var. *canadense*) which grows in dense stands and dominates other plant species where present.

Chaparral thickets within the project area contain a number of different shrubs and small trees, including poison oak (*Rhus diversiloba*), scrub oak (*Quercus dumosa*), manzanita (*Arctostaphylos*), holly-leaved cherry (*Prunus ilicifolia*), sumac (*Rhus sp.*), ceanothus (*Ceanothus sp.*), and chamise (*Adenostoma fasciculatum*) (USACOE 1992). The chaparral cover type is generally not present within the proposed inundation zone of the reservoir, however.

b. Fish

Fish resources at Lake Kaweah include both warm and coldwater species (Table 1). The lake has been stocked in recent years with several warmwater species and rainbow trout. Rainbow trout (*Oncorhynchus mykiss*) are stocked in the fall when water temperatures cool to a tolerable level. The allotment of rainbow trout for stocking is about 40,000 annually. Trout probably do not survive the high water temperatures and low dissolved oxygen conditions experienced in the summer. However, some fish may move into the cooler waters of the Kaweah River as reservoir conditions worsen, thus allowing survival of some fish for more than 1 year. The majority of fish taken by anglers are bluegill, rainbow trout and largemouth bass.

The quality of the Lake Kaweah fishery has declined since the lake was originally filled in 1962. As is characteristic of new fisheries, many large fish were caught in the lake until the mid-1970's. Since the mid-1980's the quality of the fishery has deteriorated significantly.

Table 1. Fish species occurring in Lake Kaweah and the lower Kaweah River. Data compiled from California Department of Fish and Game files and KASCO (1993).

Fish species		Kaweah River	Lake Kaweah
Kern brook lamprey	*Lampetra hubbsi*	X	
threadfin shad	*Dorosoma petenense*	X	
Mississippi silverside	*Menidia beryllina*	X	
rainbow trout	*Oncorhynchus mykiss*	X	X
riffle sculpin	*Cottus gulosus*	X	
California roach	*Hesperoleucus symmetricus*	X	
hitch	*Lavinia exilicauda*	X	
hardhead	*Mylopharodon conocephalus*	X	
Sacramento squawfish	*Ptychocheilus grandis*	X	
Sacramento blackfish	*Orthodon microlepidotus*	X	
splittail	*Pogonichthys macrolepidotus*	X	
golden shiner	*Notemigonus crysoleucas*	X	X
goldfish	*Carassius auratus*	X	
carp	*Cyprinus carpio*	X	X
Sacramento sucker	*Catostomus occidentalis*	X	
brown bullhead	*Ictalurus nebulosus*	X	
white catfish	*I. catus*	X	X
channel catfish	*I. punctatus*	X	X
blue catfish	*I. furcatus*	X	
mosquitofish	*Gambusia affinis*	X	
striped bass	*Morone saxatilis*	X	
white bass	*Morone chrysops*	X	X
bluegill	*Lepomis macrochirus*	X	X
redear sunfish	*L. microlophus*	X	X
green sunfish	*L. cyanellus*	X	
black crappie	*Pomoxis nigromaculatus*	X	X
white crappie	*P. annularis*	X	
largemouth bass	*Micropterus salmoides*	X	X
smallmouth bass	*M. dolomieui*		X
spotted bass	*M. punctulatus*	X	X
bigscale logperch	*Percina macrolepida*	X	
tuleperch	*Hysterocarpus traski*	X	

In 1987, the California Department of Fish and Game chemically treated the lake to remove white bass (*Morone chrysops*) which were illegally introduced years earlier. White bass are considered to be a threat to striped bass, salmon and other fisheries in the Sacramento-San Joaquin Delta. The lake has continued to be restocked with game fish since that time. Fish census data during the chemical treatment showed that the lake previously held large numbers of carp (*Cyprinus carpio*). The bottom-feeding carp probably feed partially on fish eggs in the substrate, thus they may significantly impact the reproductive success of other, nest-building fish species in the lake. Carp have returned to Lake Kaweah from upstream since the 1987 chemical treatment. Chemical treatment of the Kaweah River upstream of the lake is not possible because the city of Three Rivers uses the Kaweah River for its water supply.

To promote the fishery, a variety of habitat enhancement features have been developed. Within the lake, brush piles, tree rows and reclaimed Christmas trees have been placed in the fluctuation zone to provide refuge for adult and juvenile fish. The fluctuation zone is also planted with annual grains to provide additional refugia for juvenile fish. Lengths of concrete pipe have also been introduced as artificial spawning containers for channel catfish.

Willows have been planted along the shoreline and maintained as needed by a drip irrigation system. In some areas, fencing has been erected to reduce damage to the fluctuation zone fish structure and vegetation due to cattle grazing.

To reduce the adverse effects of reservoir water level fluctuations on centrarchid spawning, a small spawning pond was constructed in the Greasy Creek arm of the reservoir. This stabilizes the water level and improves spawning success in the area. However, the small size of the pond, as compared to the reservoir, severely limits the effectiveness.

Presently, several factors limit the Lake Kaweah fishery. Water quality can be poor, especially in summer months when water temperatures rise and dissolved oxygen levels decrease. A thermocline does not typically exist in Lake Kaweah. Significant water level fluctuations also pose a threat to fish. Lake levels can change drastically from snowmelt runoff. This can occur into the spring when most fish spawn. Irrigation releases normally begin around June 1, when most nest-building fish species have just completed spawning and young fish are hiding in flooded vegetation at the lake edge. As the lake level begins to drop, young fish are forced out of the shoreline cover and exposed to increased predation. Several efforts have been made, as mentioned previously, to alleviate this problem, but effectiveness varies with rates and extent of water level reductions.

Perhaps the most significant problem facing the fishery is the lack of a minimum pool. The 8,000 AF sedimentation pool, which in the past served as a minimum pool, is nearly filled to capacity (less than 1,000 AF remain). Most of the filling occurred during runoff periods in 1969, and it is assumed that the sediment pool will be completely filled by about 1996. In past years, irrigation interests have provided water to maintain a pool, but there are no guarantees for the future. More pressure to completely drain the reservoir is more likely in future years, because of increasing need for sources of water other than the State Water Project and CVP. The locally preferred alternative, discussed later in this report, would provide increased pool space in the future during most years. The no-action alternatives and NED plans do not currently provide for guaranteed water storage space.

A reduction in lake volume from 186,000 AF to less than 1,000 AF, could devastate the fishery. Predation on juvenile and small fish in a less than 1,000 AF pool would be quite severe. Fish not lost to predation could succumb to high water temperatures and low dissolved oxygen levels in the late summer and fall.

In summary, sediment pool filling and the lack of a dedicated minimum pool pose a serious threat to the continued existence of the present Lake Kaweah fishery.

c. Wildlife

The predominant mammalian wildlife species found in the Lake Kaweah area include mule deer (*Odocoileus hemionus*), raccoon (*Procyon lotor*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), ground squirrels (*Spermophilus* sp.), badger (*Taxidea taxus*) muskrat (*Ondatra zibethicas*), opossum (*Didelphis marsupialis nuttalli*), jackrabbit (*Lepus californicus*), spotted skunk (*Spilogale putorius*), striped skunk (*Mephitis mephitis*), and cottontail rabbit (*Sylvilagus nuttalli*). Birds common to the area include western meadowlark (*Sturnella neglecta*), acorn woodpecker (*Melanerpes formicivorus*), red-shafted flicker (*Colaptes cafer*), red-tailed hawk (*Buteo jamaicensis*), American coot (*Fulica americana*), grebes and various passerine species. Upland game birds include band-tailed pigeon (*Columba fasciata*), mourning dove (*Zenaida macroura*) and California quail (*Callipepla californica*). Several waterfowl species winter in the area, including Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), pintail (*Anas acuta*),

and the common merganser (*Mergus merganser*). Waterbirds such as the great blue heron (*Ardea herodias*), American bittern (*Botaurus lentiginosus*), American avocet (*Recurvirostra americana*), black-necked stilt (*Himantopus mexicanus*), killdeer (*Charadius vociferus*), and the common snipe (*Gallinago gallinago*) feed along the reservoir's shallow water edge. In addition, turkey vulture (*Cathartes aura*), black-shouldered kite (*Elanus caeruleus*), northern harrier (*Circus cyaneus*), and American kestrel (*Falco sparverius*) frequent lands surrounding the reservoir (USACOE 1992).

The project area also provides habitat for a variety of reptiles and amphibians. Common reptiles include the western fence lizard (*Sceloporus occidentalis*), western skink (*Eumeces skiltonianus*), gopher snake (*Pituophus melanoleucus*), common king snake (*Lampropeltis getulus*), and the western rattlesnake (*Crotalus viridis*). Representative amphibians in the area are the western toad (*Bufo boreas*), bullfrog (*Rana catesbeiana*), Pacific tree frog (*Hyla regilla*), and the California slender salamander (*Batrachoseps attenuatus*)(USACOE 1992).

2. Future Without-Project Conditions (No-action alternative)

Without-project reservoir operations over the proposed project life (2000-2100) would differ from those of existing conditions. The remaining (less than 1,000 AF) sedimentation space within the reservoir would be filled prior to the year 2000. Thus, during any year, the reservoir could be completely emptied for flood storage. The likelihood of such an occurrence is a topic of debate among all agencies involved with the reservoir. Since the time the sediment pool was found to have only 1,000 AF of sediment space remaining, the Corps and local sponsors have modified reservoir operations, and have never actually drawn the reservoir down to 1,000 AF. This has allowed them to reserve some water in the reservoir for fisheries and recreation; the water is also used as a carry-over water supply in case of a dry winter. The Corps and local sponsors maintain that there would be increased pressure to empty the reservoir in the future if the project is not constructed, because water supply and flood control capacities would continue to become diminished over time.

a. Vegetation

The change in hydrological conditions over time would have some small effect on vegetation existing within the reservoir inundation zone. The riparian scrub within the reservoir, under existing conditions, is inundated virtually every year (Appendix B); however, the duration of inundation during any year may vary from 1 to 11 months. Over the 100-year period of analysis, the riparian scrub existing at the lower elevations of the reservoir would be inundated less often, and for shorter durations than under pre-project conditions. Thus, the riparian scrub would have an increasingly longer growing season as the year 2100 approaches. This would likely increase the value of the riparian scrub for both terrestrial and aquatic resources, because the trees would likely grow larger; they could also expand their range within the reservoir inundation area.

b. Fish

Conditions for fishery resources within Lake Kaweah would likely degrade further from existing conditions. By the year 2000, no sedimentation pool will remain. Thus, the fishery resources may be destroyed should the Corps and local water users decide to completely drain the reservoir. Any increase in water needs from Lake Kaweah in future years may also contribute to the likelihood of a complete or nearly complete reservoir drawdown.

Under these conditions, recruitment of young game fish into the adult population would decrease, due to predation and reduced spawning success related to drawdown rates. Fish kills resulting from poor water quality (or lack of water) would also likely increase. Thus, the existing population of

harvestable fish would be decreased in the future. If the reservoir was drained, the existing fishery would at least temporarily extirpated. Under this condition, the Department of Fish and Game or local interests may stock additional warmwater gamefish in the reservoir when adequate water conditions returned. However, there are no guarantees that this would occur. In light of the State's current financial situation, additional stocking of warmwater game fish in Lake Kaweah could become problematic, especially if de-waterings became relatively frequent events.

c. Wildlife
Under without-project conditions, wildlife populations would likely remain as under existing conditions. No significant change is expected, except that the willow scrub area within the reservoir may be of higher value to terrestrial organisms, because it would be inundated by water less often than in the past.

3. Future With-Project Conditions (NED plan)

With-project reservoir operations would differ from without-project conditions because of the increase in reservoir storage capacity. As in the without-project scenario, the reservoir would still be subject to emptying during any year, although the likelihood of such an occurrence is uncertain. A minimum pool, which would guarantee protection of the existing fishery, is not proposed for the NED plan.

a. Vegetation
Based on data provided by the Department of Water Resources (DWR 1989; Ben Steen, DWR, Redding, pers. comm.), which was modified by the Service and Corps staff, construction of the project and the subsequent raising of the reservoir would: 1) inundate 36 acres of blue and live oak woodland, 125 acres of blue oak savannah, 63 acres of grassland, 10 acres of riparian forest, and 1 acre of riparian scrub; 2) increase inundation depth and duration of 60 acres of riparian forest which occur at higher elevations within the present inundation zone, and 91 acres of riparian scrub occurring mostly at lower elevations within the present inundation zone; and 3) alter 7 acres of river and stream habitat located within the proposed new inundation areas (Table 2). "Disturbed" areas (non-habitat areas, such as roads and parking lots), which would be inundated total 8 acres.

Table 2. Area (acres) of cover types which would be affected by proposed project operation. Operation impacts refer to areas which would be affected by changes in inundation due to enlarged reservoir operation. Elevations below 694 feet msl are within the existing reservoir; elevations between 694 feet and 715 feet are within the proposed new inundation areas.

	Inundation Impacts		Total
Cover Type	<694 feet	694 - 715 feet	
oak savannah	7	125	132
oak woodland	2	36	38
grassland	0	63	63
riparian forest	60	10	70
riparian scrub	91	1	92
riverine	7	0	7
disturbed areas	0	8	8
TOTALS	167	243	410

Construction and disposal impacts also would occur with project construction. The 3-acre staging area at the base of the dam would avoid any important existing habitat types, as the area is highly disturbed. The dam face, which would be covered by spoils, does not presently contain significant wildlife habitat.

Oak trees are not tolerant of water saturation in spring; thus any oak trees that are not cut within the new inundation zone would be expected to die within the first few years. The 9 acres of existing oak trees which are located just below the 694 feet elevation along the Kaweah River also would not survive their increased flooding regime. Grassland plant species above the present waterline would not survive inundation; they would be replaced partially by water-tolerant annual grass species and cocklebur, much the same as those areas which currently exist within the reservoir.

The riparian forest vegetation which exists just below the current 694 feet level would not be likely to survive in its present condition. Because they would be inundated about three times more frequently (Appendix B), and at greater depths and duration than under existing conditions, we expect that the riparian forest vegetation in this area would gradually be replaced by more disturbance-tolerant species, such as black willow and buttonbush. Thus, a riparian scrub area would likely replace the riparian forest within the first 20 years of project construction. Riparian forest vegetation occurring just below the 715 feet level would not be as negatively affected by project construction, because these areas would not be inundated as frequently as those at lower elevations.

The riparian scrub cover type which exists within the reservoir would also be affected by project construction. The black willow trees that occur at the lowest reservoir elevations (570 to 585 feet elevation) already show signs of extreme stress related to inundation effects; the project would inundate these trees for longer periods of time each year, and at a greater depth. The effect that increased inundation and water pressure would have upon these trees is unknown, but in light of the fact that the existence of such a dense stand of trees at present is considered anomalous (Dr. T.T. Kozlowski, University of California Santa Barbara, personal communication), the continued existence of any of the trees would be unlikely. For our analyses, however, we have assumed that 30 percent of the willow scrub area would be lost due to inundation impacts. We based this assumption upon literature reviews, and consultation with local experts and Corps staff. But we also recommend that the site be monitored over the life of the project to determine the actual fate of this cover type.

Riparian scrub at other (585-694) elevations within the reservoir would be negatively affected by the proposed project operations, but to a lesser degree than those existing at lower elevations. Overall, there would be a general decrease in habitat value and acreage of willow scrub; the magnitude of decrease would be inversely correlated to elevation.

b. Fish

Fish resources of the lake would probably worsen under the NED plan compared to existing and without-project conditions. Water levels in the lake would fluctuate more rapidly, degraded summer water quality would continue (high temperatures, low dissolved oxygen levels), and water levels in the reservoir would continue to be lowered below adequate fishery maintenance levels.

Under these conditions, the existing warmwater fishery would probably not remain self-sustaining. Summer drawdown increases would severely stress adults and juvenile largemouth bass and other centrarchids. Also, juveniles would be more susceptible to predation as the reservoir shrinks in area and depth. Adults that survive would continue to spawn in the lake; however, juvenile recruitment to the population would be quite limited, because of

unsatisfactory water quality conditions in the reservoir, high predation due to poor nearshore cover conditions, and reduced spawning success caused by more rapid water fluctuations. Many of the existing spawning structures and willow plantings constructed and planted by local fishermen's groups and the California Department of Fish and Game would cease to be functional, under with-project conditions. Also, degraded summer and fall water quality is more conducive to the survival of species such as carp. A larger carp population feeding on benthic substrate would also add cumulative impacts to centrarchids by further reducing their survival.

c. Wildlife

Under with-NED plan conditions, a significant amount of wildlife habitat would be lost. The loss of riparian, oak woodland and grassland wildlife habitats would adversely affect all wildlife populations that inhabit these areas either permanently or seasonally. Certain wildlife populations inhabiting these areas would be directly lost because of the inundation, or displaced and eventually lost, because neighboring areas would be at or near full carrying capacity. More rapidly fluctuating water levels would reduce reproductive success of burrowing mammals and reptiles due to spring inundation. Thus, food base organisms for the higher trophic level species near the reservoir would be reduced.

Those species not directly impacted by inundation would also be adversely affected as their habitat declines. Much of the riparian vegetation around the existing inundation zone is expected to be degraded or lost. The degradation or loss of riparian vegetation would impact a wide range of resident and migratory birds and small mammals that use the area.

Reservoir use by migratory waterfowl and other water-associated birds would likely not change under with-project conditions. These species would probably continue to use the reservoir in moderate numbers, as they presently do.

4. Future With-Project Conditions (Locally Preferred Plan)

Wildlife and vegetation impacts for the locally preferred plan would be about the same as those for the NED plan. However, reservoir fisheries impacts would be significantly lessened because of the revised flood control diagram. Reservoir fishery resources would likely remain as is, or improve because the likelihood of Lake Kaweah being emptied for rainflood releases is low.

B. KAWEAH RIVER BASIN

1. Existing Fish and Wildlife Resources

Most of the information provided in this section is taken from the KAS Consultants (KASCO) report, *Kaweah River Corridor Enhancement Study, Part Two - Environmental Setting* (KASCO 1993). That report also includes vertebrate and plant species lists for the Kaweah River Corridor Study area.

a. Vegetation

Typical riparian plant species, dominated by willow, cottonwood, and sycamore are found downstream of Terminus Dam. Riparian vegetation is especially dense around the old gravel excavation pits just below Terminus Dam. Cattails and other emergent vegetation also occur along the channel banks. As the Kaweah River branches onto the San Joaquin Valley floor, the abundance and density of the riparian vegetation lessens due to the influence of agricultural encroachment and urban development, becoming sparse or absent as the river bifurcates into various distributaries approaching the Tulare Lakebed. Little or no riparian vegetation remains in the river and slough channels as the watershed nears the Tulare Lakebed (USACOE 1992), except in the Nature Conservancy Reserve along the Tule River, just upstream of the Lakebed.

Land use downstream of Terminus Dam is tied very closely to agriculture. Generally, much of the relatively narrow zone of agricultural land between Lake Kaweah and Visalia is planted in citrus and deciduous fruit orchards interspersed with mixed vegetable crops. The land has been cultivated up to the edge of the floodways of the Kaweah River's natural distributaries and tributaries, leaving little or no margin between the cultivated land and the instream riparian vegetation (DWR 1989).

Various-sized patches of native vegetation are scattered throughout the land downstream of Terminus Dam. Areas of native vegetation may represent many land-use types, from riparian vegetation along stream corridors, to fallow fields, to open water ponding basins. The non-native, weedy giant bamboo has become established in sections of many downstream channels, choking out much of the native vegetation (DWR 1989). Small areas of native grassland communities are scattered amongst the non-native grassland which dominates most of the grassland habitat within the project area (KASCO 1993).

Despite the large conversion of natural plant communities to agriculture, the Kaweah River delta still supports some significant remnants of valley oak woodland, valley oak riparian, mixed riparian, and willow scrub. Valley oak riparian communities consist of riparian forest species of which the canopy is dominated by valley oak (*Quercus lobata*). They are found only in California's Central Valley and are in serious decline. Valley oak woodland communities, typically found in drier areas are characterized by having a relatively open canopy cover. Understory vegetation typically consists of grasses; thus, dense understory canopies which are typical of valley oak riparian communities do not occur in valley oak woodlands. The Nature Conservancy's Kaweah Oaks Preserve contains significant stands of both the above valley oak communities.

The canopy of mixed riparian forest is dominated by western sycamore (*Platanus racemosa*) and Fremont's cottonwood (*Populus fremontii*). Mixed riparian forest are found scattered throughout many areas downstream of Terminus Dam (KASCO 1993), but usually are confined to a thin strip of vegetation immediately adjacent to a watercourse.

Remnants of Great Valley willow scrub habitat are also found along the river and stream channels. This community consists of a variety of willow species, as well as Fremont's cottonwood, California rose, and California wild grape (KASCO 1993).

b. Fish

The lower river is intermittent and varies in flow enormously in response to irrigation and flood control releases. Large stretches of river are often completely dewatered, leaving only a few pools of standing water. Warm waters and irrigation diversions prohibit the existence of significant cold- and warm-water fisheries in the lower Kaweah River, although some warm-water species do persist in areas relatively close to Terminus Dam, where water is typically available year-round.

Species which are known to occur in the lower Kaweah River and its distributaries were listed earlier in Table 1. Many of the known species are also known to occur in Lake Kaweah. In addition to species stocked into Lake Kaweah, others apparently reintroduced to the lower river from sources such as the California Aqueduct and Friant-Kern Canal include blue catfish, brown bullhead, striped bass, Mississippi silversides, log perch, threadfin shad, hitch, Sacramento blackfish, Sacramento splittail (rare), goldfish, carp, mosquito fish and tule perch. Sportfishing for these species is generally not significant because, as stated above, large sections of the river often go dry when releases from the dam are not sustained, thereby limiting fish survival and reproduction.

The only native fish that have been recently collected on the Kaweah River below Terminus Dam are Kern brook lamprey, Sacramento squawfish (*Ptychocheilus grandis*), and Sacramento sucker (KASCO 1993). It is also likely that two other native species occur on the Kaweah River below Terminus Dam: California roach (*Hesperoleucus symmetricus*) and hardhead (*Mylopharodon conecephalis*) (KASCO 1993).

c. Wildlife

Apart from some areas where exceptional valley oak woodlands dominate (see vegetation section above), wildlife use of the reach of river and distributaries downstream of Terminus Dam has been significantly lessened because of human disturbances, nearness of homes, commercial buildings and farms, and degraded habitat. The downstream area supports mostly metropolitan wildlife species that have adapted to life within the confines of remnant native or fallow grasslands, sparse wetlands and the narrow corridor of remaining riparian vegetation that grows along the rivers, creeks, sloughs, and some man-made ditches. These more urbanized species include the raccoon, opossum, cottontail, striped skunk, California ground squirrel, and several small mammals. Other animal species that are less adaptable to change have either disappeared or are struggling for survival in limited habitat (USACOE 1992).

Many birds, such as western bluebird, American robin, northern mockingbird, phainopepla, and house finch, utilize the native fruit-bearing shrubs and vines which are found in abundance within the riparian communities (KASCO 1993).

California towhee (*Pipilo crissalis*), rufous-sided towhee (*Pipilo erythrophthalmus*), black-headed grosbeak (*Pheucticus melanocephalus*), blue grosbeak (*Guiraca caerulea*), and lazuli bunting (*Passerina amoena*) are among the seed-eating species that inhabit the riparian thickets along the lower Kaweah River. California towhees and rufous-sided towhees are present all year within the project area, but are found locally only where there is an extensive, dense, brushy understory. Black-headed grosbeak, blue grosbeak, and lazuli bunting are all summer visitors, and are all presumed to nest within the area. Like towhees, the blue grosbeak and lazuli bunting both require areas with sufficient understory; the blue grosbeak often prefers stinging nettle for a perch and nest site. Black-headed grosbeaks can inhabit more open woodlands (KASCO 1993).

Riparian habitats are prolific insect producers. Northern oriole (*Icterus galbula*), common yellowthroat (*Geothlypis trichas*), yellow warbler (*Dendroica petechia*), black phoebe (*Sayornis nigricans*), ash-throated flycatcher (*Myiarchus cinerascens*), and western wood pewee (*Contopus sordidulus*) are a few of the birds found within the area that feed almost exclusively on such insects. Northern oriole, yellow warbler, ash-throated flycatcher, and western wood pewee are summer visitors, while common yellowthroat and black phoebe can be found year-round within the area. All of these insect-eating bird species are known to nest within the area (KASCO 1993).

Borrow pits near the confluence of Dry Creek and the Kaweah River also contain significant riparian stands composed of cottonwoods and willows. Birds of particular interest at this site include willow flycatcher (*Empidonax traillii*), yellow warbler, yellow-breasted chat (*Icteria virens*), red-shouldered hawk (*Buteo lineatus*), and Cooper's hawk (*Accipiter cooperii*). A great blue heron (*Ardea herodias*) rookery has also become established on Dry Creek; individuals may occasionally forage in the lower river and lake areas.

Some common amphibians and reptiles found within the Kaweah River corridor include western toad (*Bufo boreas*), Pacific treefrog (*Hyla regilla*), bullfrog (*Rana catesbeiana*), western pond turtle (*Clemmys marmorata*), western fence lizard (*Sceloporus occidentalis*), western whiptail (*Cnemidophorus tigris*),

gopher snake (*Pituophis melanoleucus*), common garter snake (*Thamnophis sirtalis*), western black-headed snake (*Tantilla spp.*), western rattlesnake (*Crotalus viridis*), California legless lizard (*Anniella pulchra*), Gilbert's skink (*Eumeces gilberti*), and southern alligator lizard (*Gerrhonotus multicarinatus*) (KASCO 1993).

2. Future Without-Project Conditions

Over the 100-year period of analysis used for evaluating project impacts, Lake Kaweah would suffer a small reduction in storage capacity under without-project conditions. Thus, releases from the reservoir may, in the future, occur slightly earlier in the season to meet flood control requirements. The effect of this reduction on the Kaweah River area would be that the riparian areas along the lower Kaweah River and its distributaries would receive more water, earlier in the season. These changes, however, are expected to be minimal, and would likely not significantly affect the ecological landscape over time. Thus, we expect no significant overall differences between existing and future without-project conditions. However, the Service may report impacts to this area in later drafts of this report, based on report review comments and supporting information that may be received.

a. Vegetation
Conditions within the lower Kaweah River and surrounding areas would likely remain as under existing conditions.

b. Fish
Conditions for fish are not expected to change in these areas.

c. Wildlife
Under without-project conditions, wildlife would likely remain as now under existing conditions.

3. Future With-Project Conditions (NED Plan)

As previously stated in the Methods section, impacts to the Kaweah River floodplain include those actions which would induce development in the floodplain. Thus, land-use projections play a critical role in evaluating impacts to fish and wildlife resources in this area. Reviewers of this report with specific information on potential project-induced or project-accelerated land-use changes in wildlife areas that may occur with the project are encouraged to include such information in any review comments provided to the Service.

a. Vegetation
As stated earlier, significant riparian vegetation is typically confined to the stream channel. The only likely adverse effect to most of these areas is a small decrease in peak flood flows. However, any vegetation along streamcourses downstream of Visalia may become dewatered more often, because of the increased storage capacity at Lake Kaweah. However, since these effects are expected to be very minor, and since no known significant riparian vegetation stands exist downstream of Visalia, impacts are expected to be minimal.

The reduced flooding the city of Visalia and surroundings would encourage development in areas presently periodically flooded (between the existing and the new 100- year floodplain), and increased water supplies could allow additional development of native lands for agriculture. The most significant habitats are those associated with oak woodlands in and east of Visalia. Flood reduction would also encourage the conversion of existing agricultural lands and remaining native habitats in this area for commercial and residential uses. However, such changes in land use associated with the project are not quantifiable at this time.

Under with-project conditions, flood flows to waterfowl habitat in the Creighton Ranch Nature Preserve would likely be reduced. Water sources from the Tule River would continue, but a similar reservoir enlarging project is proposed for Lake Success. Riparian habitat conditions at the Creighton Ranch Preserve are already critical. Although some irrigation water may be conveyed across the site, drought conditions have resulted in very little water passing through the preserve over the last several years. Any reduction of flooding of the lower basin and Preserve could be detrimental to existing habitats in the Preserve. Many riparian trees have already died due to lack of water. Although the storage for irrigation water will continue as under existing conditions, the reduction or elimination of periodic flood flows could essentially eliminate flooding of these areas. Periodic flooding is needed to maintain the biological value and integrity of the Preserve. Without flooding, the vegetation species composition could change to more drought-tolerant plants. The project will exacerbate this problem, probably causing permanent loss of riparian forest on site unless appropriate mitigation is developed.

With construction of the proposed project, an opportunity to import the full entitlements of Class 2 water, from the San Joaquin River via the Friant Kern Canal, would be available. (Class 2 water is defined as that supply of CVP water which can be made available on an intermittent basis, for delivery from Millerton Lake, the Friant-Kern Canal, and the Madera Canal, in addition to Class 1 water which is made available as a dependable water supply.) With the expanded flood storage (43,000 acre-feet), the flood pool in Lake Kaweah would not have to be evacuated as under existing conditions. Presently, flood releases out of Friant Dam cannot be diverted for use in the Kaweah River Basin because sufficient flood capacity is not available in Lake Kaweah, and hence, flood releases must also be made from Terminus Dam. With the additional flood control capacity, flood releases from Lake Kaweah would be made less often, thereby allowing diversion of Friant-Kern Canal water down the river for irrigation or groundwater recharge more often. Thus, additional water could be used for conversion of native lands for agriculture; this scenario appears unlikely, however, in light of the fact that few lands in the Kaweah River Basin are undeveloped, and the relatively small net increase in water supply from the project.

b. Fish

With-the-project, little change to fisheries would occur on the lower Kaweah River. Although the frequency and extent of flood releases would be altered, the timing of water releases for irrigation would remain essentially the same as now. The river would continue to be dewatered periodically in response to changing seasonal irrigation needs. Therefore, habitat conditions for fish in the lower Kaweah River would probably not change and would remain poor.

Currently, there are inadequate flow requirements for fisheries in the lower Kaweah River. With construction of additional reservoir storage space, some water could potentially be used to provide adequate flows for the existing warmwater fishery and other rare species, such as the Kern brook lamprey. However, there are no such defined fish and wildlife enhancement measures associated with this project at this time.

c. Wildlife

Secondary impacts would occur with project construction. With increased flood protection in the lower basin, some lands presently in agricultural production, or remaining as native vegetation, would now likely be developed. Wildlife values of these areas would thus be gradually lost over time, as residential and commercial developments encroached into these areas.

The vast agricultural fields downstream of Terminus Dam could also undergo some changes of farming use, such as conversion of row crops to dairy farming due to the decrease of the incidence of flooding. Our initial investigation

on land use changes consisted of lands which would be removed from the 100-year floodplain. Significant impacts to these lands are not expected because existing land use is not condusive to wildlife habitat. Of the remaining native lands within this area, any inducement of conversion to agricultural production or other development would have a significant detrimental impact to wildlife inhabiting these areas. This is due primarily to the scarcity of remaining native habitat in the lower Kaweah River Basin.

4. Future With-Project Conditions (Locally Preferred Plan)

Impacts to the Kaweah River Basin would be identical to those described above for the NED plan.

C. TULARE LAKE BASIN

1. Existing Fish and Wildlife Resources

a. Vegetation

The historic permanent and seasonal wetlands in the Tulare Lake Basin have been reduced from nearly 500,000 acres historically to less than 15,000 acres annually now; much of the remaining area (5,000 acres) occurs on the Kern National Wildlife Refuge and nearby duck-hunting clubs. Historical losses of wetlands resulted from conversion of wetlands to agricultural use, and the construction of irrigation and flood control dams on tributary streams. More recent losses have occurred from the reduced availability of surface water to maintain existing wetlands (National Wildlife Refuge and duck-hunting clubs), and contamination of many remaining wetlands (Kesterson NWR).

The historic permanent and seasonal wetlands of the Tulare Lakebed and surrounding areas have been replaced with flooded agricultural fields, floodwater detention basins, evaporation ponds, private duck-hunting clubs, and state and Federal wildlife refuges. Currently, seasonally flooded habitat in the lakebed exists in the Hacienda and Wilbur flood water storage areas totaling about 21,000 acres, which have a combined capacity of about 200,000 AF. Based on the Corps of Engineers' hydrologic simulations for Year 2050 conditions (Appendix B), the Kaweah River would flood the storage cells and other parts of the Lakebed about 1 in 2.2 years (current conditions are about once in 2.7 years, according to the same simulations data). Small portions of the South Wilbur and Hacienda flood areas have also become revegetated with riparian trees and other vegetation. However, no substantial native vegetation remains in the extensive areas under cultivation, which are prone to occasional flooding during major precipitation and snowmelt flood events.

Flooding in the lakebed can occur from all four major rivers in the area, the Kings, Tule, Kaweah, and Kern, either singly, or in combination. Since most of the lakebed is extensively farmed, only small, isolated areas of natural vegetation remain. Limited areas of native plants that still occur on undisturbed areas outside the riparian zone are mainly of the lower sonoran grassland association and alkali sink association (CDFG 1987).

Acreages of certain wetland types, including sewage ponds, agricultural storage ponds, evaporation ponds, and groundwater recharge spreading ponds have increased in recent years to serve the expanded urban and agricultural communities. Most of these wetlands, with the general exception of the evaporation ponds, are beneficial and provide for substantial use by waterfowl, various waterbirds and other wildlife. Many of the area's evaporation ponds are contaminated with elevated concentrations of salt, arsenic, boron, selenium and other elements. Waterbird use of such areas has been shown to result in adverse biological effects on reproduction and survival (SJVDP 1990). Most of the evaporation pond areas are cleared of vegetation annually, although some have variable vegetation types present.

b. Fish

In the late 19th century, commercial fisheries existed within the reservoir, as did commercial markets for frog legs, waterfowl, and even turtles (Haslam 1993). However, because the lakebed has been altered by water diversions, channelization, canals, levees, and draining of the lakebed, fish presently inhabit only the canals and altered rivers in the area, and the lakebed when it is flooded. Today, the remaining aquatic areas of the Tulare Lakebed still supports some native fish species such as tule perch, Sacramento sucker, riffle sculpin, and endemic minnows (CDFG 1987).

Nonnative fish species found in the lakebed channels include striped bass, channel and white catfish, largemouth bass, Mississippi silversides, golden shiner, white bass, and mosquitofish.

When much of the lakebed was flooded in the record wet rainfall year of 1982-83, productivity of the "newly" formed lake was exceptionally high. The California Department of Fish and Game (1987) assumed that this was due to fertilizer used in farming activities, plus the nitrogenous by-products of crops inundated by flood waters, and that this essentially created a new lake. The lake's fishery was extremely popular with anglers at the time because of high numbers of fish, and resultant high catch rates.

c. Wildlife

Most available information on Tulare Lake wildlife refers to migratory waterfowl. The Tulare Lake Basin supports numerous species and significant populations of waterfowl and other waterbirds of the Pacific Flyway. It is perhaps considered most important today as a concentration area for pintail ducks. During the mid-August through September period, an average of 34,000 pintails, representing 40 percent of the Central Valley total, has been recorded in the area (USFWS 1987b). Pintails are typically found feeding in recently flooded fields, drainwater ponds, and flood storage areas of the Basin.

Based on Central Valley waterfowl population estimates conducted between 1973 and 1977 by the Service, the Tulare Basin provides habitat for about 1 percent of the Central Valley goose population (3,400 geese); 4 percent of the dabbling ducks (188,000 ducks); 1 percent of the diving ducks (393); 3 percent of the mergansers (65); and 4 percent of the coots (16,000). In total, about 208,056 waterfowl winter in the Tulare Basin, which comprises 4 percent of the total Central Valley waterfowl population (USFWS 1987b).

In the past, during the late summer and early fall period, waterfowl extensively used the agricultural fields of the area which were flooded for "pre-irrigation" soil moisturizing and salt leaching. It was estimated that 37 percent of the 356,000 acre-feet of water (mean water requirement in the basin) was used for pre-irrigation, primarily from September through January (Tulare Lake Basin Water Storage District 1981). In the past, tens of thousands of acres were flooded at one time. The use of "pre-irrigation" flooding, however, has somewhat declined in the lakebed as agricultural practices have gradually changed to more water-conserving pre-irrigation techniques. This has reduced areas used by wintering waterfowl in the basin.

During the winter and spring months, the Tulare Lakebed is intermittently flooded by rains and uncontrolled snowmelt flooding from the Kings, Tule, Kern and Kaweah Rivers. This attracts waterfowl and other migratory waterbirds into the Tulare Lakebed. Although the area is extensively farmed and water flow in the tributary streams is almost totally controlled, flooding of the area, either by rains, irrigation, or floodflows, still attracts large numbers of waterfowl and other waterbirds. This annual concentration, especially of pintail ducks (Barnum and Euliss 1991) mentioned above, demonstrates the ancestral tie to the Tulare Lake area, and the availability of feeding and nesting habitat.

Other birds besides waterfowl are also important components of the Tulare Basin avifauna. Shorebirds and other water birds use flood storage areas, evaporation ponds, and other ponded areas in the summer as breeding areas. Bird surveys by Barnum *et al.* (in prep.) documented 129 bird species in southern San Joaquin Valley evaporation ponds; most of the ponds were located in the Tulare Basin. Seventy-five of the species were waterbirds, of which 20 were waterfowl species. Twenty-six species were breeding at the evaporation ponds, whereas 55 species are known to nest at the Kern National Wildlife Refuge (NWR), located south of the Lakebed. Highest concentrations of birds were found on an evaporation pond immediately south of the Lakebed, near the Kern NWR and the Wilbur and Hacienda flood storage areas. When these flood storage areas contain water, the same associations of waterbirds discussed above would be present in these areas.

Other common waterbird species in the Tulare Lakebed include eared, Clark's and western grebes, great, snowy and cattle egrets, black-crowned night-heron, white-faced ibis, mallard, pintail, cinnamon teal, shoveler, ruddy duck, American coot, snowy plover, long-billed curlew, killdeer, least sandpiper, long-billed dowitcher, Wilson's phalarope, Caspian, black, and Forester's terns, tree and cliff swallows, and red-winged blackbirds. Large colonies of black-necked stilts and American avocets are among the most abundant species, representing about 50 to 70 percent of all breeding birds in the area. The rookeries of egret, ibis, and black-crowned night-herons are also quite substantial.

Within the Tulare Lakebed, the South Wilbur and East, Middle and West Hacienda floodwater holding areas attract numerous waterfowl and other water-associated birds. During 1982 and 1983, the wetest year on record, concentrations of over 122,000 and 246,000 waterfowl, respectively, were observed in the East Hacienda area alone (USFWS unpublished data). Some areas were flooded in excess of one year.

During drier years, the South Wilbur and Hacienda areas, when flooded, may provide up to about one-third of the uncontaminated wetland habitat in the Tulare Basin, which is the breeding or overwintering ground for about 4 percent (208,000 individuals) of the total Central Valley waterbird population (USFWS 1987b).

Coe (1990) compared the density of wintering ducks on various wetland types from 1982 to 1984 in the Tulare Lake Basin. These included oxidation ponds, irrigated fields, freshwater areas, duck-hunting clubs, and evaporation ponds. The freshwater and duck club category included floodwater retention areas (e.g., South Wilbur and Hacienda cells), and flood overflow areas (e.g., Tulare Lakebed). Highest concentrations were observed on oxidation ponds (16.8 ducks/acre), followed by irrigated fields (10 ducks/acre), freshwater and duck clubs (3.2 ducks/acre), and evaporation ponds (2.4 ducks/acre). Duck densities were 12.4 ducks/acre in the Hacienda complex, 0.8 ducks/acre in the South Wilbur area, and less than 0.2 ducks/acre in the Tulare Lake overflow areas. Similar concentrations for the entire southern San Joaquin Valley were assessed by Barnum and Euliss (1991) in surveys conducted from 1980 to 1987.

In addition to irrigated agricultural lands and floodwater holding areas, a large number of birds are also attracted to the agricultural evaporation ponds (as high as 38,000 birds in 1982). These areas tend to attract more and more birds as pre-irrigation practices on agricultural fields change, a chronic lack of water plagues the Kern and Pixley NWRs, and the number of private duck clubs decreases.

The Tulare Lakebed and surrounding areas within the basin have a significant agricultural drainage water contaminant problem which, among other impacts, severely jeopardizes the continued existence of waterbirds in the Tulare Basin. Groundwater levels in the Tulare Lakebed vary from 0 to 5 feet in

depth. Areas adjacent to the Tulare Lakebed contain many substances (including selenium, arsenic, boron, chromium, and molybdenum) which naturally occur in the rocks or soils; they are commonly found in shallow groundwater and drainage water extracted from the land. A number of evaporation ponds have been constructed to serve individual farms and water districts to contain, and evaporate off, the drainage water.

The largest concentration of evaporation ponds (4,500 acres) is the complex serving the Tulare Lake Drainage District lands. These ponds are located north of, and adjacent to, the Kern NWR. Many of these evaporation ponds have already been found to pose significant contaminant-related hazards to various water birds and other species of wildlife (SJVDP 1987). Selenium concentrations, deformity rates, reproductive failures, and bird mortalities are all at least as great as any recorded at Kesterson NWR (SJVDP 1987), the Central Valley site where selenium contamination was first found to be adversely affecting waterbirds.

Because of the significant loss of wetlands in California and especially in the southern portion of the Central Valley, any available wetlands are heavily used, and therefore, play a vital role in maintaining Pacific Flyway bird populations.

2. Future Without-Project Conditions

For the without-project conditions, we assumed that no other flood protection works would be provided for the Tulare Lakebed area. However, projects are currently proposed for reservoir enlargements on both the Kings and Tule Rivers, both of which would have similar effects as this project on Tulare Basin flooding. Should those projects be constructed, we assume that appropriate mitigation for their impacts would be provided. We recommend that cumulative effects of the three projects be assessed prior to completion of any feasibility reports.

Over the 100-year period of impact analysis (2000 to 2100), flood protection for the Lakebed area would decrease slightly, due to minor decreases in reservoir flood protection capacities in the upstream reservoirs. Under without-project conditions, 2.7-year and 2.2-year flood protection would occur in the Lakebed in the years 2000 and 2100, respectively (Corps data, Appendix B). (The level of flood protection changes over the 100-year project life due to changes in reservoir sediment loads and operations.) Flood magnitudes and duration would also increase slightly over the study period.

a. Vegetation
Conditions within the Tulare Basin would remain, more or less, as under existing conditions.

b. Fish
Conditions for fish are not expected to change in these areas. Differences in fish species composition and densities would be likely, but any downward or upward trends are not predictable.

c. Wildlife
Under without-project conditions, wildlife conditions would remain, more or less, as under existing conditions, but the frequency of flooding to the Tulare Lakebed area would increase slightly over the period of study. As discussed above, decreased reservoir flood control capacities in the Pine Flat, Kaweah, and Success Reservoirs would increase flooding frequency to the Lakebed. Thus, suitable wintering waterfowl and summer breeding habitats would likely become gradually, but only very slightly more abundant, and would occur during drier years than under existing conditions.

3. Future With-Project Conditions (NED and Locally Preferred Plans)

Either of the proposed alternatives would prevent some Kaweah River floodwaters from reaching the Tulare Lakebed. According to the Corps' hydrologic simulations, small-sized flood events (less than 3.3-year events) would no longer send Kaweah Basin floodwaters to the Lakebed, and larger flood events would be decreased in magnitude. Ponded floodwaters may also be removed from the area more rapidly than under without-project conditions.

Actual differences between with- and without-project conditions are quite complex for any given water year. The differences depend in part upon the flood magnitude and duration, time of year, upstream water storage capabilities, and hydrology of neighboring watersheds (i.e., Kings and Tule Rivers). Thus, the Corps' simulations data must be regarded at best as a reasonable estimation of hydraulic changes, given the existing information. The only actual flooding data for the Tulare Basin available is confined to only a few years. Thus, information on the project's environmental (and economic) impacts, within this report and in the Corps' forthcoming draft EIS, could be subject to change if the *actual* flooding information differs greatly from the *simulated* conditions.

Impacts discussed in this section are made assuming that the proposed flood control projects on Pine Flat and Success Reservoirs are not constructed. Our impact estimates would require modification if one of these (or other) projects, which also would affect fish and wildlife resources of the Tulare Basin, were constructed.

a. Vegetation
Reduced flooding in the Tulare Lakebed would have little impact on native vegetation of the area, since little native vegetation is now present. Reduced flooding could, however, affect agricultural lands. First, certain annual crops would likely be planted earlier in the season. Second, crops would likely be planted in areas which are not planted now because of anticipated periodic flooding. Although the South Wilbur and Hacienda flood storage areas are not presently cropped, the decrease in need to use these areas for storing floodwater may bring portions of these areas into agricultural production. However, local agricultural interests maintain that these areas would not be farmed, due to poor soil quality and the relatively small reduction in floodflows to the area.

b. Fish
As stated above, flooding of the Tulare Lakebed would decrease in frequency and extent from existing conditions. Flood flows that presently reach the lakebed during extremely wet years would continue to flow into the area. The magnitude and duration, however, would be decreased. Although reduced flows into the Tulare Lakebed from the Kaweah River would be biologically adverse, the impacts would probably be minimal, largely because the Tulare Lakebed fishery conditions are presently poor-to-fair, at best.

c. Wildlife
Under with-project conditions, cropping patterns in the area would likely remain similar to existing conditions. Even with the reduction of the flooding threat, future conditions would not likely be conducive to large-scale conversion of field crops to orchards and vineyards or other higher-valued crops.

Reduced flooding of the area could, however, eliminate the need to divert floodwaters into cells created in the basin to control flooding. Although the added storage at Lake Kaweah (43,000 AF more storage) would only contribute a relatively small amount to the reduction in flood flows to the Tulare Lake Basin, the cumulative effects of the proposed increased storage on the Tule

River (20,000 AF) and Kings River (120,000 AF), in addition to the 43,000 AF on the Kaweah River, would severely reduce or could totally eliminate any flooding in the Tulare Lake Basin. Since the Tulare Lake Basin is heavily used by migratory waterfowl, shorebirds, and other water-associated birds when flooded, any losses in flooded lands, or conversion of flood storage areas to agriculture, would have a significant adverse effect on these wildlife resources; with flooding virtually eliminated, the impacts would be very severe.

Without the need to maintain the flood cells, areas such as the South Wilbur flood area (4,300 acres, 1982-83) and possibly the East Hacienda flood area (5,600 acres, 1982-83) could, even though they are marginal agricultural lands, be brought into agricultural production. The Hacienda and Wilbur cells are used primarily to store floodwaters and to release water for irrigation when needed; thus, water can be retained in these cells for significant periods. Therefore, such cells presently provide essential habitat for various waterbirds; any reduction of their values could severely impact an array of waterbird species.

In the enclosed impact analyses, we did not assume that the flood storage areas would be farmed under future conditions as a result of this project. However, as stated above, the cumulative effects of this and the other flood control projects for the Lakebed make this change likely and, consequently, there could be significant losses of waterbird habitat. Thus, we believe it is imperative, that during the planning process of projects involving Tulare Basin streamcourses, a thorough study be conducted which assesses in detail the cumulative effects of all proposed flood control projects on Tulare Basin fish and wildlife resources.

Furthermore, increased flood storage could allow irrigation districts within the Kaweah, Tule, and Kings River basins to take their full entitlement of Class 2 water from the San Joaquin River via the Friant-Kern Canal. Presently, importation of San Joaquin water is limited by flood storage needs in the three respective drainages.

With the additional storage available in these basins, however, releases to maintain flood storage capacity would be drastically reduced, more storage space could be available, and thus more importation of San Joaquin River water could occur than is presently possible.

The effects of such an action would not only be localized in the three respective basins, but also on the fish and wildlife resource of the lower San Joaquin River, the Sacramento-San Joaquin Delta, and San Francisco Bay. Since this system is already severely stressed due primarily to inadequate flows, any further flow reductions could have highly-significant and far-reaching effects on fish and resources of these downstream areas.

The importation of additional water into the three basins would also allow greater irrigation of agricultural land and potential conversion of some lands to higher-valued crops, or it could enhance the locals' water-marketing capabilities. In the Kaweah River Basin, imported Friant-Kern water can, under with-project conditions, be used for irrigation or stored for later use during those periods when floodwaters from Lake Kaweah would no longer need to be released into the river channel. With increased flood storage capacity, former floodwaters could then be stored in Lake Kaweah, and, later, released for irrigation or sale to other areas.

Another impact that would occur with the additional storage of water and importation of Friant-Kern Canal water involves the effects on the agricultural drainwater problem in the Tulare Lake Basin. It is estimated that about 5,300 acres of evaporation ponds (CDFG 1988) presently occur in the basin. The Service has found that embryo deformities of waterbirds, related

to concentrations of selenium and other contaminants, are common in some evaporation ponds of the Basin. Deformity rates in some instances are at least three times higher than those found at Kesterson National Wildlife Refuge a few years ago.

Any increase in irrigation over existing levels in the three basins would add to the agricultural drainwater contaminant problem. Additional evaporation ponds could be required to accommodate increased drainwater, and since many migratory waterfowl, shorebirds, and other water-associated birds are attracted to such evaporation ponds, primarily because of the lack of natural wetlands in the area, many adult birds and their offspring would be adversely impacted. Such problems could result in violations of the Migratory Bird Treaty Act and other Federal laws. Thus, the Service strongly opposes the construction or increased use of any new evaporation ponds in the San Joaquin Valley without full mitigation of their detrimental effects.

D. THREATENED AND ENDANGERED SPECIES

Below are brief discussions of State- and federally-listed threatened and endangered species which may be found within each potential project impact area. These discussions should be regarded as preliminary information, which we are providing only to assist the Corps in preparation of any Biological Assessments (BA) that may be deemed necessary, or in revising and updating the Corps' present BA's.

Appendix C contains a summary of a Federal agency's responsibilities under Section 7(a) and (c) of the Endangered Species Act of 1973, as amended (Act). We recommend the Corps also review its requirements under the Act, as published in 50 CFR 402. The Service has consultation responsibility for most of the federally-listed species that may be affected by the project, and should be contacted regarding further consultation requirements. The National Marine Fisheries Service would have responsibility for any marine species, and should be consulted on any activities which may affect them. The California Department of Fish and Game should also be contacted regarding any species which is listed under the California Endangered Species Act.

The Corps should request in writing from the Service a list of all federally-listed and proposed threatened and endangered species within the project area, or an updating of any list more than 90 days old at the time preparation of any additional or updated BA for this project is undertaken.

The Service most recently provided the Corps with a list of Federally-listed threatened and endangered species in January 1995 (Appendix C). These species may also be present in any mitigation areas proposed for the project impacts; thus any Biological Assessment should include these areas.

Ecos, Incorporated (1990), under contract to the California Department of Water Resources, investigated the occurrence of several State and Federal special-status animal species in the Kaweah Basin. Their investigation did not include the Tulare Lakebed area. They found that several endangered species or suitable habitat for certain species occurs within the project area. Some of these species may be negatively affected by implementation of the project, both from the effects of inundation of habitat and from impacts in downstream areas within project limits.

Suitable habitat exists at Lake Kaweah for several threatened and endangered animal species, but few are known to occur there. The area proposed for inundation includes perch sites used by bald eagles (*Haliaeetus leucocephalus*). Also, Critical Habitat Area 9 for the California condor (*Gymnogyps californianus*) includes the southern arm of Lake Kaweah (USFWS 1976). In addition, valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) may exist near the reservoir; its host plant, the blue

elderberry (G. *Sambucus*), is known to occur above the south and east shores of Lake Kaweah. As of 1991, no evidence of valley elderberry longhorn beetle use has been found at the site (Barr 1991).

The Department of Water Resources conducted a rare plant survey in the Kaweah River Basin in 1989. Their vegetation report (DWR 1991) states that two candidate plant species for Federal listing exist near Lake Kaweah, the spiny sepaled coyote thistle (*Eryngium spinosepalum*) and the Kaweah brodiaea (*Brodiaea insignis*). Kaweah brodiaea, which is also listed as Endangered by the State, is known to occur along Dry Creek; it is not believed to occur around Lake Kaweah. One population of *E. spinosepalum*, about 350 individuals in 1989, was found near the eastern shore of Lake Kaweah just above the proposed inundation level. The population could be impacted by the proposed project if human impact increases at the site.

Impacts to several San Joaquin Valley listed species from construction of Terminus Dam have likely been considerable. By reducing the likelihood of flooding and providing a stable water supply, construction of Lake Kaweah has resulted in the conversion of endangered species habitat to agricultural and urban uses. The proposed project may further these losses. Such impacts to San Joaquin Valley listed species should be addressed by the Corps through formal consultation.

For several species, surveys will likely be necessary to determine their current distribution within the project area. We recommend that the Service's Section 7 coordinator at the Sacramento Ecological Services Field Office be contacted for appropriate field survey methodologies for all species which additional information is found to be necessary.

The California Department of Fish and Game has provided a list of State special-status species protected under the California Endangered Species Act, which may be affected by the project. Information on any California threatened and endangered species are described below; other Protected or Special Concern species are listed in a letter to the Service from the Department of Fish and Game, which is enclosed as part of Appendix C.

1. Listed Species

blunt-nosed leopard lizard, *Gambelia silus* (E)[1]
State status: Endangered
The blunt-nosed leopard lizard inhabits San Joaquin saltbush and California Prairie plant communities. They prefer relatively open areas for basking. Such areas also allow lizards to move easily and quickly when foraging, or to hide under perennial shrubs when ambushing prey or escaping predators. Although they are able to construct their own burrows, leopard lizards also use kangaroo rat burrows when seeking shelter from predators and the sun. Leopard lizards are diurnal and are most active in the late morning and afternoon (SJVDP 1990).

---

[1] Federal Status:

(E)-Endangered (T)-Threatened (P)-Proposed (CH)-Critical Habitat

(1)-Category 1: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

(2)-Category 2: Taxa for which existing information indicated may warrant listing, but for which substantial biological information to support a proposed rule is lacking.

(m)-Listing petitioned.

Blunt-nosed leopard lizards are opportunistic feeders; their diet consists primarily of insects, but occasionally they will eat other vertebrate prey. Leopard lizards hibernate during winter and emerge from their burrows in early spring. The breeding season occurs in April and May and it is only during this time that males become territorial, defending a home range of 0.52-4.2 acres from male intruders. The home ranges of several females may overlap a single male's territory. The average clutch size for blunt-nosed leopard lizards is 2.9 each season. Hatchlings emerge in late July and early August (SJVDP 1990).

In addition to the loss of its habitat throughout the San Joaquin Valley, the decline of blunt-nosed leopard lizard populations has been attributed to overgrazing, possible poisoning by insecticides and rodenticides, activities associated with petroleum development, and destruction of habitat by off-road vehicles (SJVDP 1990). Project-induced development of lands which are occupied by, or suitable for, blunt-nosed leopard lizards may result in adverse effects to this species.

bald eagle, *Haliaeetus leucocephalus* (E)
State status: Endangered
Bald eagles are known to migrate through and winter in the San Joaquin Valley. They feed mainly on fish, but also scavenge on water birds and mammals. Bald eagles prefer to perch high in large, stoutly-limbed trees, on snags or broken-topped trees, or on rocks near water. They generally require large bodies of water, or free-flowing rivers with abundant fish, and adjacent snags or other perches. Eagles are monogamous, breeding first at year 4 or 5, with an average clutch size of 2 eggs (Zeiner *et al.* 1990). Populations of bald eagles have become seriously diminished in number due to shooting, pesticides and human encroachment. Artificial reservoirs such as Lake Kaweah have become important wintering areas for eagles in California. Bald eagles and golden eagles are known to winter regularly at Lake Kaweah, and use trees located on the north side of Lake Kaweah for perching and roosting. A bald eagle nest, located in a riparian forest just downstream of Terminus Dam, was reported by a local resident in 1993; however, Department of Fish and Game staff could not later locate the nest site (Ken Sanchez, USFWS, Sacramento, pers. comm.). Bald eagles may be adversely affected by losses of trees on the reservoir perimeter, or by construction-related impacts to riparian areas immediately downstream of the reservoir. Before potential project impacts to bald eagles can be determined, additional studies are needed to determine the presence of, and habitat use by bald eagles at Lake Kaweah.

San Joaquin kit fox, *Vulpes macrotis mutica* (E)
State status: Threatened
The kit fox, smallest of the fox species, inhabits arid regions of western North America. They live in grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs and scrub. Like the giant and Fresno kangaroo rats, on which it is dependent for food, the kit fox is generally nocturnal, spending most of the daylight hours in elaborately constructed dens. Burrows can be as long as 6 to 15 feet, consisting of numerous tunnels and chambers which are dug in light sandy loam soils in areas of gentle slope. During the summer, an individual fox may use as many as four or more dens each month to avoid fleas. Home ranges overlap and are usually not greater than 1-2 square miles. During the breeding season, adults and pups occupy more complex dens which belong to specific family groups and are probably constructed over many years (SJVDP 1990).

The breeding season lasts from December to February, and females give birth to an average litter of four pups in February or March. Both parents hunt and provide food for the pups until May or June, and families disperse to nonbreeding dens in July or August (SJVDP 1990).

The primary factor contributing to the decline of the kit fox is the conversion of suitable habitat to irrigated agriculture. In addition to the loss of its habitat, researchers have reported dramatic declines in kit fox populations due to shooting, trapping, burying in dens during land leveling, poisoning through secondary ingestion of rodenticides and vehicle traffic mortalities (SJVDP 1990).

No recent observations of kit fox dens have been made in the study area, but suitable habitat, including potential dens, exists in the study area. Project-induced development of lands suitable for kit fox habitation would further reduce habitat quality for kit foxes in the southern San Joaquin Valley.

Tipton kangaroo rat, *Dipodomys nitratoides nitratoides* (E)
State status: Endangered
The Tipton kangaroo rat is a subspecies of the San Joaquin kangaroo rat. They are restricted to remnants of the San Joaquin saltbush and alkaline California prairie plant communities on the valley floor in the Tulare Basin. They burrow in friable soils of alluvial fans and flood-plains that tend to be powdery rather than hard when dry. Burrows are located in open areas near alkali sinks on slightly elevated hummocks, which are not subject to flooding. The highest population densities occur in areas of sparse-to-moderate shrub cover, containing scattered cover of grasses and forbs (SJVDP 1990).

The primary threat to the Tipton kangaroo rat is the continued loss of habitat due to conversion of native lands to agriculture. Additional threats include flooding, livestock grazing, inadvertent rodenticide poisoning, and the loss of habitat due to the construction of drainage evaporation ponds (SJVDP 1990). Project-induced development of lands suitable for kangaroo rat habitation would further reduce habitat quality for this species in the southern San Joaquin Valley.

valley elderberry longhorn beetle, *Desmocerus californicus dimorphus*, (T)
State status: None
The valley elderberry longhorn beetle (VELB) has been found only in association with its host plant, the blue elderberry (*Sambucus* sp.). Adults feed on the foliage and perhaps flowers, and are present from March through early June. In the spring the beetles mate, and the females lay eggs on living elderberry plants. After transforming into an adult within the plant, the beetle chews an exit hole and emerges from the elderberry. Elderberry shrubs/trees with VELB populations occur in a variety of habitats and plant communities, but most often in riparian or savanna areas (Barr 1991). Elderberry plants exist within the project area near Lake Kaweah and downstream of Terminus Dam (Barr 1991), but existing populations of VELB have not been documented. Project-induced losses of elderberry plants would, however, further reduce habitat availability for this species in the southern San Joaquin Valley. The Corps should obtain mitigation guidelines from the Service to plan for any adverse impacts to elderberry plants which may be impacted as a result of project construction. If it is determined that the proposed project may affect elderberry plants, formal consultation with the Service should be initiated.

California jewelflower, *Caulanthus californicus*, (E)
State status: Endangered
This annual herb, a member of the mustard family, grows to about 1 foot in height and has translucent white flowers with purple to green tips. It was once known from 47 sites, but only 9 natural populations and 1 introduced population of the plant now exist (USFWS 1990). Project-induced flood reduction or development of any lands where this species is present may further jeopardize the continued existence of this species in the southern San Joaquin Valley.

vernal pool fairy shrimp, *Branchinecta lynchi* (T)
State Status: none
These fairy shrimp inhabit ephemeral pools. Nearly all fairy shrimp feed on algae, bacteria, protozoa, rotifers, and bits of detritus. The females carry the eggs in an oval or elongate ventral brood sac. The eggs are either dropped to the bottom or remain attached until the female dies and sinks. The thick-shelled "resting" or "winter" eggs are capable of withstanding high heat, cold, and prolonged desiccation. The eggs hatch when the vernal pools and swales fill with rainwater. The early stages of the fairy shrimp develop rapidly into adults (USFWS 1992). Project-induced flood reduction or development of any lands where this species is present may further jeopardize the continued existence of this species in the southern San Joaquin Valley.

2. Proposed Species

California red-legged frog, *Rana aurora draytonii* (PE)
State Status: Special concern
The California red-legged frog was recently proposed by the Service for listing as endangered under the Endangered Species Act (59CFR:4888, February 2, 1994). This highly aquatic frog occurs in the vicinity of quiet, permanent pools of streams, marshes, and occasionally ponds. Adults eat aquatic and terrestrial insects, crustaceans, snails, worms, fish, tadpoles, and smaller frogs. Aquatic larvae are mostly herbivorous. Loss of habitat and the introduction of exotic predators are a concern (Zeiner *et al.* 1990). Losses of habitat from project-induced development or flood reduction may affect the continued existence of this species in the San Joaquin Valley.

Greene's tuctoria, *Tuctoria greenei* (PE)
State Status: Endangered
Vernal pools are the principle habitat for this California endemic species which is confined mostly to the San Joaquin Valley. This plant does not have much inundation tolerance, and is found in both high and low terraces in clay pan soils (Fuller 1992). Project-induced development or flood-reduction of any lands where this species is present may further jeopardize the continued existence of this species in the southern San Joaquin Valley.

Hoover's spurge, *Chamaesyce hooveri* (PT)
State Status: None
This plant is endemic to California and found in vernal pool habitat. It has a high tolerance to long periods of inundation and is frequently found in small drainages and low terraces 100-500 feet in elevation. The flowering period is June-July (Fuller 1992). Project-induced development of, or reduced flooding to, any lands where this species is present may further jeopardize the continued existence of this species in the southern San Joaquin Valley.

San Joaquin adobe sunburst, *Pseudobahia peirsonii* (PE)
State status: Endangered
The San Joaquin adobe sunburst is a member of the sunflower family, and is an erect annual herb about 4 to 18-inches-tall with a loose covering of white, wooly hairs. The bright yellow flower heads, which appear in March or April, are solitary at the ends of the branches. This plant occurs primarily in nonnative grasslands in the eastern and southeastern portions of the San Joaquin Valley, but at a few sites occurs at the ecotone between the nonnative grassland and blue oak woodland communities. This plant has been threatened by one or more of the following: conversion of native habitat for agriculture, urbanization, overgrazing, competition from introduced plants, recreational activities, water projects, mining, highway projects, and other anthropogenic actions. Project-induced development of any lands where this species is present may further jeopardize the continued existence of this species in the southern San Joaquin Valley.

San Joaquin orcutt grass, *Orcuttia inaequalis* (PE)
State Status: Endangered
Habitat for this annual late-season plant consists of vernal pools, with hard pan soils in both high and low terraces. This California endemic species flowers in June and July (Fuller 1992). Twelve populations are known to exist within Fresno and Merced counties. The species is thought to have been extirpated from Tulare County. However, reduced flooding frequency or project-induced development of any lands where this species is present may further jeopardize the continued existence of this species in the southern San Joaquin Valley.

E. MITIGATION

1. Mitigation Planning Goals

The recommendations herein for mitigation and the protection of fish and wildlife resources conform with the Service's Mitigation Policy as published in the Federal Register (46:15 January 23, 1981). The Mitigation Policy provides Service personnel with guidance in making recommendations to protect 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 habitat values involved. The Resource Categories cover a range of habitat values from those considered to be unique and irreplaceable to those believed to be much more common and of relatively lesser value to fish and wildlife. The Mitigation Policy does not apply to threatened and endangered species.

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

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

In addition to mitigation goals based on habitat values, as defined according to Resource Categories in the Mitigation Policy, Region 1 of the Service has a

goal of "no net loss of wetlands *acreage* or habitat values, whichever is greater." This additional mitigation goal is applied to all proposed Federal and non-Federal water development or flood control activities in California that may affect wetlands habitats.

At least eight distinct, mappable cover-types occur within the project area. These cover-types and their associated Resource Categories and mitigation planning goals are discussed below.

a. Riparian forest and riparian scrub
The evaluation species selected for riparian forest and riparian scrub habitats that may be impacted are Swainson's hawks, wood ducks, and northern orioles. Woody riparian vegetation provides important cover, and roosting, foraging, and nesting habitat for these species. Large diameter trees also provide critical nesting sites for species such as wood ducks and Swainson's hawks. Riparian forest and scrub-shrub cover-types are of generally high value to the evaluation species, and are overall, extremely scarce (less than 2 percent remaining from pre-development conditions). Therefore, the Service finds that any riparian forest and riparian scrub habitats that would be impacted by the project should be considered Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value". In addition, the Service's regional goal of "no net loss of wetlands--acreage or habitat values, whichever is greater" would apply to these cover-types where they classify as wetlands according to the Service.

b. Seasonal/intermittent wetlands
The evaluation species selected to determine the value of seasonal/intermittent wetlands, such as those existing in the south Wilbur and Hacienda areas, are three breeding shorebirds: American avocet, snowy plover, and black-necked stilt. These birds were chosen because they are good indicators of potential impacts to other waterbirds, have high non-consumptive values, and because of Service responsibilities for their protection under the Migratory Bird Treaty Act. The Wilbur and Hacienda areas, which provide some high-value seasonal/intermittent wetlands breeding habitat in wet years, are remnants of the natural wetlands which were completely obliterated from the Tulare Basin for agriculture over the last 130 years. Evaporation ponds in the Tulare Basin also attract breeding shorebirds, but because of contaminant-related mortalities and deformities, birds should be encouraged to use alternative breeding sites. Based on the high value of seasonal/intermittent wetlands to the evaluation species, the losses of historic breeding areas, and the paucity of other suitable breeding sites in the area, the Service has determined that such wetlands which would be affected by the project shall be classified as Resource Category 2, with an associated mitigation planning goal of "no net loss of in-kind habitat value". In addition, the Service's regional goal of "no net loss of wetlands acreage or habitat values, whichever is greater" would apply to this cover-type.

c. Agricultural/Upland areas
Agricultural/upland areas predominate in the study area. This cover type includes the non-seasonally flooded agricultural lands, grasslands, levee slopes, and other mainly herbaceous areas. The evaluation species selected for this cover type are the rough-legged and red-tailed hawks, which utilize upland agricultural areas and related areas for foraging, and dabbling ducks, which heavily utilize seasonally flooded or pre-irrigated agricultural areas for foraging (Barnum and Euliss 1991). These species were selected because of the Service's responsibilities for their protection and management under the Migratory Bird Treaty Act, and their overall high non-consumptive and consumptive (ducks) values to humans. Agricultural/upland areas potentially impacted by the project vary in their relative values to the evaluation species, depending on the degree of human disturbance, plant species composition, juxtaposition, and magnitude and frequency of flooding and irrigation. Native grasslands in the study area are relatively rare (a 26

percent decline throughout the state since 1940 (Garrison 1993)), and are usually of higher value if relatively undisturbed.

Some of the agricultural/upland areas, particularly those in the Tulare Basin which are pre-irrigated, are relatively abundant, but of high value to the evaluation species, and thus have a mitigation planning goal of "no net loss of habitat value while minimizing loss of in-kind habitat value" (i.e., Resource Category 3). Other agricultural/upland areas that may be impacted have much less value for the evaluation species due to a variety of degradation factors; the Service's mitigation planning goal for these areas is "minimize loss of habitat value" (i.e., Resource Category 4).

d. Oak Woodlands

Oak woodlands as defined here includes the more specific cover-types of oak woodlands, oak savannahs, and oak riparian woodlands. These hardwood ranges generally can be classified as areas where tree canopy cover is 10 percent or greater, and may consist of blue, live, valley, or other species of oaks. The evaluation species selected for this cover type are the acorn woodpecker and mule deer. Acorn woodpeckers utilize oak woodlands for nearly all their life requisites; 50-60 percent of acorn woodpecker's annual diet consists of acorns (Garrison 1993). Acorn woodpeckers also can represent impacts to other canopy-dwelling species. Deer also heavily depend upon acorns as a dietary item in the fall and spring; the abundance of oak acorns and other browse influences the deer's seasonal pattern of habitat use. Both these species were selected because of their overall high non-consumptive values to humans. Mule deer also provide important consumptive (hunting) values to humans in the State. The importance of California's hardwood forests to wildlife cannot be overemphasized; a total of 331 of the 643 species of wildlife in California's Wildlife Habitat relationships system find hardwood-dominated habitats either suitable or optimum for breeding (Garrison 1993).

Despite fairly widespread occurrences of various oak woodland types in the State, human uses have heavily impacted wildlife which utilize them. Between 1945 and 1985, about 1.2 million acres of oak woodland were lost, mostly to rangeland clearing. Hardwoods are still cleared for firewood and increased development, which has spread into the foothills throughout the California. Based on the very high value of oak woodlands to the evaluation species, and their rapidly declining abundance, the Service has determined that oak woodlands which would be affected by the project shall have a mitigation planning goal of "no net loss of in-kind habitat value" (Resource Category 2).

e. Lacustrine areas

For the lacustrine aquatic habitat cover-type of Lake Kaweah, the evaluation species are the rainbow trout and sunfish (Centrarchidae family). Both species exist in the reservoir; the sunfish family includes large and smallmouth bass, various sunfishes, and crappies. Both evaluation species provide a significantly valuable fishery to anglers. Hatchery-raised rainbow trout are stocked within the reservoir annually. It is presumed that, because of high lake temperatures in the fall, rainbow trout do not survive throughout the summer in Lake Kaweah. Similar areas suitable for bass and trout fishing are relatively abundant throughout California, but few others are found close to Visalia. Therefore, based on the medium to high value of the evaluation species to anglers, and the relative abundance of lacustrine and other aquatic types supporting such fisheries within the State, the Service has assigned this cover-type a mitigation planning goal of "no net loss of habitat value while minimizing loss of in-kind habitat value" (Resource Category 3).

f. Riverine areas

The evaluation species selected for riverine areas are the rainbow trout and the common merganser, which are valued by humans for both consumptive (i.e., fishing) and non-consumptive (i.e., birdwatching) uses. The rainbow trout is a common resident of western Sierra Nevada rivers; although some trout adapt

fairly well to lacustrine conditions, resident rainbow trout typically complete their entire life cycle in such rivers. Mergansers use riverine areas for feeding on small fish; this species is commonly found foraging in the Kaweah River upstream of Lake Kaweah.

River and stream habitats have been severely degraded throughout the state over the past 150 years. Nearly every river within the state has been altered by channelization, dams, water diversions, pollution, and numerous other factors. The entire Kaweah River reach downstream of Terminus Dam has been altered in such a manner, and its values to fish and wildlife has been equivalently altered. Areas upstream of the reservoir are in a somewhat more pristine state, and are of much higher value to fish and wildlife. Based on the high value of this cover to the evaluation species, and its relative scarcity within the region, the Service finds that any riverine areas that would be impacted by the project should have a mitigation goal of "no net loss of in-kind habitat value" (i.e., Resource Category 2).

2. Mitigation Site Descriptions

Several sites were assessed for their ability to providing suitable compensation mitigation for any unavoidable project impacts. Each of the sites is briefly described below.

a. Existing Lake Kaweah Project Lands

Existing project lands are preferred by the Corps for use as mitigation areas, because costs associated with lands acquisition are reduced. Existing project lands are often the compensation sites preferred by the Service as well, because, in many cases, mitigation would then occur in close proximity to the impacted areas. Generally, mitigation located at, or near, the site of adverse impacts is preferred because regional net losses of habitat values are reduced.

The existing lands owned by the Corps at Lake Kaweah include the lake itself and areas around the perimeter of the lake. If the proposed project was implemented, additional lands around the perimeter would be purchased. Nearly all of the uplands surrounding the reservoir consist of oak woodland, oak savannah, and some grasslands. Like other oak woodlands located in foothill areas, tree densities on south-facing slopes are typically much less than those on the north-facing slopes, primarily because of the typically dry nature and poor water-retention capacities of lands with southern exposures and steep slopes. However, some exceptions do occur; south-facing slope tree densities on the north side of the lake, where water moisture is retained in the soils, are about the same as those areas which have north-facing slopes.

Many of the areas on the north side of the reservoir are presently subject to cattle grazing, which generally reduces habitat values and the ability for oak regeneration. However, we believe that cattle grazing impacts to the oak woodlands are less important than effects due to poor soil water retention. We have noted that grazed woodlands on the north side of the reservoir have densities about equal to ungrazed densities on the south side, when soil moisture characteristic are assumed to be about the same. Also, young oak trees appear to be similarly abundant in both grazed and ungrazed areas at Lake Kaweah, although we have not yet quantitatively assessed these data.

Exclusion of cattle grazing on the north side of the reservoir could improve oak tree recruitment in the area, but such enhancement measures would not provide sufficient benefits to offset all impacts to oak woodlands in this area. Tree plantings would also be needed, and on the drier south-facing slopes plantings would likely require watering for many years.

We also have concerns regarding the persistence of any replantings on the south-facing slopes; it may be possible to plant more trees in the area, but

future natural recruitment rates would continue to be low, because of the lack of water in the soils. Thus, replantings would increase tree densities for a period of time, but the site would eventually "thin out" naturally due to moisture stress. Furthermore, the increment of benefit which can be derived from enhancement of existing oak woodlands is relatively low; consequently, compensation acreages would be high, and additional lands would need to be purchased to meet compensation requirements. Because this measure could not possibly provide complete compensation for project-induced impacts, the Service has not included a HEP evaluation of an oak enhancement scenario on project lands. We could later, if requested by the Corps, assess the extent to which such an oak woodland mitigation scenario could reduce the amount of off-site mitigation needed.

Suitable lands do exist within the existing reservoir for replacing riparian scrub which would be lost as a result of project construction. Suitable areas within the reservoir were determined by observations of the location and inundation frequencies of existing riparian scrub. This cover type is primarily located within swales throughout the upper reservoir inundation zones, and on some flatter areas within the reservoir between roughly elevations 590 feet and 650 feet msl. Both areas, when not completely inundated, appear to have good localized moisture retention characteristics.

Potential replacement areas for willow scrub are generally located within the reservoir in areas of similar hydrology; the best areas for willow scrub would generally be at the higher elevations. One such area is the Greasy Creek arm of the reservoir, which currently displays very little habitat value because of the extensive cattle grazing which occurs in the area when water levels are low. The Greasy Creek arm appears to be suitable for willow scrub pole planting revegetation. It is likely that drip irrigation would also be necessary during a 2- to 3-year establishment period; however, overall costs for this mitigation measure would still be relatively low, since pole cuttings are available locally. The creek has perennial water flow, and elevation gradients generally conducive to the needed soil moisture characteristics.

We determined suitability for willow scrub plantings based on land slope, elevation, and hydrology. Typical lands suitable for such planting would have a relatively flat slope, occur at somewhat higher elevations within the reservoir, and have soils which are typically moist or in proximity to a perennial water source. Along 2,200 lineal feet of Greasy Creek within the inundation zone of the lake (from about elevation 580 feet to the 694 feet inundation zone), there are approximately 3 acres suitable for willow scrub replantings. Fencing would be required to exclude damage from cattle grazing and trampling.

Other areas within the reservoir zone would also be suitable for willow scrub plantings. For example, the campground area near Horse Creek also has suitable soil saturation from creek flow. Some stands of willows already occur in the area; these stands could be extended and widened along the creek in areas which currently support primarily cocklebur growth. Additional pole cuttings could also be placed within several other sections of the reservoir, including along the Kaweah River below elevation 694 feet, and in several areas which would become periodically inundated after project implementation. Drip irrigation could be necessary in some of these areas to ensure vegetation establishment. We estimate that about 40 acres of lands suitable for willow scrub plantings occur in these areas.

b. Kaweah River Corridor Study Sites
A recent study prepared for the city of Visalia and the Kaweah River Delta Water Conservation District (Kaweah River Corridor Study: CDM 1993, KASCO 1993) evaluates the environmental restoration potential of 14 sites along the Kaweah and St. John's Rivers downstream of Terminus Dam. Several of these sites could serve as ideal compensatory mitigation areas for riparian forest, oak woodland, and grassland cover-types. The sites are the Service's preferred location for mitigation of these habitat types.

The Kaweah River Corridor Study sites were evaluated using several parameters, including a) location within the floodplain, b) presence of alluvial soils, c) current and historical habitat quality, and d) management (site preparation, planting, and maintenance) costs. The four sites we selected to evaluate are located near the Santa Fe Railroad track crossing along the lower Kaweah River, and are referred to as the Lindsey Strathmore Irrigation District (LSID) Northeast, LSID Southeast, LSID Northwest, and LSID Southwest sites, where site acreages are 140, 80, 230, and 250 acres, respectively. Each site contains fine sandy loam soils, and is located within areas subject to relatively frequent flooding events. Existing habitat quality on each of the sites are somewhat similar; each site supports a narrow but significant corridor of riparian vegetation bordering the lower Kaweah River. A great blue heron and great egret rookery (56 nests observed last year) exists in four large sycamore trees located along the river on the LSID-Northeast and LSID-Southeast sites (KASCO 1993). Farther from the river, a few scattered oak trees grow at each site. Lands at all sites are currently subject to cattle grazing; all grassland vegetation and riparian understory vegetation show signs of disturbance from cattle.

Significant riparian corridor expansion and oak tree regeneration opportunities are available at each site. Lands near the river could be graded to increase overbank flooding frequency as appropriate. Different elevation gradients could be created on the sites to allow grassland, valley oak savannah and woodland, and mixed riparian forest cover-types to be intermixed on all sites. Because the sites are all located adjacent to one another and are in close proximity to the Nature Conservancy's Kaweah Oaks Preserve, a riparian corridor could be established that would further enhance habitat values at all the sites. Although these wildlife mitigation sites would not be managed for the purpose of flood storage or percolation, they could be designed to allow diversion of some flood waters to the areas, which would enhance the growth of riparian areas, provide additional flood relief to areas downstream, and retain some water for groundwater recharge.

c. Kaweah River Rock Site
The Kaweah River Rock site is currently used for sand and gravel extraction. The 260-acre site abuts the north bank of the St. John's River, about 4,000 feet downstream of its juncture with the Kaweah River at McKay's Point. This site, currently heavily disturbed from gravel extraction, supports some significant stands of willow/cottonwood riparian forest and freshwater emergent marsh in areas where open pits have been excavated below the water table. Most of these areas would be inundated by water if present water removal (by pumping) was halted.

The gravel mining operations at this site are scheduled to be discontinued within the next few years. The area would be suitable for some riparian forest and scrub mitigation and some warmwater fishery mitigation if water levels are then allowed to rise. This is not likely to be a suitable site for oak woodland mitigation because of its highly disturbed land surfaces, but some areas could be made restorable to oak woodland after some grading and recontouring, and possibly the addition of topsoils. Soil and water quality testing would need to be carried out at the site prior to its use as a compensation area. Furthermore, restoration responsibilities of the mining

operators would need to be determined and integrated with formulation and implementation of any compensation mitigation plans.

d. Dry Creek Gravel Mining Site
The feasibility of using a gravel extraction site on Dry Creek, about 2 miles upstream of its confluence with the lower Kaweah River, was also investigated to determine its utility as a mitigation site. The site was found to be unsuitable, because the operators are already required to rehabilitate the site after gravel extraction is completed. Thus, the site would lack the ability to provide any compensation "credits".

e. Wetland Mitigation Sites
Numerous lands suitable for mitigation of shorebird and waterfowl habitat in the Tulare Basin were found. At least 10 different parcels, ranging from about 20 acres to 640 acres, are potentially available. Any of these lands could be made suitable for mitigation of flood reduction impacts at the Tulare Basin, by minor modifications of topography and providing a long-term source of uncontaminated water. Prior to selection and modification of any of these sites, thorough evaluations of sediment and water quality should be conducted. Also, any site should be evaluated for presence of suitable habitat for the numerous State- and federally-listed species which may occur.

An excellent plan for providing suitable habitat for waterbird feeding and breeding was recently prepared by H.T. Harvey and Associates (1994) for Westlake Farms (Appendix E). This draft plan is designed to provide alternative habitat for waterbirds using evaporation ponds. The plan designs include pond areas with islands for nest sites and loafing, and shallow, open-water areas for feeding. Water management has been designed to minimize water use, encourage some growth of aquatic vegetation for invertebrate and seed production, while minimizing risks of avian diseases such as botulism.

3. HEP Analyses Results

The HEP analyses of impacts and proposed mitigation measures are presented in the HEP report (Appendix A). Readers interested in the quantitative bases of our mitigation recommendations should refer to that Appendix.

VI. DISCUSSION

The results and recommendations in the discussion below are for compensatory mitigation of unavoidable impacts due to implementation of the project. They do not supersede our primary recommendation for implementation of impact avoidance mitigation. The results and mitigation recommendations are based on our Habitat Evaluation Procedures (HEP, enclosed as Appendix A) conducted on the cover types located at Lake Kaweah.

All the analyses which were done for this project contain the assumption that compensatory mitigation will function as planned. However, in the past, this assumption has often proved to be incorrect. Detailed mitigation and monitoring plans, which include planting design, monitoring methods, success criteria, and remedial measures, must be included in the project design. Appendix D includes a riparian vegetation monitoring plan recommended by the Service for the Corps' Guadalupe River Flood Control Project. A monitoring and remedial-action plan of similar detail, which would ensure success of the mitigation efforts, would need to be developed and implemented for the Kaweah project. If sufficient mitigation monitoring and remedial-action plans are not implemented as part of the project, the Service would need to revise the HEP analyses appropriately, and mitigation requirements would likely be higher for most habitat types. The Service is available to provide technical assistance for the monitoring plan, and could develop it. In any event, the Service modify our existing mitigation recommendations for future drafts of

this report, based on our assessments of the mitigation planting designs and mitigation monitoring plans.

The Department of Fish and Game should be offered management responsibilities and O&M funding for all non-reservoir mitigation lands. If non-public entities are instead made responsible for operations and maintenance, appropriate provisions should be taken to ensure that management continues over the life of the project. These provisions should include the transfer of lands and O&M funding to the Department of Fish and Game if other land managers became incapable of continuing their management responsibilities.

A. RIPARIAN FOREST

Compensation mitigation for the inundation degradation of 70 acres of riparian forest vegetation at Lake Kaweah would necessitate 12.2 acres of lands to be provided for revegetation of native woody riparian species along the lower Kaweah River using the LSID mitigation sites, or other comparable sites. As discussed earlier in the report, modifying the hydrology by grading, replanting, and removing (and excluding) cattle from the site would be necessary.

All plantings would require watering and other maintenance for a minimum of several years, or until the vegetation has become well-established and self-sufficient. The most efficient and reliable method of watering is generally a drip irrigation system. Estimated cost for the riparian revegetation plan is $22,000 per acre, excluding land costs. This estimate is a rough average cost for landscape architect companies such as those contracted for mitigation of the Corps' Sacramento River Bank Protection Project. Another, potentially less expensive method of accomplishing revegetation would be to contract The Nature Conservancy (TNC) to provide revegetation services. Using primarily volunteer labor, TNC is presently revegetating riparian lands along the Sacramento River for less than $5,000 per acre. Average annual replacement and maintenance cost is estimated at $2,300, regardless of the revegetation approach used.

B. RIPARIAN SCRUB

To mitigate the loss of 10 acres and the degradation of 82 acres of riparian scrub, 21 acres of willow and cottonwood cuttings would need to planted in the Greasy Creek arm of Lake Kaweah, or other comparable site, and also at other appropriate higher-elevation areas within the Lake Kaweah periodic inundation zone. Plantings in the Greasy Creek arm of the reservoir should be fenced and cattle grazing should be eliminated.

C. GRASSLANDS

Mitigation for impacts to grassland areas would be self-producing. It would be provided by the project implementation in areas where oak woodlands and savannah are removed.

D. OAK WOODLANDS/SAVANNAH

To mitigate the loss of 38 acres of oak woodland between the existing and new gross pool level of Lake Kaweah, planting trees on 99 acres of the lower Kaweah River LSID mitigation sites, or other comparable sites, would be necessary. A tree density goal of not less than 60 adult (i.e., at about 50 years old) trees per acre would need to be achieved to come close to meeting the HEP assumptions. In the same impact area, the loss of 132 acres of oak savannah would need to be mitigated by replanting 320 acres of oak trees, with an adult tree density goal of 25 trees per acre when the oaks reach maturity.

A detailed, long-term monitoring plan, with appropriate success criteria and project remedial contingency plans, should be established prior to project construction. Estimated cost to plant 50-200 young trees on a 1-acre area is about $15-20,000. Annual maintenance and reporting cost is $5,000 for the first 5 years and would probably decrease after that time. The following paragraphs discuss the optimal ways in which to approach the replanting of oak woodlands. Appendix E provides summary sheets describing the replanting needs of several oak species common to California.

Numerous papers and symposia (e.g., Pacific Southwest Research Station 1991) have been published on the replanting of oak woodlands, all of which have detailed experiences of limited revegetation success. Many techniques are known which will allow satisfactory growth and survival to the sapling stage (3-4 feet tall), but there is a gap in research knowledge on how to facilitate recruitment of sapling trees to adults. In natural systems also, low regeneration rates can be attributed to low adult recruitment; many 3 to 6-foot juvenile trees and mature adults are found, but interim stages are uncommon. Because of the low regeneration rates currently exhibited in California's oaks, natural recruitment (i.e., broadcast spreading of acorns over a site) would not be a viable alternative for mitigation of oak woodlands.

It is important to note that, although a variety of planting methods may work successfully to grow oak trees, none are foolproof. There are tradeoffs to be considered (costs versus effectiveness), and the best methods are not known for this particular site. Thus, any replanting design must include a specific and detailed monitoring and maintenance plan with remedial measures that are flexible with regards to the requirements of the planting site. Only in this manner can success of the applied mitigation effort be reasonably assured.

The following list of recommendations is based on a literature review by Service staff, and personal conversations with authorities on California oak regeneration (Mark Borchert, Los Padres National Forest, Goleta, California; Doug McCreary, University of California Cooperative Extension, Integrated Hardwood and Range Management Program, Browns Valley, California; John Stebbins, California State University at Fresno):

1. Lands directly adjacent to Lake Kaweah would not be appropriate for oak regeneration since they are near their carrying-capacity at the present time. Mitigation lands should be sought which previously held oak woodlands and have been impacted from extensive grazing or conversion to farmlands.

2. Both planting of acorns and seedling planting can be achieved successfully. Acorn planting would be the less expensive method because of reduced labor costs associated with greenhouse care. An alternative procedure would be to "hedge bets" by planting both acorns and seedlings. In a best-case scenario, one can expect about 75 percent survival to seedling stage of acorns planted according to the methods below.

3. Acorns should be harvested from local trees, and should be planted the same year as harvesting. Planting should be done early in the winter (early to mid-November) to allow maximum growth by the summer months.

4. To increase water retention, compacted soils should be augured to a depth of 12 to 24 inches before planting.

5. A fertilizer tablet (cost = 5 cents) should be placed in each of the augured holes before planting.

6. Acorns should be planted about 2 inches below the ground. Two or three acorns should be planted in each hole.

7. Acorns or seedlings should be irrigated (drip irrigation) for approximately 5 years after planting. The actual time needed for irrigation is dependant upon plant growth and characteristics of the site. The monitoring program should be designed to determine when plants become self-sustaining, so that irrigation at sites can be discontinued.

8. Growth of young plants is enhanced by removal of grasses from each plant. Grasses compete for nutrients, water, and light, and provide refugia for herbivorous insects and small mammals.

9. Herbivory should be minimized to the maximum extent possible by: a) fencing the site to prevent cattle grazing; b) protecting individual plants from herbivory using either tree shelters, Tubex containers or aluminum window screen cages. Tree shelters are translucent plastic tubes which have been found to accelerate growth of oak seedlings. They provide not only protection from herbivory, but also provide partial shading, retain moisture, and increase carbon dioxide levels around the plant. Tree shelters cost about $4, as compared to about $3 for Tubex containers or screen cages.

10. To obtain the goal of 100-200 trees per acre, either 250 seedlings or 400 acorns should be planted and maintained according to these recommendations.

Under these conditions, the trees may be expected to grow about 1 foot per year and become established within about 10 years. As stated above, however, the replanting of oak trees can be viewed as more of an art than a science; intensive monitoring, along with a maintenance program that is adaptable to the tree needs, is essential.

E. FISHERY MITIGATION

The complete loss of fishery resources (reservoir draining) may occur as a result of the NED plan's implementation, or even if the project is not constructed. In either case, the Corps should providing the appropriate NEPA documentation for this impact. The locally preferred plan would actually alleviate these adverse conditions in the reservoir. Since the reservoir would be drained if the NED plan is implemented, the appropriate arena for this impact assessment would be the EIR/EIS for the project. If the project is not constructed, an EA would nevertheless still be necessary if and when the Corps and local interests decide to drain the reservoir under their existing authorities.

To mitigate the loss of, or possibly enhance, the fishery, a minimum pool of water of about 7,000 acre-feet is required. Two measures exist to provide a minimum pool: (1) maintaining adequate capacity in the reservoir through silt and sediment removal, and (2) the acquisition of a sufficient quantity of water to fill and maintain the pool. Silt removal in amounts equal to, or greater than, that flowing into the reservoir would be needed. This would allow the long-term maintenance of a minimum pool in the reservoir. Specific sites within the reservoir should be designated for silt removal. Silt removal should be conducted first at the sites exposed most frequently. By focussing on silt removal when not inundated, reservoir water quality would not be degraded. In addition, silt removal should be carried out in areas which have very little existing habitat values for fish or terrestrial wildlife. Costs to remove silt are estimated to range between $3 and 7 per cubic yard, depending on the methods used, based on estimates from Kaweah Sand and Gravel Company.

The establishment of a minimum pool, in conjunction with enhancement through fish habitat creation, (e.g., strategic placement of large boulders and trees or other cover) would significantly improve existing fish resources and the value of the sport fishery. Large boulders or rocks exposed during silt

removal should be retained on-site for fish habitat. With these recommended improvements, sport fishing values would be expected to improve substantially over values expected with-the-project.

F. TULARE BASIN WETLANDS

To fully mitigate the impacts to spring- and summer-resident shorebird and waterfowl habitat in the Tulare Basin (mainly in the Wilbur and Hacienda areas), 366 acres of spring/summer wetland habitat would need to be created as the areas described in the "Mitigation Site Description" section of this report. This new habitat would need to be flooded with clean, fresh water from February 15 to July 15 each year (152 days). A recommended site design, prepared by H.T. Harvey and Associates (1994), is provided as Appendix E.

G. INDUCED DEVELOPMENT IMPACTS

At this time, due to a lack of specific information as to future growth conditions, we have not included any mitigation recommendations for project-induced development which may occur as a result of the project. Although few lands of value to fish and wildlife are being removed from the 100-year floodplain, the proposed action, as stated earlier, has the potential to affect, through agricultural conversion and urban development, fish and wildlife habitat throughout Tulare and King's Counties. Any such potential impacts to federally-listed species should be determined, and addressed through Section 7 consultation under the Endangered Species Act. Future drafts of this report may include recommendations for any induced development impacts, as more information on land use becomes available.

H. CUMULATIVE IMPACTS

A detailed analysis of the cumulative impacts of the proposed enlargement of Lake Kaweah, in combination with the proposed enlargements of Success and Pine Flat Dams should be conducted. In the Service's view, neither this FWCA Report, nor any NEPA document the Corps subsequently produces will be complete without such an analysis. For the Service to proceed with such an analysis now, the Corps needs to provide forthwith detailed data describing the hydrological changes expected downstream of Success and Pine Flat Dams, including Tulare Basin changes, if these projects were to be implemented. The Service believes that the impacts of the Kaweah project would be magnified in a synergistic manner with concurrent implementation of either of the other projects. Consultation under Section 7 of the Endangered Species Act would also be required for such impacts.

VII. CONCLUSIONS AND RECOMMENDATIONS

It is the Service's view that this project would significantly impact fish and wildlife resources in the immediate vicinity of Lake Kaweah, and in areas downstream. We project that habitat values for fish and wildlife would be reduced as a result of reduced flooding, and increased availability and use of water for agriculture. Most adverse impacts appear to be mitigable should either the NED or locally-preferred plans be implemented.

The Service's Mitigation Policy defines mitigation as including the following elements: avoiding impacts, minimizing impacts, rectifying impacts, reducing impacts over time, and compensating for impacts. The Service considers these elements to represent the most desirable sequence of steps in the mitigation planning process. In determining when to move from any one element to the next in the sequence, success or failure of particular techniques or approaches in the past under similar circumstances (as reflected in the results of previous mitigation evaluation studies) are taken into account.

The recommendations to offset impacts from the project contained within this section constitute what the Service believes, from a fish and wildlife resource perspective and consistent with our Mitigation Policy, to be the best present recommendations for the project, based on the information presently available to us. Nevertheless there are some clear deficiencies. For example, the hydrological information, particularly for the Tulare Lakebed area, is likely to be inaccurate simply because it is based only on hydrological simulations, which likely do not adequately reflect the complex actual hydrological conditions in the Tulare Basin. Therefore, we may later update and refine our analyses and mitigation recommendations if and when additional or alternative data (or comments on this draft FWCA Report) are received.

Moreover, the outcomes of any new or renewed consultations, as required under Section 7 of the Endangered Species Act, could also affect the recommendations given herein. Thus, the Service will not be issuing its final FWCA report until the Corps has demonstrated full compliance with Section 7.

The Service's preferred and most-sought choice for mitigation of impacts from this project is to avoid them altogether. Such avoidance mitigation could be accomplished as follows: 1) constructing new water storage areas and flood diversion structures in the Kaweah Basin and Tulare Lakebed; and 2) providing for full use of existing flood storage areas, including the Creighton Ranch and the South Wilbur and Hacienda areas. These water storage areas could provide multiple-use benefits as warm-water fisheries and migratory waterfowl and shorebird habitats. The water storage areas would not provide as much flood protection to the city of Visalia; however, the proposed alternatives also both provide relatively low (about 70-year) levels of flood protection.

The Service recommends that the Corps of Engineers:

<u>General Recommendations</u>

1. Reevaluate fully both the need for the project and the type of alternatives considered for achieving the intended objectives. Because of the magnitude and extent of fish and wildlife losses and problems in the region, a broader, more integrated approach to flood control and water management within the Tulare Basin, such as the Kaweah River Corridor Study, may be appropriate.

2. Conduct a basin-wide review of cumulative impacts of the Kaweah, Lake Success, and Pine Flat projects to determine: a) impacts currently imposed by water projects on fish and wildlife resources of the Tulare Basin, San Joaquin River, and Sacramento-San Joaquin Delta; and b) potential cumulative impacts of the various proposed major water development projects in the southern San Joaquin Valley. Or, at a minimum, provide for the Service to complete such cumulative impacts analyses, detailed data describing the hydrological changes expected to occur downstream of the Corps' proposed Success and Pine Flat Dam projects. Such data must include changes expected in the Tulare Lakebed and Basin.

3. Include in any report of the Corps of Engineers for this project the conservation and development of fish and wildlife resources among the purposes for which the project is to be authorized.

4. Incorporate the following language in the recommendations of any report of the Corps of Engineers for the project:

   "Additional studies of fish and wildlife resources affected by the project be conducted, as necessary after the project is authorized, in accordance with Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.); and such

reasonable modifications be made in the authorized project facilities and operations as may be agreed upon by the Director of the U.S. Fish and Wildlife Service and the Chief of Engineers for the conservation, improvement, and the development of these resources."

Following are recommendations for mitigation, should the project planning proceed with either of the present alternatives:

5. To protect reservoir fishery resources, implement the Locally Preferred Plan instead of the NED plan.

6. Address any impacts (to listed and non-listed species) resulting from project-induced agricultural or urban development within the appropriate environmental documentation for this project. Initiate the appropriate consultation with the Service, as required under the Endangered Species Act, for such potential effects on listed species.

7. Avoid impacts to any riparian and other wetland vegetation at the currently proposed disposal and staging areas.

8. Mitigate the degradation of 70 acres of riparian forest habitats by replanting 12.2 acres of native woody riparian species as described earlier in this report at the LSID compensation areas, or equivalent sites approved by the Service.

9. Mitigate the losses of 10 acres of riparian scrub habitat by replanting 21 acres with willow and cottonwood pole cuttings within the inundation zone of the reservoir, as described earlier in this report.

10. Mitigate the losses of 38 acres of oak woodland and 132 acres of oak savannah by replanting 99 and 320 acres of oak woodland and savannah, respectively, at the LSID compensation areas, or equivalent site(s) approved by the Service, as described earlier in this report.

11. Mitigate losses of waterbird habitats in the Tulare Basin by creating 366 acres of new spring/summer wetlands habitat as described earlier in this report. These wetlands must function from February 15 to July 15 annually and be supplied with appropriate contaminant-free water.

12. Develop detailed mitigation, monitoring and remedial action plans for each mitigation action and site. Coordinate all phases of mitigation plan development and implementation with the Service and California Department of Fish and Game.

13. Seek and initiate a cooperative restoration effort, as agreed upon by the Secretary of the Army and the Secretary of the Interior, for this and other Corps projects (Success Reservoir and Pine Flat Dam) to further the goals of the North American Waterfowl Management Plan of May 14, 1986.

14. Provide guaranteed, adequate annual water supplies to the Kaweah Oaks and Creighton Ranch Preserves at the appropriate time of year to maintain riparian, wetland, and oak woodland habitats.

15. All trees (especially oaks) removed from the new inundation zone should be used to enhance wildlife habitat. The limbs should be retained for brush piles in areas where cover is limited for smaller wildlife species. The trunks should be used to create "artificial" snags for cavity nesting birds, or perching and basking sites in riparian pond areas for species such as western pond turtle and cormorant. No trees should be harvested for human uses.

16. The loss of bald eagle roost trees should be mitigated by the installation of artificial roosts scattered around the reservoir site.

VIII. LITERATURE CITED

Barnum, D.A., R.J. Cooper, and D.L. Schlafmann. In prep. Birds on evaporation ponds during breeding periods in the San Joaquin Valley, California. 18 pp.

Barnum, D.A., and N.H. Euliss, Jr. 1991. Impacts of changing irrigation practices on waterfowl habitat use in the southern San Joaquin Valley, California. Calif. Fish and Game 77:10-21.

Barr, C.B. November 1991. The distribution, habitat, and status of the valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (Fisher), (Insecta: Coleoptera: Cerambycidae). USFWS, Ecological Services Field Office, Sacramento, California. 134 pp.

Burcham, L.T. 1982. California Range Land: An Historico-Ecological Study of the Range Resource of California. U.C. Davis Center for Archaeological Research. Publ. No. 7. Davis, CA. 261 pp. + map.

Bert, W.H. and R.P. Grossenheider. 1980. Peterson Field Guides - *Mammals*. Houghton Mifflin Company. 289 pp.

California Department of Fish and Game. 1987 Final EIR. White bass management program. pp. 17-21.

California Department of Fish and Game. 1988. Private Wetlands in the Kern-Tulare Basin, California: Their Status, Values, Protection and Enhancement. Prepared by Jones & Stokes, CA

CDM Camp Dresser and McKee in association with KAS Consultants . 1993. Kaweah River Delta Corridor Enhancement Study, Part One-Water Resources.

Coe, H.N. 1990. Use of wetlands in the Tulare Lake Basin by wintering ducks. Master's Thesis. Oregon State University.

Cone, V.M. 1911. Irrigation in the San Joaquin Valley, California. USDA Office of Exp. Stns. Bull. No. 239. US Govt. Print. Office, Wash. D.C. 62pp.

Department of Water Resources. 1991. Vegetation Report. Dry Creek Reservoir site and enlarged Kaweah Reservoir. California Department of Water Resources, Northern District, 44 pp. + appendices.

Ecos, Inc. June 11, 1990. Biological data report for the Kaweah River Basin Project. 54 pp. + appendices.

Fugro-McClelland (West), Inc. 1992. Tulare Lakebed Waterfowl Report.

Haslam, G. 1993. The other California: the Great Central Valley in life and letters. University of Nevada Press.

KASCO; KAS Consultants in association with CDM Camp Dresser and McKee. 1993. Kaweah River Delta Corridor Enhancement Study, Part Two-Environmental Habitat.

Preston, 1981. Vanishing landscapes: Landscapes, land and life in the Tulare Basin. UC Press, Berkeley, CA.

Reisner, M. 1986. Cadillac Desert. Viking Press. New York.

San Joaquin Valley Drainage Program. 1990. Fish and Wildlife Resources and Agricultural Drainage in the San Joaquin Valley, California.

Stebbins, R. 1985. Peterson Field Guides - *Western Reptiles and Amphibians.* Houghton Mifflin Company.

Tulare Basin Water Storage District. 1981. Report on irrigation, drainage and flooding in the Tulare Lake Basin.

Tulare Lake Basin Water Storage District. June 10, 1994. Letter to Perry Metzger, USACOE, providing comments on the Service's March 31, 1994 preliminary draft FWCA report.

U.S. Army Corps of Engineers. 1979. Water Resources Development in California. South Pacific Division, U.S. Army Corps of Engineers. San Francisco, California. 203 pp.

U.S. Army Corps of Engineers. 1987. Reconnaissance Report. Kaweah River Basin Investigation. July, 1987, 86 pp.

U.S. Army Corps of Engineers. 1992. Administrative Draft Integrated Feasibility and Environmental Impact Statement. Kaweah River Basin Investigation, California.

U.S. Army Corps of Engineers. Letter, dated January 21, 1994. Unpublished project description and hydrological data provided to the Fish and Wildlife Service.

U.S. Fish and Wildlife Service. 1987a. Birds: Kern National Wildlife Refuge, California. U.S. Department of the Interior, U.S. Government Printing Office.

U.S. Fish and Wildlife Service. 1987b. Concept plan for waterfowl wintering habitat preservation, Central Valley, California - an update. North American Waterfowl Management Plan. USFWS Region 1, Portland, Oregon.

U.S. Fish and Wildlife Service. 1990. Endangered Species Technical Bulletin. Vol. XV, No. 8.

Visalia Times-Delta. May 7, 1992. Article by Lewis Griswold.

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

IX. APPENDICES

A. **APPENDIX A - HEP REPORT**

B. **APPENDIX B - CE HYDROLOGY DATA**

C. **APPENDIX C - ENDANGERED SPECIES INFORMATION**

D. **APPENDIX D - VEGETATION MONITORING PLAN**

E. **APPENDIX E - WESTLAKE FARMS WETLAND DEMONSTRATION PROJECT**

Appendix A

Habitat Evaluation Procedures

Draft

United States Department of the Interior
Fish and Wildlife Service

KAWEAH RIVER BASIN INVESTIGATION
HABITAT EVALUATION PROCEDURES

Ecological Services
Sacramento, California

prepared for
U.S. Army Corps of Engineers
Sacramento District

January 1996

INTRODUCTION

These applications of the Fish and Wildlife Service's (Service) Habitat Evaluation Procedures (HEP) are intended to quantify the impacts to fish and wildlife resources that would occur with the proposed enlargement of Lake Kaweah. The proposed project is fully described in the "Project Description" section of the accompanying Fish and Wildlife Coordination Act (FWCA) report. The analysis herein is applicable to both the NED and locally-preferred plans.

The Service's Habitat Evaluation Procedures (HEP) are used to quantify anticipated impacts to fish and wildlife and their habitats, and to determine mitigation needs. This particular HEP study addresses the direct effects of (a) inundating terrestrial habitats in the Lake Kaweah area and (b) flood reducing effects to areas downstream of Terminus Dam.

STUDY AREA

The study area for this HEP includes all land and vegetation within the proposed Terminus Dam expanded pool area, below the proposed gross pool elevation of 715 feet msl. Lands within floodplains of the Kaweah River and its distributaries are also included.

Lake Kaweah lies in the foothills of the western slope of the Sierra Nevada on the Kaweah River. The dam was completed in 1962, and its impoundment forms Lake Kaweah. Readers should refer to the accompanying FWCA report for a full description of these areas.

DESCRIPTION OF HEP

HEP is a methodology, developed by the Service and State and Federal resource and water development agencies, which can be used to document the quality and quantity of available habitat for selected fish and 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-use 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, provided a mitigation plan has been developed for specific alternative mitigation sites.

A HEP application is based on the assumption that the value of a habitat for selected species or the value of a community can be described in a model which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs). The HUs and Average Annual Habitat Units (AAHUs) over the life of the project are then used in the comparisons described above.

The reliability of a HEP application and the significance of HUs are directly dependent on the ability of the user to assign a well-defined and accurate HSI to the selected evaluation elements or communities. Also, a user must be able to identify and measure the area of each distinct cover-type being utilized by fish and wildlife within the project area. Both the HSIs and the habitat acreages must also be reasonably estimable at various future points in time. The Service has determined that these HEP criteria can be met, or at least reasonably approximated, for the Kaweah River Project; thus HEP is an appropriate analytical tool.

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 Fish and Wildlife Service. The mitigation policies of the Service (see description within the body of the FWCA report) were also carefully considered.

The primary goal was to evaluate, as required by the FWCA, the impacts on fish and wildlife which would occur as a result of project construction and operation, and to assess different mitigation scenarios for their ability to compensate for project impacts. Although we evaluate different compensation scenarios, mitigation which avoids, minimizes, rectifies, and reduces or eliminates adverse impacts are preferred before compensation.

The following general objectives were established for the HEP used in this study:

1. Determine the baseline wildlife habitat values for the selected evaluation species.

2. Quantify impacts to wildlife habitats from the construction and operation of the flood control structures.

3. Develop a series of management actions and plans for potential mitigation lands.

4. Determine the replacement acreage of various habitats necessary to compensate for the impacts of these activities on the habitats. More specifically, the goal of the HEP analysis was to provide recommendations in accordance with the Service's classification of these habitats under the Mitigation Policy, as described in the FWCA Report.

METHODOLOGY

The Service's 1980 version of HEP was used in this application which was conducted in part during 1990, 1992, and completed in March 1994. HEP team members originally were Gail Presley, California Department of Fish and Game, Fresno; Matt Davis, Corps of Engineers, Sacramento; Kent Nelson, Department of Water Resources, Fresno; and Monty Knudsen, U.S. Fish and Wildlife Service, Sacramento. During Fiscal Year 1992, Michael Fris (U.S. Fish and Wildlife Service) and Jane Rinck (Corps of Engineers) replaced their agency representatives.

Six general habitat types were identified to be assessed in the potential impact zones by site visits, reviewing existing literature, and discussions with representatives from the Service and Corps of Engineers (Corps). The existing habitats affected by the proposed project are summarized in Table 1.

Habitat types were mapped and described by the California Department of Water Resources (DWR 1989). DWR delineated each habitat on the basis of plant species composition and dominance. Acreages of habitats impacted in the Tulare Basin were estimated from hydrological data supplied by the Corps of Engineers.

For this analysis, all blue and live oak woodland habitat types were collectively classified as oak woodlands. The habitats were collectively classified for the following reasons: 1) all oak woodland habitats had similar HSI values for all species; therefore the value of the two habitat types was assumed to be about equal; 2) there is a fine gradient of delineation between habitat types; oak woodland habitats at the study site are frequently composed of both live oak and blue oak trees; and 3) DWR did not provide their criteria for delineation of habitats in their vegetation report, so the acreages could not be reassessed by our staff.

Table 1 summarizes the habitats, acreages, and HSI models that were used for quantifying impacts to fish and wildlife at the two sites.

All the models were developed at the Service's Sacramento Ecological Services Field Office; the models have all been used in other HEP applications, and have been reviewed by species experts and staff at the National Biological Survey's (formerly the Service's) National Ecology Research Center. Copies of the models are included as Appendix A-I.

In addition to their applicability to the sites, the models were chosen because (1) they were readily available, (2) their variables included characteristics of the habitat that would be affected with the project, (3) the suitability indices could be determined given the data at hand, and (4) their relative simplicity facilitated completing the HEPs in the short time available. The models used are designed as planning tools, and are not exhaustive syntheses of everything that can possibly affect each species.

HSI models generally measure the value of certain attributes of a given habitat or community. Examples of such attributes include percent woody or herbaceous cover, presence of ponded water or saturated soil, and water depth. HSI model outputs reflect the carrying capacity of the particular habitat type for the evaluation elements. The HSI value thus calculated represents the degree to which the study area contains the structural and functional components necessary to support the life requisites of these species.

This preliminary HEP analysis will likely later be expanded to include several additional species. Data has already been collected for several other species, but has not yet been assessed for the HEP, due to time constraints. Our preliminary assessment of these supplemental data, which have not been included in this report, is that they will not significantly modify the mitigation recommendations already given herein, because the primary variables

Table 1. Summary of the existing habitats evaluated for impacts in the Kaweah River Basin Investigation, existing acreages which may be affected (not completely lost) by the project, and evaluation species used in the HEP. Acreages of wetlands/agricultural lands are expressed in terms of average annual decreases in acreage of flooded lands.

HABITAT-TYPE	AREA (acres) Lost	AREA (acres) Degraded	EVALUATION SPECIES
oak woodland	38		gray fox plain titmouse
oak savannah	132		gray fox plain titmouse California vole
riparian forest		70	cover-type model
riparian scrub	10	82	cover-type model
grasslands		98	California vole western meadowlark
wetlands/agricultural lands		1139/273	summer waterbird guild

which have driven this HEP evaluation are included within the models presently used. However, the additional species data will likely be included later to strengthen the scientific merit and biological basis of our recommendations.

The gray fox HSI model was selected to evaluate habitat values provided by the oak woodland and oak savannah habitats of the Lake Kaweah area because of this species' requirement for cover and den sites within woodlands. For the oak savannah cover type, only the fox's feeding life requisite was assessed.

The plain titmouse HSI model was selected to evaluate habitat values provided by the oak woodland and savannah habitats because it is a bark forager which prefers large-diameter oak trees for foraging. These characteristics typify the oak woodland and savannah habitats at the reservoir.

The California vole HSI model was selected to evaluate habitat values provided by the oak savannah and grassland habitat types because of this species requirement for (1) tall, dense herbaceous vegetation, (2) friable soils, and (3) presence of logs and/or matted vegetation for burrowing. These characteristics are exhibited by the existing oak savannah and grasslands of Lake Kaweah.

Three community-based or guild models, described below, were also used for analyses of project impacts. These community-based models were all developed to provide an assessment of habitat quality for an array of species which generally use a given community-type. The output of each model reflects the ability of a given habitat to support species diversity and richness within a community. Guild models, which are specific to organisms which have similar ecological requirements, typically reflect the suitability of a habitat type for an array of species represented within the guild.

The riparian forest cover-type HSI model was selected to evaluate Lake Kaweah's riparian forest habitat values. This cover-type model is an amalgam of various species HSI models, primarily those of raptors and riparian songbirds. The model evaluates key components of the riparian forest community; high HSI values reflect high species richness and diversity. The components include (1) tree height, (2) canopy closure, and (3) understory density.

The riparian scrub cover-type HSI model was selected to evaluate Lake Kaweah's riparian scrub habitat values. This cover-type model is an amalgam of various species HSI models, primarily those of various riparian songbirds which utilize dense stands of shrubs for feeding and nesting. Dense stands of willows are typical of existing riparian scrub habitat at Lake Kaweah.

The summer waterbird guild HSI model was specifically developed by the Service and Corps for this project to evaluate the inundated agricultural areas and seasonal wetlands of the Tulare Basin. This model was developed to reflect the fact that, when standing water is present or soils are saturated on these habitat types, the habitats are of high value to the evaluation species. Existing data on waterbird abundance in the Tulare Basin support this assumption. This model was developed by reviewing the key attributes of other waterbird species models, including wintering shorebirds, waterfowl, and other species such as herons and egrets. Although the model is simplified, we believe it to be appropriate for the types of project impacts in the Tulare Basin, where habitat quality at the impact sites would be affected primarily by the presence or absence of water. However, the Service may refine the model for the project at a future date, which could result in some modifications to the analyses and recommendations contained herein.

The capacity of each sample site to meet the needs of these evaluation species within the project impact and compensation areas was determined by the HEP team through measurement of specific habitat variables. Values for the

Suitability Indices (SIs) of each species HSI were determined by information gathered in the field, aerial photography, or review of existing records. Table 2 lists the variables contained in each model and indicates how the data for each variable was obtained.

Field sampling for the Kaweah River HEP study was conducted from March to June 1990, and in September to November 1993. The number of sample sites used to evaluate each habitat was based on the acreage and degree of heterogeneity of the vegetative structure of each habitat type. Data for each model variable were collected in each of these cover types, and an average HSI value was derived for each species for each cover type in which it was evaluated. The annual grassland and oak woodland habitats were fairly homogeneous with respect to vegetative structure. Samples were taken in both grazed and ungrazed areas, and the average HSI value was derived, weighted by the relative acreage of grazed versus ungrazed acres.

At the completion of data collection, the HSIs were calculated by hand or using a calculator, as appropriate, for each evaluation species. The equations used to calculate the HSIs are contained in each model (Appendix A-I).

Since it is not possible to empirically determine habitat quality and quantity for future years, future HSI values were estimated. This was accomplished by

Table 2. HSI model variables used in the Kaweah River Basin Investigation HEP.

VARIABLE	HOW OBTAINED
GRAY FOX	
V1 - % herbaceous ground cover	field measurement
V2 - distance to cover	field measurement
V3 - density of shrub understory	field measurement
V4 - # den sites per acre	field measurement
PLAIN TITMOUSE	
V1 - tree diameter	field measurement
V2 - trees per acre	aerial photographs
V3 - % oak trees	field measurement
CALIFORNIA VOLE	
V1 - height herbaceous vegetation	field measurement
V2 - % herbaceous cover	field measurement
V3 - soil type	field measurement
V4 - presence of logs and other cover	field measurement
WESTERN MEADOWLARK	
V1 - distance to water	aerial photographs
V2 - height/density of herbaceous vegetation	field measurement
V3 - abundance of singing perches	field measurement
RIPARIAN FOREST	
V1 - avg. Tree height	field measurement
V2 - avg. canopy width	field measurement
V3 - tree canopy closure	aerial photographs
V4 - # tree/shrub species	field measurement
V5 - understory density	field measurement
RIPARIAN SCRUB	
V1 - # tree/shrub species	field measurement
V2 - canopy closure	field measurement
V3 - avg. stand width	aerial photographs
SUMMER WATERBIRDS	
V1 - acres of ponded water or saturated soils	Corps hydrological data
V2 - duration of ponding (152 days optimal)	Corps hydrological data
V3 - edge effect	Field observations
V4 - water source cycling	Field observations

increasing or decreasing specific baseline values for each evaluation species, based on probable future conditions and the HEP team's best professional judgement. The assumptions used to derive future HSI and acreage values with- and without-the project on the impact and compensation areas are contained in Appendix A-II and summarized in Table 3. Tulare Basin management plans are assumed to be similar to those for the Westlake Farms Wetland Demonstration project (Appendix E).

Although several compensation scenarios were considered for the analysis (see the "Mitigation Site Evaluation" section of the FWCA report), we have provided only one compensation scenario for each habitat type. However, some of these scenarios, such as the LSID compensation plan, are applicable to several potential mitigation sites. Similarly, the management plans for the Tulare Basin Wetlands Compensation Area (MP6 and MP7) would be applicable to several locations. Primary differences between specific sites are probably minor, but the Service would evaluate any specific chosen sites later when that information becomes available. Costs for the different LSID or Tulare Basin compensation areas may differ in terms of land costs or in site preparation.

Table 3. Predicted habitat changes for Target Years of the Kaweah River Basin Investigation. See also the attached FWCA Report for site descriptions, and Appendix A-II for baseline and future HSI values.

TARGET YEAR	ASSUMPTION
Future Without Project (PA 1, Impact Area)	
Target Year 0	Baseline habitat conditions as described in FWCA report.
Target Year 1	Same as baseline conditions. Reservoir decreases in size very gradually, due to sediment increases.
Target Year 102	Upper elevation riparian vegetation in reservoir is inundated slightly more frequently over the 100-year period. Tulare Lakebed flood storage areas receive water slightly more frequently, due to decreased flood capacity upstream.
Future With Project (PA 2, Impact Area)	
Target Year 0	Baseline habitat conditions.
Target Year 1	Same as baseline conditions. Construction begins. Oak trees are cleared, removal of vegetation in staging areas and disposal areas commences, bridge construction impacts commence.
Target Year 2	Construction impacts completed. Gradual inundation effects commence. Grassland quality is immediately reduced in newly-inundated areas, but increases in acreage due to tree clearing. Flood frequency decreases in the Tulare Lakebed.
Target Year 20	Riparian forest composition changes to more primary successional species (willows, cottonwood), which are more tolerant of harsher conditions. Riparian scrub quality decreases throughout the reservoir, as depth and frequency of inundation increases. Some losses of scrub at lowest elevations, and some new riparian scrub at elevations 694 - 715.
Target Year 102	Same as TY 20.
Future Without Management Plan (MP 1, LSID Compensation Areas)	
Target Year 0	Baseline habitat conditions - Sites characterized by upland vegetation (grasses, scattered shrubs, narrow riparian corridor, few scattered oaks) and grazed by cattle.
Target Year 1	Same as baseline
Target Year 102	Same as baseline
Future With Management Plan (MP 2, LSID Compensation Areas)	
Target Year 0	Baseline habitat conditions as in MP1.
Target Year 1	Compensation site acquired, developed, and managed to provide riparian forest, oak savannah and woodlands, and grasslands.
Target Year 10	Compensation area habitats continue to develop.
Target Year 102	Same as TY 10.

Table 3. (Continued). Predicted habitat changes for Target Years of the Kaweah River Basin Investigation. See also the attached FWCA Report for site descriptions, and Appendix A-II for baseline and future HSI values.

TARGET YEAR	ASSUMPTION
Future Without Management Plan (MP 3, Lake Kaweah Riparian Scrub Compensation Areas)	
Target Year 0	Baseline habitat conditions - Sites either denuded by cattle grazing and hoof traffic, or site characterized by monoculture of cocklebur).
Target Year 1	Same as baseline.
Target Year 102	Same as baseline.
Future With Management Plan (MP 4, Lake Kaweah Riparian Scrub Compensation Areas)	
Target Year 0	Baseline habitat conditions as in MP1.
Target Year 1	Cattle grazing excluded. Compensation sites planted with willow and pole cuttings, drip irrigation.
Target Year 10	Compensation site canopy cover increases to 30 percent.
Target Year 20	Compensation site canopy cover increases to match baseline conditions at higher elevations.
Target Year 102	Same as TY 20.
Future Without Management Plan (MP 5, Tulare Basin Wetlands Compensation Area)	
Target Year 0	Baseline habitat conditions - sites denuded of significant vegetation, subject to grazing, or are duck clubs which have not received water in recent years. No endangered species concerns at the sites. --
Target Year 1	Same as baseline.
Target Year 102	Same as baseline.
Future With Management Plan (MP 6, Tulare Basin Wetlands Compensation Area)	
Target Year 0	Baseline habitat conditions as in MP5. 1412-acre site.
Target Year 1	Site is graded to provide islands, variable depths. Fresh water applied to the site for 45 days at depths ranging from 1-8 inches for shorebirds to deeper areas for waterfowl.
Target Year 102	Same as TY 1.
Future With Management Plan (MP 7, Tulare Basin Wetlands Compensation Area)	
Target Year 0	Baseline habitat conditions as in MP5. 366-acre site.
Target Year 1	Site is graded to provide islands, mounds, deep pools, variable depths. Water applied to the site from the end of February to Mid-July, at depths from 1-8 inches for shorebirds; deeper areas for waterfowl.
Target Year 102	Same as TY 1.

The HEP version 2.1 Accounting Software package was used on an IBM-compatible computer to calculate HUs, AAHUs, and size of the compensation areas needed to offset project impacts to wildlife.

RESULTS AND DISCUSSION

Our results are based on project designs and hydrological information as presently provided by the Corps. There may be further changes or refinements to the project prior to preparation of the required environmental documents. Also, in some instances, these designs may not have yet incorporated all of the more desirable forms of mitigation (i.e., *avoidance, minimization, reduction, and/or rectifying impacts*), before *replacement* mitigation was considered. Therefore, the Service's statement of certain *replacement* mitigation numbers should not be construed as our acceptance that all other more desirable forms of mitigation have been fully exhausted by the Corps.

For this HEP, the Service's mitigation objective for each habitat type is to ensure that compensation is consistent with the fish and wildlife habitat values involved. Riparian forest, riparian scrub, oak woodlands, and oak savannah at Lake Kaweah, and flooded agricultural and native lands of the Tulare Basin are of high value to fish and wildlife and have been significantly reduced in abundance in the ecoregion; therefore, our goal as described in the attached FWCA report is for no net loss of in-kind habitat value, or acreage (i.e., Resource Category 2). Grassland habitats at Lake

Kaweah are of high to medium value to wildlife; our goal for this habitat type is no net loss of habitat value while minimizing loss of in-kind habitat value (i.e., Resource Category 3).

Results of the impact analysis (Table 4, Form D's in Appendix A-III) show that habitat values would be lost as a result of project construction for all cover types except grasslands. Grasslands undergo an increase in acreage with project construction because of the clearing of oak woodlands and savannah habitats on the existing reservoir perimeter. All oak woodland and oak savannah habitat values would be lost as a result of project construction. The project would also result in losses of riparian forest and riparian scrub habitat values, in part from direct losses of acreage due to construction and inundation impacts, and also from *degradation* of remaining habitats due to increased periodicity of inundation.

The results of management plans for compensatory mitigation of impacts are also shown in Table 4. Management of the LSID sites for a combination of riparian forest, oak woodland, and oak savannah habitats would require a total of 457 acres divided as follows: 99 acres of oak woodland, 324 acres of oak savannah, and 34 acres of riparian forest. The compensation mitigation need within the reservoir for losses of riparian scrub was determined to be 21 acres.

For project impacts to agricultural areas and flood detention cells in the Tulare Basin, mitigation could theoretically be accomplished in two ways, but one scenario would not be biologically feasible. First, 1,412 acres of lands *suitable for shorebird and waterfowl feeding and breeding, which would not otherwise be subject to flooding or spreading under the with-project scenario*

Table 4. Form H data. Summary of impacts and mitigation that would be provided by the management plans. Underlined numbers in the right column are the acres of each habitat type required for mitigation.

HABITAT TYPE (Management Plan) Species	Acres lost/modified	AAHU's lost	AAHUs provided per acre by mgmt plan	Compensation Acres Needed
OAK WOODLAND (MP2)	38/0			
gray fox		-29.54	0.297	99.39
plain titmouse		-30.68	0.622	49.28
OAK SAVANNAH (MP2)	132/0			
gray fox		-125.30	0.387	323.86
plain titmouse		-82.89	0.527	157.24
California vole		-113.15	0.353	320.59
GRASSLANDS	0/288			
California vole		+56.89		
western meadowlark		+83.36		
RIPARIAN FOREST (MP2)	0/70			
cover-type model		-9.73	0.798	12.19
RIPARIAN SCRUB (MP3)	10/82			
cover-type model		-18.04	0.872	20.71
AGRICULTURAL LANDS (MP6)	0/273			
summer waterbirds		-11.97	0.416	29.0
FLOOD STORAGE AREAS (MP6)	0/1139			
summer waterbirds		-140.42	0.416	337.0
AGRICULTURAL LANDS (MP7)	0/273			
summer waterbirds		-11.97	0.112	273.0
FLOOD STORAGE AREAS (MP7)	0/1139			
summer waterbirds		-140.42	0.123	1139.0

could be flooded for 45 days during the spring of each year. This scenario is not feasible for this project because lands flooded for only 45 days would not allow for shorebird breeding to occur. Also, if lands are used which are already subject to flooding (e.g., the Wilbur or Hacienda areas, or other portions of the Lakebed), *the acreages needed to offset losses would be higher than those given to account for those years in which these areas would already be flooded anyway without mitigation actions being taken.* Based on flood frequency data, we estimate that required acreages would probably be about 40 percent higher than the 1,412 acre value presented here. However, regardless of the acreage value provided, the Service would not endorse this management plan unless it could be accomplished in a manner which would still allow these areas to receive natural flows of water for longer durations during some years, so that birds could occasionally use the areas for breeding habitat, as they presently do in the Wilbur and Hacienda areas.

A second, and our preferred management plan for Tulare Basin impacts, would be to annually provide water, from February 15 through July 15, to 366 acres of lands suitable for shorebird and waterfowl feeding and breeding. Again, these lands could be either within areas currently subject to flooding or spreading, or in areas which are not subject to such flooding. However, if lands are used that would still be subject to periodic flooding anyway, without mitigation actions being taken, the mitigation acreage requirement would be about 40 percent greater.

CONCLUSIONS AND RECOMMENDATIONS

Our recommendations for compensation mitigation of the proposed project's impacts are presented in the accompanying draft FWCA report. However, these recommendations should not be construed as endorsement or support of this project, or that compensation mitigation is the preferred method of mitigating impacts of the proposed project.

As stated in the accompanying FWCA report, a long-term mitigation monitoring plan is an essential component of any compensation mitigation. Monitoring should be provided which assesses whether the project mitigation actually provides the intended habitat values. Periodic HEP evaluations over the project life should be an essential component of this monitoring program, as should an overall assessment of the mitigation site for other deficiencies which may lead to mitigation site inadequacy or failure.

Appendix A-I

Habitat Suitability Index Models

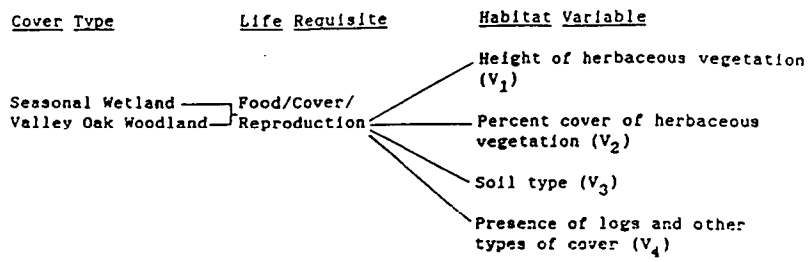
DRAFT HABITAT SUITABILITY INDEX MODEL

CALIFORNIA VOLE (*Microtus californicus*)

by

Barrett A. Garrison
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

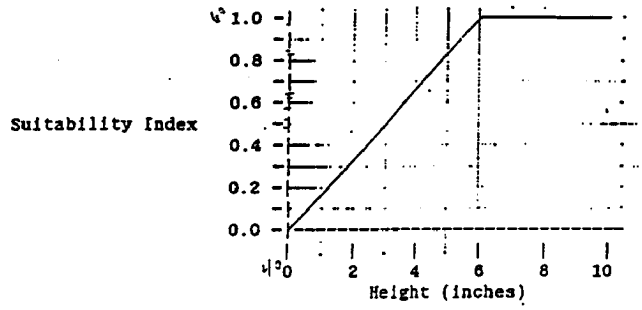
July 1988



Variable	Cover Types	Sampling Technique
V_1 - Height of herbaceous vegetation	Seasonal Wetland Valley Oak Woodland	Average height in 1 m^2 quadrant
V_2 - Percent cover of herbaceous vegetation	Seasonal Wetland Valley Oak Woodland	1 m^2 quadrant
V_3 - Soil type	Seasonal Wetland Valley Oak Woodland	Inspection of sample area, county soil survey
V_4 - Presence of logs and other types of cover	Seasonal Wetland Valley Oak Woodland	Visual inspection of sample area

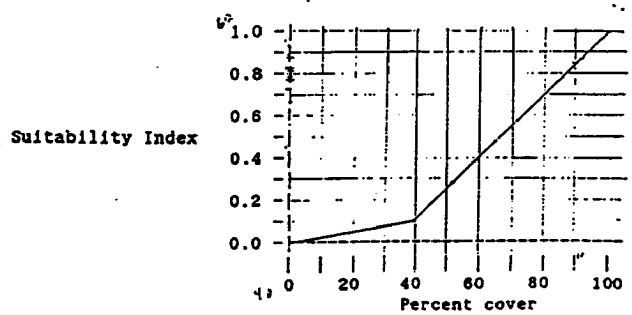
Variable 1: Height of herbaceous vegetation.

Assumes: California voles require relatively tall herbaceous vegetation for both food (Gill 1977, Batzli 1986) and cover (Ingles 1965). Grasses of the genera Hordeum, Bromus, and Lolium are included as food items (Gill 1977). Herbaceous vegetation ≥ 6 in. tall is considered optimum.



Variable 2: Percent cover of herbaceous vegetation.

Assumes: Relatively dense herbaceous vegetation is needed for cover. Cover = 100 percent is considered optimum.



Variable 3: Soil type within sample area.

Assumes: Friable soils such as silts and loams are optimum because voles can dig their burrows (Ingles 1965). Soils such as sands and clays are not optimum.

Suitability Index (SI) = 1.0 if soil type is silty or loamy and friable.

SI = 0.5 if soil type is not silty or loamy and is moderately friable.

SI = 0.2 if soil type is not silty or loamy and is not friable.

Variable 4: Presence of logs and other types of cover within the sample area.

Assumes: California voles will use logs, matted vegetation, brush piles, discarded trash and rocks for cover in addition to their burrows (California Department of Fish and Game undated).

SI = 1.0 if logs, brush piles, matted vegetation, and/or rocks are abundant and well distributed throughout the sample area.

SI = 0.7 if logs, brush piles, matted vegetation, and/or rocks are moderately abundant and distributed throughout the sample area.

SI = 0.4 if logs, brush piles, matted vegetation, and/or rocks are sparsely distributed throughout the sample area.

SI = 0.1 if logs, brush piles, matted vegetation, and/or rocks are absent from the sample area.

HABITAT SUITABILITY INDEX MODEL

Plain Titmouse *(Parus inornatus)*

by

Michael Long and Daniel Strait

U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

June 1989

Habitat Use Information

General

The plain titmouse inhabitats oak and pinyon-juniper woodlands from Oregon south and west to Texas. It is a year-round resident, and maintains a territory throughout the year. The species is generally a secondary cavity nester, although it may occasionally excavate its own hole.

Food

As a group, titmice take a wide variey of foods, but they are considered insectivorous during the summer, and consumers of fruit, seeds, and some insects in the winter (Perrins 1979). Root (1967 - cited by Verner 1979), found that a large proportion of their food consisted of plant material and arthropods living on the bark of trees. Wagner (1981) found the plain titmouse took a great variety of arthropod taxa.

The titmouse is primarily a bark forager, although it also forages on tree foliage and occasionally on the ground (Hertz et. al. 1976). Most foraging by this species is done between 0 - 9 m (0 - 30 ft) of the ground (Wagner 1981; Hertz et. al. 1976). Hertz et. al. found that plain titmice showed a preference for foraging in blue oaks *(Quercus Douglasii)* over coast live oaks *(Q. agrifolia)*. Hertz et. al. (1976) attributed the avoidance of live oaks to their smooth bark which is poor habitat for arthropods. Block and Morrison (1986) also found the titmouse to use blue oaks more than valley oaks *(Q. lobata)*, black oak *(Q. Kelloggii)*, and canyon live oak *(Q. chrysolepis)* for foraging at Tejon Ranch, California. The plain titmouse will forage extensively in live oaks however, especially when other oak species are not present (Dixon 1954).

Reproduction

The plain titmouse is a secondary cavity nester, nesting in natural cavities, old woodpecker holes, or nest boxes. It prefers natural cavities over excavated cavities (Wilson, pers. comm.). Bent (1946) reported nests from 1 - 10 m (3 - 32 ft) above the ground. Bent, citing Dawson (1923), reported the titmouse to occasionally excavate its own nest cavity in blue oaks. The plain titmouse prifers wooded areas with intermediate to high percentage canopy coverage dominated by blue, live and valley oaks (Verner and Boss 1980).

Cover

Cover is provided by the oak woodlands and riparian areas in which the plain titmouse lives. Roost sites are provided by natural cavities, old woodpecker holes, or by dense foliage which simulates a cavity (Dixon 1949).

Interspersion

Plain titmice maintain year-round territories. Three territories observed by Hertz et. al. (1976) averaged 0.8 ha (2.0 ac) in California oak woodland. Dixon (1949) found 12 territories located primarily in live oak woodland. These territories ranged in size from 1.3 - 5.1 ha (3.3 - 12.5 ac) with an average size of 2.6 ha (6.3 ac). According to Dixon (1956) 1.0 ha (2.5 ac) would probably be close to an absolute minimum size for a territory.

Water Requirements

In a study by Williams and Koenig (1980), the plain titmouse was classified as an occasional drinker.

Model Applicability

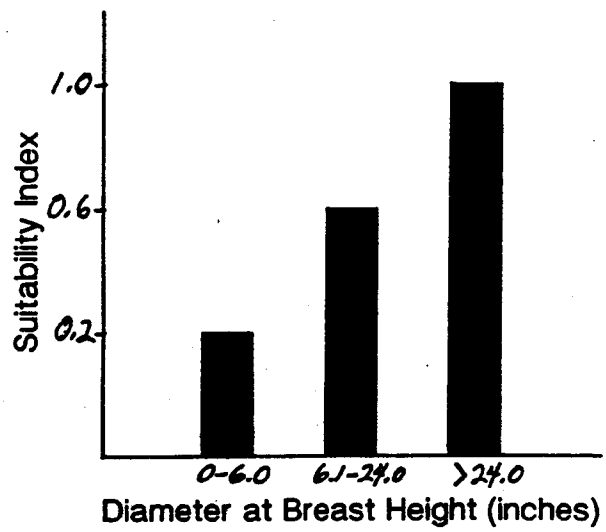
This model was deveveloped for use in evaluating habitat suitability of oak savannah, oak woodland, and riparian woodland in Merced, Fresno, Stanislaus, and San Benito Counties in California from 500 - 2500 ft in elevation. The basic assumptions for using the model are that meeting the reproductive needs of the plain titmouse will take care of its cover and food needs throughout the year. This assumption seems warranted. Verner (1979) believes that proper management for oaks for breeding birds should also provide the habitat needs for species that use oaks at other times of the year. In addition, it is assumed that water is not a limiting factor. It is assumed that the model is valid for use in riparian areas as well as the oak woodlands despite the fact that the model was initially developed for oak woodlands.

Model Description

Little quantitative data were found on the habitat needs of the plain titmouse. The most useful information was the information on habitat factors related to breeding for the species presented by Ohmann and Mayer (1986). Using data from the California Wildlife Habitat Relationships data base and the Forest Inventory and Analysis Research Unit inventory, Ohmann and Mayer developed a habitat suitability index model for the plain titmouse from which Variable 1 was derived.

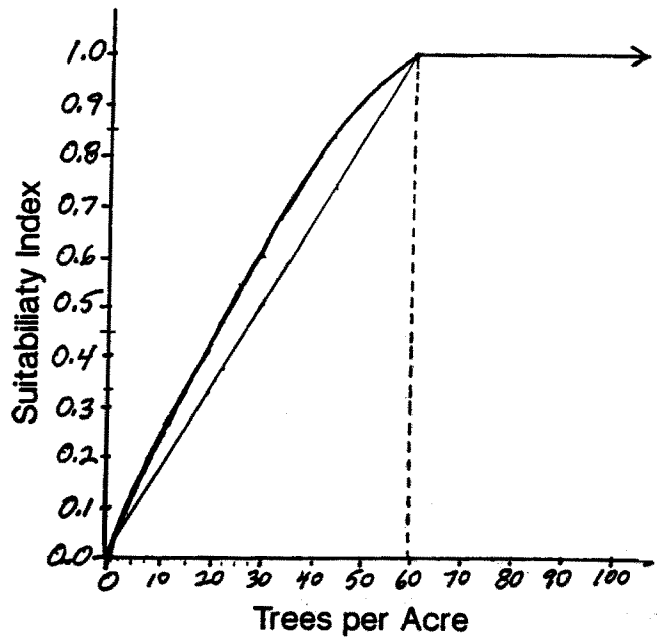
Variable 1. Tree diameter.

Ohmann and Mayer found tree size and percent canopy closure to be the major variables determining suitability of a habitat for the plain titmouse. Our model will assume that the diameter of a tree and the size of the canopy are correlated to the extent that they can be considered a single variable to be represented in this model by diameter at breast height (DBH). Presumably this variable best represents older trees with more cavities for nesting and greater bark surface which supports a greater prey base.



Variable 2. Trees per acre.

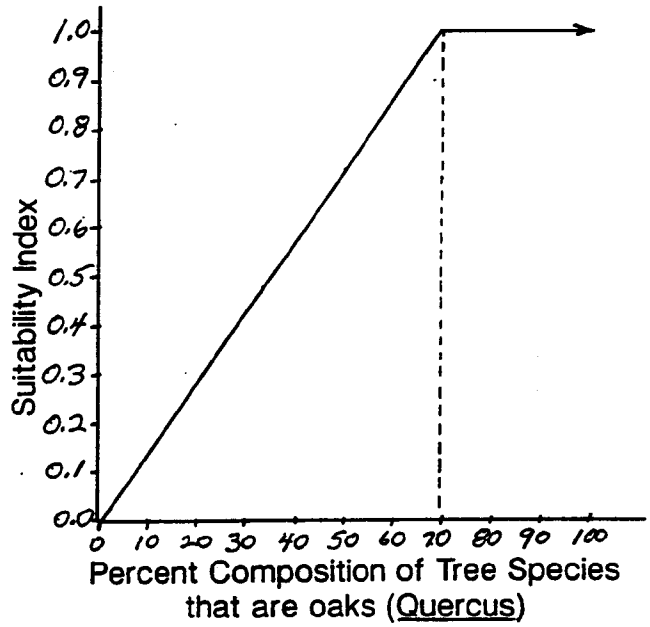
Plain titmouse abundance was found to increase as the number of trees increased (Wilson, pers. comm.). This may be particularly important in areas of low to moderate canopy cover. Studies at the Hopland, California field station found titmouse abundances to peak in areas with 750 trees/5 ha (= 60 trees/ac).



Both Variables 1 and 2 relate directly to the extent of a stand's canopy closure such that the importance placed on canopy closure by Ohmann and Mayer is encorporated into this model through the use of Variables 1 and 2.

Variable 3. Percent composition of tree species that are oaks *(Quercus)*.

Verner and Boss (1980) stated that the plain titmouse prefers stands dominated by blue, live and valley oaks. We have been unable to find any studies documenting the presence of the plain titmouse in an area without a major proportion of oaks. For the sake of this model then, we will consider the presence of oaks to be a life requisite such that the optimum titmouse habitat is one dominated by oaks.



HSI Determination

In each sample area, tree diameter is measured along with the number of trees per acre and the percentage of those trees that are oaks. The Habitat Suitability Index for the sample site is then determined using the following formula:

$$HSI = \frac{V_1 + V_2 + V_3}{3}$$

Suggestions for Applying the Model

1. The tree diameter classes for calculating Variable 1 (DBH) were not specified by Ohmann and Mayer. Therefore, all trees within the sample plot should be included in the DBH determination.

2. If no trees > 4 inches DBH are found in the sample plot, the HSI for the sample plot is 0.0. A 4 inch DBH tree is probably about the smallest tree that could have a cavity of sufficient size for the titmouse.

3. Ideally, all tree species in the study area should be fully leafed out when applying the model. Therefore, the best time for sampling is spring and summer.

Literature Cited

Bent, A.C. 1946. Life histories of North American jays, crows and titmice. U.S. Natl. Mus. Bull. No. 191. 495 pp.

Block, W.M. and M.L. Morrison. 1986. Conceptual framework and ecological considerations for the study of birds in oak woodlands. In: Proceedings of the Symposium on Multiple-use Management of California's Hardwood Resources, November 12-14, 1986, San Luis Obispo, California. Gen Tech. Rep. PSW-100, Berkeley, CA. Pacific Southwest Forest and Range Experiment Station, For. Serv., U.S. Dept. Agric.: 1987.

Dixon, K.L. 1949. Behavior of the Plain Titmouse. Condor 51:110-136.

Dixon, K.L. 1954. Some ecological relations of chickadees and titmice in Central California. Condor 56:113-124.

Dixon, K.L. 1956. Territoriality and survival in the Plain Titmouse. Condor 58:169-182.

Hertz, P.E., J.V. Remsen, and S.I. Zones. 1976. Ecological complimentary of three sympatric parids in California oak woodland. Condor 78:307-316

Ohmann, J.L. and K.E. Mayer. 1986. Wildlife habitat of California's hardwood forests - linking extensive inventory data with habitat models. In: Proceedings of the Symposium on Multiple-use Management of California's Hardwood Resources, November 12-14, 1986, San Luis Obispo, California. Gen. Tech. Rep. PSW-100, Berkeley, CA. Pacific Southwest Forest and Range Experiment Station, For Serv., U.S. Dept. Agric.:1967

Perrins, D.M. 1979. British Tits. William Calins and Sons and Co. LTD, Glasgow. 304 pp.

Root, R.B. 1967. The niche expoitation pattern of the Blue-grey Gnatcatcher. Ecol. Monogr. 37:317-350.

Verner, J. 1979. Birds of California's oak habitats - management implications. In: Plumb, Timothy R., tech. coord. Proceedings of the Symposiuym on the Ecology, Management, and Utilization of California Oaks, Claremont, Calif., June 26-28, 1979. Gen. Tech. Rep. PSW-44. Berkeley, Ca: Pacific Southwest Forest and Range Experiment Station. For. Serv., U.S. Dept. of Agri: 1980:246-264.

Verner, J. and A.S. Boss, tech. coords. 1980. California Wildlife and Their Habitats: Western Sierra Nevada. Gen. Tech. Rep. PSW-37. Pacific Southwest Forest and Range Experiment Station, For. Serv., U.S. Dept. of Agri., Berkeley, CA. 439 pp.

Williams, P.L. and W.D. Koenig. 1980. Water dependence of birds in a temperate oak woodland. Auk 97:339-350.

Wagner, J.L. 1981. Seasonal change in guild structure: oak woodland insectivorous birds. Ecology 62:973-981.

Wilson, R.A. Personal communication citing the California Dept. of Forestry publication Silvicultural options in managed oak woodlands to benefit breeding birds. Humboldt State University, Arcata, CA.

DRAFT HABITAT SUITABILITY INDEX MODEL

WESTERN MEADOWLARK (*Sturnella neglecta*)

by
Barrett A. Garrison
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

July 1988

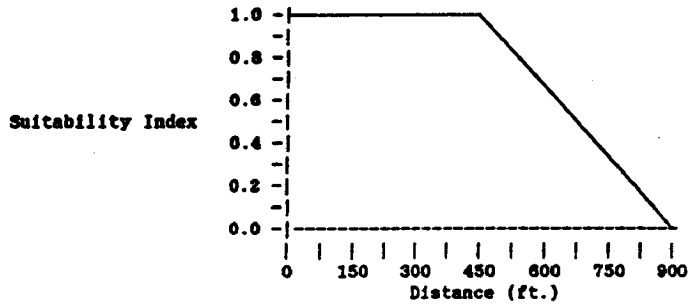
Model modified from:
Longwood, M.D. 1980. Terrestrial habitat evaluation criteria handbook, Ecoregion 2610, the Central Valley of California. U.S.D.A., Soil Conservation Service, Davis, CA. Unpublished draft. Various paging.

Cover Type	Life Requisite	Habitat Variable
Seasonal Wetland	Water	Distance to water (V_1)
	Reproduction/ cover	Height and density of herbaceous vegetation (V_2)
		Abundance of singing perches (V_3)

Variable	Cover Types	Sampling Technique
V_1 - Distance to water	Seasonal Wetland	Rangefinder, pacing, tapemeasure
V_2 - Height and density of herbaceous vegetation	Seasonal Wetland	1 m^2 quadrant
V_3 - Abundance of singing perches	Seasonal Wetland	Count within 1 acre circular plot

Variable 1: Distance to water from sample point.

Assumes: Western meadowlarks respond to low water availability by limited physiological reductions in water needs and losses (Pierce 1975). However, captive birds will consume water when it is available. The meadowlark's breeding territory ranges from 3 to 32 ac. (Kendeigh 1941, Lanyon 1956). Assuming a circular territory and an average size of 15 ac., water ≤ 450 ft. from the sample point is considered optimum.



Variable 2: Height and density of herbaceous vegetation.

Assumes: Western meadowlarks require relatively dense grassy vegetation to conceal themselves and their nests which are built on the ground or in or on vegetation (Grinnell and Miller 1944). Vegetation > 8 in. tall with cover > 50 percent is considered optimum.

SI = 1.0 if herbaceous vegetation is tall (> 8 in.) with dense cover (> 50 percent).

SI = 0.8 if herbaceous vegetation is moderately tall (4-8 in.) with dense cover (> 50 percent).

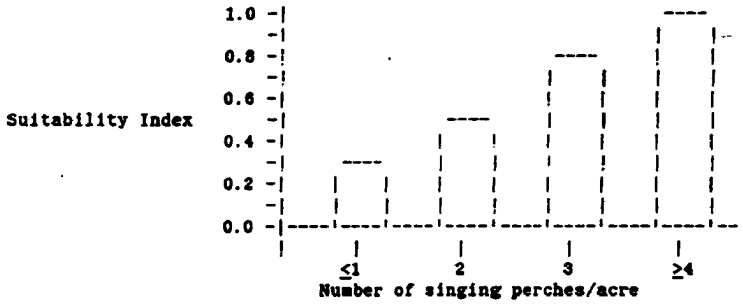
SI = 0.5 if herbaceous vegetation is moderately tall (4-8 in.) with moderately dense cover (30-50 percent) or open cover (10-30 percent).

SI = 0.2 if herbaceous vegetation is moderately short (1-4 in.) with open (10-30 percent) or moderately dense cover (30-50 percent).

SI = 0.1 if herbaceous vegetation is very short (< 1 in.). Cover does not influence habitat suitability when vegetation is so short.

Variable 3: Abundance of singing perches within 1 acre circular plot.

Assumes: Western meadowlarks utilize fence posts, isolated shrubs and trees, rocks, telephone poles and wires, earthen mounds, and tall weeds for singing perches. Singing perches are not considered limiting because they will sing from the ground. Assuming an average breeding territory size of 15 ac. with singing perches evenly distributed throughout the territory, optimum habitat conditions occur with ≥ 4 singing perches/ac. Singing perches are counted as discrete units within the sample area. A telephone or fence line with wire bisecting the sample point = 2 singing perches. To get SI for study area round up or down to nearest integer.



HSI Determination

$$HSI = \frac{V_3 + V_4 + V_5}{3}$$

No particular life requisite is considered limiting, therefore the HSI value will be the average of the SI's for the individual life requisites. Food is assumed not to be limiting and is represented by the reproduction/cover life requisite.

Model Applicability

This model is a hypothesis of the relationships between various attributes of grassland and seasonal wetland habitats and the suitability of these habitats to western meadowlarks. Seasonal wetlands provide habitat for meadowlarks because these wetlands function like annual grasslands when they are dry. The model can be used in the Central Valley of California up to 2,000 ft. elevation at all times of the year when seasonal wetlands are dry.

Modifications from Previous Model

This model differs from the 1980 model because of the following modifications: 1) summer and winter diet variables were dropped; 2) cover type and quality were combined into a single variable - height and density of herbaceous vegetation; and 3) abundance of song perches was quantified by counting perches within the sample area. This model will be used as part of a Habitat Evaluation Procedures analysis to assess potential habitat impacts from the proposed Wilcox offstream storage reservoir in central Tulare County, California.

Literature Cited

Bryant, H.C. 1914. A determination of the economic status of the western meadowlark (Sturnella neglecta) in California. Univ. Calif. Publ. Zool. 11: 377-510.

Grinnell, J., and A.H. Miller. 1944. The distribution of the birds of California. Pac. Coast Avifauna No. 27. 608 pp.

Kendeigh, S.C. 1941. Birds of a prairie community. Condor 43: 165-174.

Lanyon, W.E. 1956. Ecological aspects of the sympatric distribution of meadowlarks in the north-central states. Ecology 37: 98-108.

Martin, A.C., H.S. Zim, and A.L. Nelson. 1961. American wildlife and plants - a guide to wildlife food habitats. Dover Publ. Inc., New York. 500 pp.

Pierce, A.M. 1975. Energetic and water economy in the western meadowlark, Sturnella neglecta. Diss. Abstr. Inter. 35B: 5723.

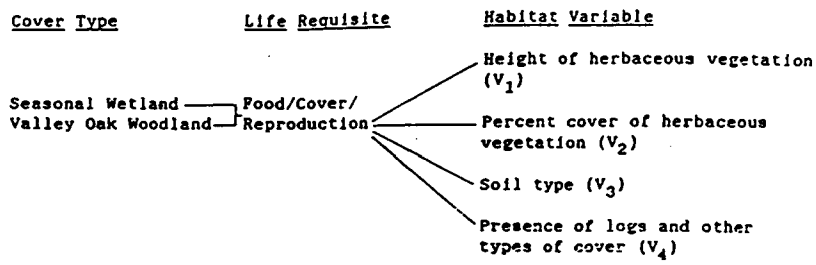
DRAFT HABITAT SUITABILITY INDEX MODEL

CALIFORNIA VOLE (*Microtus californicus*)

by

Barrett A. Garrison
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

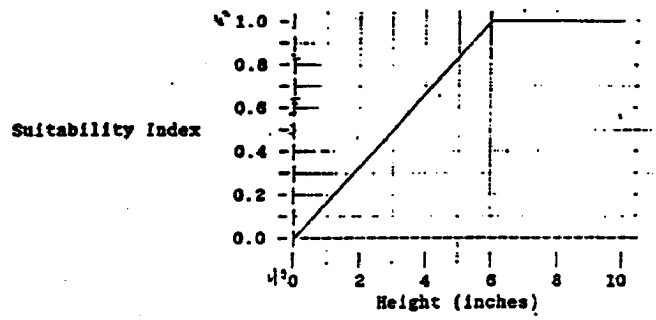
July 1988



Variable	Cover Types	Sampling Technique
V_1 - Height of herbaceous vegetation	Seasonal Wetland Valley Oak Woodland	Average height in 1 m^2 quadrant
V_2 - Percent cover of herbaceous vegetation	Seasonal Wetland Valley Oak Woodland	1 m^2 quadrant
V_3 - Soil type	Seasonal Wetland Valley Oak Woodland	Inspection of sample area, county soil survey
V_4 - Presence of logs and other types of cover	Seasonal Wetland Valley Oak Woodland	Visual inspection of sample area

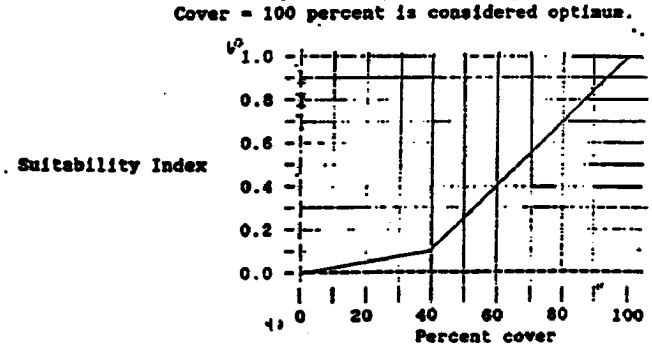
Variable 1: Height of herbaceous vegetation.

Assumes: California voles require relatively tall herbaceous vegetation for both food (Gill 1977, Batzli 1986) and cover (Ingles 1965). Grasses of the genera Hordeum, Bromus, and Lolium are included as food items (Gill 1977). Herbaceous vegetation ≥ 6 in. tall is considered optimum.



Variable 2: Percent cover of herbaceous vegetation.

Assumes: Relatively dense herbaceous vegetation is needed for cover. Cover = 100 percent is considered optimum.



Variable 3: Soil type within sample area.

Assumes: Friable soils such as silts and loams are optimum because voles can dig their burrows (Ingles 1965). Soils such as sands and clays are not optimum.

Suitability Index (SI) = 1.0 if soil type is silty or loamy and friable.

SI = 0.5 if soil type is not silty or loamy and is moderately friable.

SI = 0.2 if soil type is not silty or loamy and is not friable.

Variable 4: Presence of logs and other types of cover within the sample area.

Assumes: California voles will use logs, matted vegetation, brush piles, discarded trash and rocks for cover in addition to their burrows (California Department of Fish and Game undated).

SI = 1.0 if logs, brush piles, matted vegetation, and/or rocks are abundant and well distributed throughout the sample area.

SI = 0.7 if logs, brush piles, matted vegetation, and/or rocks are moderately abundant and distributed throughout the sample area.

SI = 0.4 if logs, brush piles, matted vegetation, and/or rocks are sparsely distributed throughout the sample area.

SI = 0.1 if logs, brush piles, matted vegetation, and/or rocks are absent from the sample area.

HSI Determination

For all cover types:

$$HSI = \frac{2V_1 + 2V_2 + V_3 + V_4}{6}$$

Variables V_1 and V_2 are assumed to play a greater role in the suitability of a given habitat type for the California vole. Presence of seasonal or permanent water and/or saturated soils are not assumed to be limiting factors and are represented by the herbaceous vegetation variables.

Model Applicability

This model is a hypothesis of the relationships between various attributes of grassland, wetland, and oak and riparian woodland habitats and the suitability of these habitats to California voles. The model is designed for use in the Central Valley of California up to 2500 ft elevation. Because California voles are permanent year-round residents, this model can be applied to these habitats at all times of the year. California voles have two- to four-year population cycles, and the causes of these cycles are not completely understood, but could be related to food quality and availability (Batzli and Pitelka 1971). This model does not account for these population cycles.

Literature Cited

Batzli, G.O. 1986. Nutritional ecology of the California vole: effects of food quality on reproduction. Ecology 67:406-412.

Batzli, G.O. and F.A. Pitelka. 1971. Condition and diet of cycling populations of the California vole, Microtus californicus. J. Mammal. 52: 141-163.

California Department of Fish and Game. Undated. California wildlife and fish habitat relationships system species note: California vole (Microtus californicus). California Dept. of Fish and Game, Sacramento, CA. 4 pp.

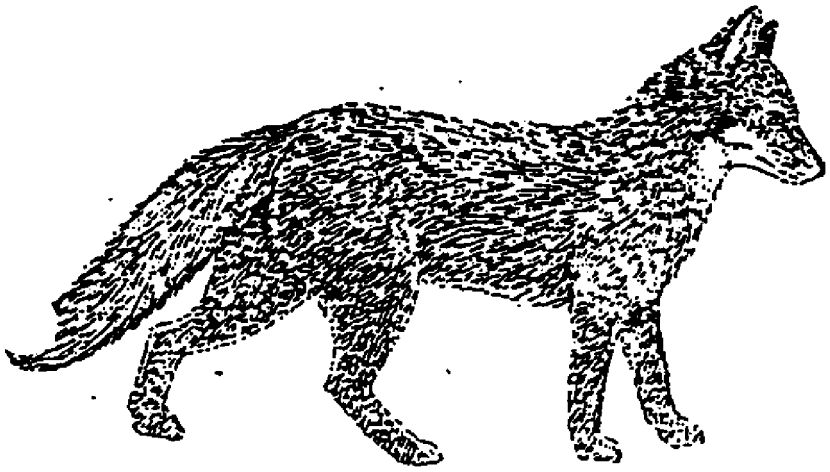
Gill, A.E. 1977. Food preferences of the California vole, Microtus californicus. J. Mammal. 58:229-233.

Ingles, L.G. 1965. Mammals of the Pacific states. Stanford University Press, Stanford, California. 506 pp.

DRAFT HABITAT SUITABILITY INDEX MODEL
GRAY FOX (*Urocyon cinereoargenteus*)

Rebeca A. Keck
U.S. Fish and Wildlife Service
Division of Ecological Services
Sacramento, California

March 1989



INTRODUCTION

The gray fox (Urocyon cinereoargenteus) occurs throughout most of the U.S. except the interior northwest and Rocky Mountains; it also occurs south throughout most of South America (Carey, 1982; Jameson, 1988). The gray fox is the most common and widespread fox in California, occurring at low to middle elevations (rarely above 5000 feet) throughout most of the state. Home range sizes are highly varied, from 30 hectares (74 acres) in California to 2755 hectares (6808 acres) in Alabama. Studies from Utah and California report home ranges not greater than 200 hectares (494 acres) (Fritzell, 1988).

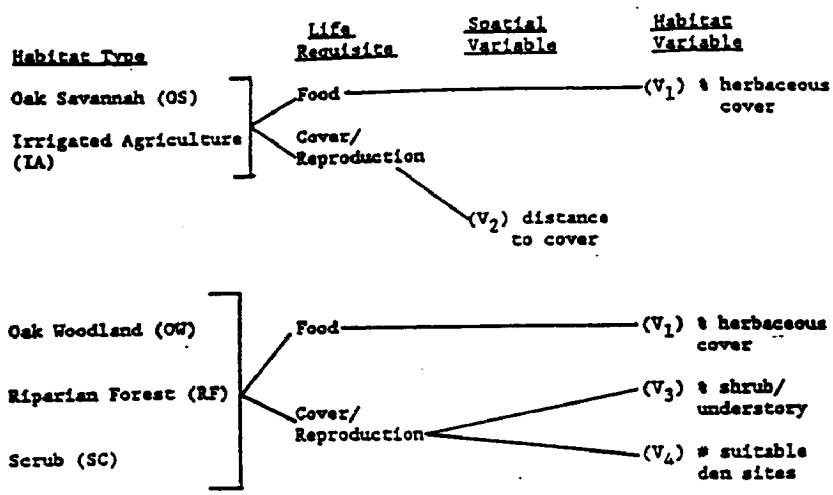
Gray foxes are very cosmopolitan in terms of habitat preference. They are reported to occupy a wide array of habitats, preferring areas of interspersion. In western North America, they favor brushy vegetation interspersed with rugged, broken terrain or riparian forest interspersed with agricultural lands. (Kucera, 1982; Hallberg and Trapp, 1984). Generally, they prefer shrub or brushland (Trapp, Schmidt, pers. comm.) and early successional stages of forest habitats (Carey, 1982).

Gray foxes are omnivorous and highly opportunistic. Diet varies regionally and is dependent on the seasonal availability of food sources. Food items include small mammals, birds, reptiles, amphibians, invertebrates, carrion, vegetation, fruit and grain (Carey, 1982; Fritzell, 1988). Rodents and lagomorphs appear to be the most common food item in the diets of gray fox in California (Grinell, et. al., 1937) but insects and fruits are also of major importance. Studies in Zion National Park, Utah, show that gray foxes are first and foremost insectivores and frugivores (Trapp, pers. comm.). Their ability to climb trees gives the gray fox a wider array of food sources than most other species of fox. Gray fox may become more frugivorous and herbivorous in the fall and winter, as the availability of prey species decreases.

MODEL APPLICABILITY

This model is designed for use in the Central Valley of California and surrounding foothills at elevations up to approximately 1500 feet.

HSI MODEL



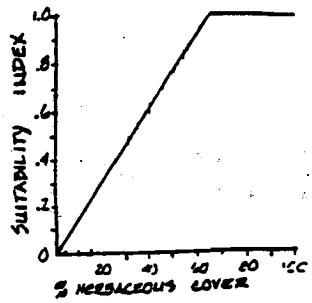
Assumptions:

1) Oak savannah and irrigated agriculture are used primarily as foraging habitat. Overall habitat suitability for these two habitats depends on proximity to cover/reproduction areas.

2) Oak woodland, riparian forest and scrub habitats provide all of the habitat features necessary for all life requisites.

Variable	Habitat Type	Suggested Sampling Technique
(V_1) % herbaceous cover	OS,IA,OW,RF,SC	Line intercept
(V_2) distance to cover	OS,IA	Aerial photo interpretation
(V_3) % shrub/ understory	OW,IA,SC	Line intercept
(V_4) # of suitable den sites	OW,IA,SC	Visual estimate

Variable 1: % herbaceous cover

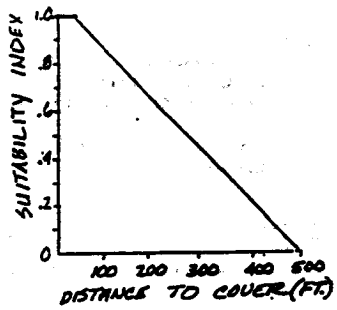


Assumptions:

1) Herbaceous cover is an essential habitat component for prey species (small mammals).

2) Optimum habitat conditions for prey species require 66% herbaceous cover (U.S. Fish and Wildlife Service, 1984).

Variable 2: Distance to cover

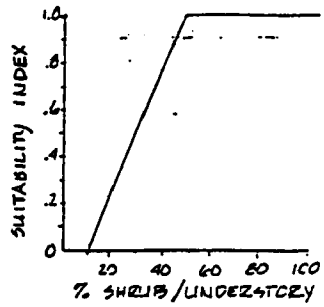


Assumptions:

1) Optimum habitat for gray fox is composed of areas which provide both forage and cover. Gray foxes do not venture far from cover. Overall habitat suitability requires that distance to cover areas be no greater than 0.1 mile (~500 feet) (Trapp, pers. comm). Cover within approximately 50 feet is optimum.

2) Overall habitat value decreases as the distance between cover and foraging areas increases.

Variable 3: Density of shrub/understory(%)

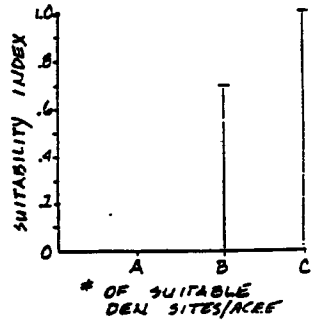


Assumption:

1) Shrub cover greater than 50% provides optimum habitat for resting and cover. Less than 10% cover is not suitable gray fox habitat (California Department of Fish and Game, 1988).

Variable 4: # suitable den sites/acre

A) No suitable den sites available.
B) 1-2 den sites available.
C) 3 or more suitable den sites available.



Assumption:

1) Suitable den sites include hollow logs, rock piles, brush piles, crevices in cliffs, and abandoned burrows.

Equations used to calculate HSI values:

Habitat type	Component	Equation
OS, IA	food, cover/reproduction	$HSI = \frac{V_1 + V_2}{2}$
OW, RF, SC	food	$SI_{food} = V_1$
	cover/reproduction	$SI_{cover/reproduction} = \frac{V_3 + V_4}{2}$
		$HSI = \frac{SI_{food} + SI_{cover/reproduction}}{2}$

Assumption:

For oak savannah and irrigated agriculture, V_1 and V_2 are assumed to function equally in determining habitat suitability. For oak woodland, riparian forest, and scrub habitats, habitat suitability is a combination of the suitability of the habitat to support the food life requisite and the cover/reproduction life requisite.

ACKNOWLEDGEMENTS

I wish to thank Dr. Gene Trapp, Department of Biological Sciences, California State University, Sacramento, California and Dr. Robert Schmidt, University of California at Davis, Hopland Field Station, Hopland, California for reviewing and providing comments on this model.

LITERATURE CITED

California Department of Fish and Game. 1988. Wildlife habitat relationship system. Species information report. Gray fox (Urocyon cinereoargenteus).

Carey, Andrew B. 1982. The ecology of red foxes, gray foxes, and rabies in the eastern United States. Wildlife Society Bulletin. 10(1):18-26.

Fritzell, Erik K. Gray fox and Island gray fox. In: Milan Novak, James A. Baker, Martyn E. Obbard and Bruce Malloch, editors. 1987. Wild Furbearer Management and Conservation in North America. p.408-420.

Fuller, Todd K. 1978. Variable home-range sizes of female gray foxes. Journal of Mammalogy. 59:446-449.

Grinnell J., J. Dixon, and J. M. Linsdale. 1937. Fur-bearing mammals of California. Vols. 1 and 2. Univ. California Press, Berkeley. 777 pp.

Hallberg, Donald L. and Gene R. Trapp. Gray fox temporal and spatial activity in a riparian/agricultural zone in California's central valley. In: Richard E. Warner and Kathleen M. Hendrix, editors. 1984. Califonia Riparian Systems: Ecology, Conservation, and Productive Management. p. 920-928.

Haroldson, Kurt J. and Erik K. Fritzell. 1984. Home ranges, activity, and habitat use by gray foxes in an oak-hickory forest. Journal of Wildlife Management. 48(1):222-227.

Jameson Jr., E. W. and Hans J. Peeters. 1988. California mammals. 403 pp.

Kucera, Thomas E. 1982. Habitat suitability index model: Gray fox. Department of Forestry and Resource Management, University of California, Berkeley. 4 pp.

Maser, C., B. R. Mate, J. F. Franklin, and C. T. Dyrness. 1981. Natural history of Oregon Coast mammals. U.S. Department of Agriculture, Forest Service General Technical Report. PNW-133. 496 pp.

Nicholson, W. S., Edward P. Hill, and Darrell Briggs. 1985. Denning, pup-rearing, and dispersal in the gray fox in east-central Alabama. Journal of Wildlife Management. 49(1):33-37.

Samuel, David E. and Brad B. Nelson. Foxes: Vulpes vulpes and allies. In: J. A. Chapman, Ph.D. and G. A. Feldhamer, Ph.D., editors. 1982. Wild Mammals of North America: Biology, Management and Economics. 1147 pp.

U.S. Fish and Wildlife Service. 1984. Draft Habitat Suitability Index (HSI) Model: Bobcat (Lynx rufus). Division of Ecological Services. Sacramento, California. 9 pp.

PERSONAL COMMUNICATION

Gordon Gould, Wildlife Biologist. California Department of Fish and Game. Sacramento, California. 1989.

Frank Hall, Wildlife Biologist, California Department of Fish and Game, Unit Manager, Honeylake Wildlife Area, California. 1989.

Ken Mayer, Wildlife Biologist, California Department of Fish and Game, Sacramento, California. 1989.

Dr. Robert Schmidt, University of California, Hopland Field Station, Hopland, California. 1989.

Dr. Gene Trapp, Department of Biological Sciences, California State University, Sacramento, California. 1989.

Dave Zeiner, Wildlife Biologist, California Department of Fish and Game. 1989.

HABITAT SUITABILITY INDEX MODEL FOR THE RIPARIAN FOREST COVER-TYPE, RIPARIAN AREAS OF THE SACRAMENTO RIVER SYSTEM

Formulated by the HEP team evaluating impacts of the
Sacramento River Bank Protection Project, Contract 45

August 1989

BACKGROUND: The Sacramento River Bank Protection Project is an ongoing project of the U. S. Army Corps of Engineers (construction agency) and State Reclamation Board (local sponsor). As it is presently constructed, the project entails traditional riprapping, whereby earthen levees and riverbanks are made uniform (by cutting and filling) and then covered with quarry rock. Construction usually involves the removal of any riparian vegetation which may be present; substantial modifications are generally also made to the nearshore aquatic zone.

To analyze the impacts of the Bank Protection Project to fish and wildlife, the Fish and Wildlife Service has recently begun evaluating each construction contract using the Service's Habitat Evaluation Procedures (HEP). For the HEP appliction a series of cover-type models -- one model for each impacted cover type--has been developed.

The cover-type model described here is for Riparian Forest Cover. This cover-type 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 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 River System's riparian zones.

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 which is derived using the Riparian Forest cover-type model is, therefore, not an exact measure of the habitat value of any single wildlife species. Instead, the HSI indicates the overall, broad quality of the cover-type to a broad array of the most important species which inhabit the Sacramento River's riparian zone. 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. Comparisons using actual HSI data collected from Riparian Forest Cover along the

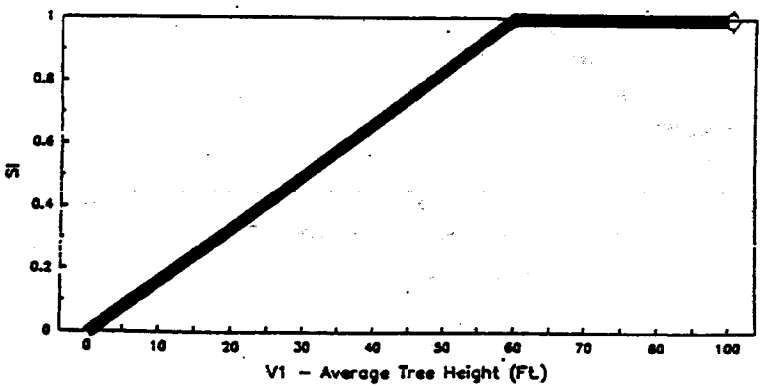
Sacramento River strongly suggest that this assumption is correct.

AREA OF APPLICABILITY: Riparian Forest Cover along the Sacramento River system.

VARIABLES:

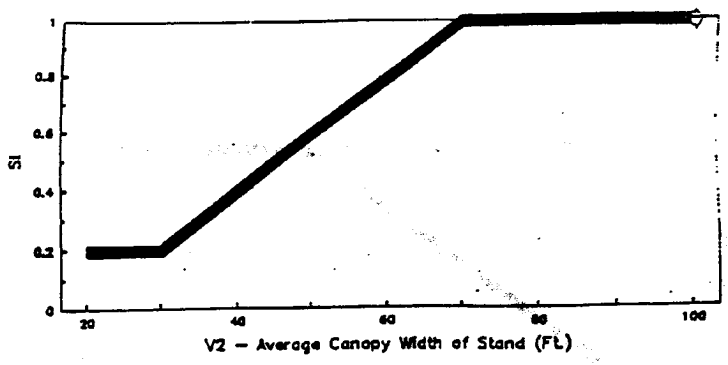
V1 -- Average tree height.
V2 -- Average canopy width of the stand.
V3 -- Tree canopy closure.
V4 -- Number of tree or shrub species.
V5 -- Understory vegetative density.

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.



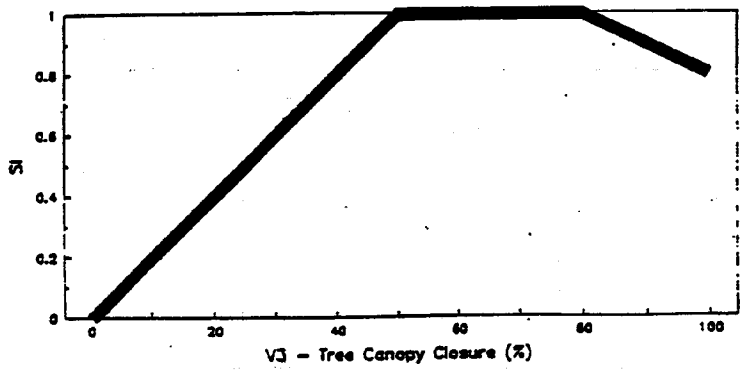
Riparian Forest Cover

V2 -- Average canopy width of the stand. Suitability Index (SI) determination. Assumptions: Generally, the wider the stand, the better the 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.



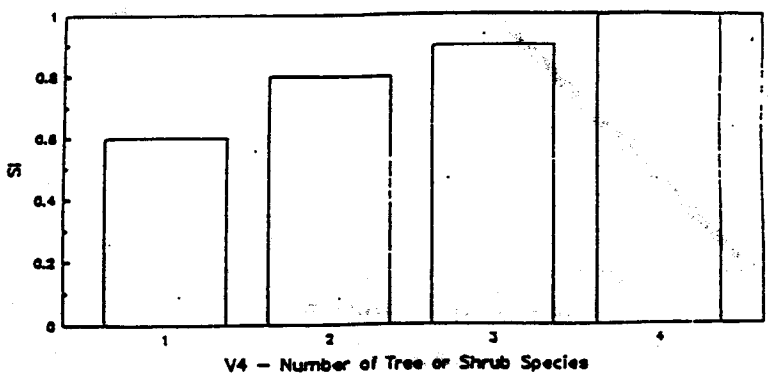
Riparian Forest Cover

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 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.



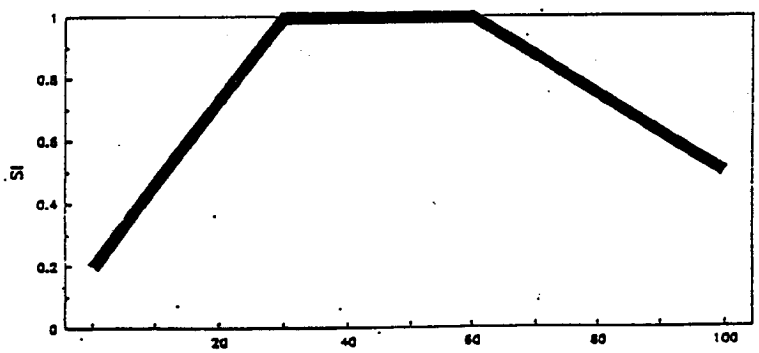
Riparian Forest Cover

V4 -- Number of tree or shrub species. Suitability Index (SI) determination. Assumptions: Habitat diversity improves carrying capacity. Generally, the more tree or 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.



Riparian Forest Cover

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 understory of the forest for the horizontal planes at 2, 6, and 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.



V5 — Understory Vegetative Density (%)
(At 2, 6, and 14 Feet Above Ground)

Riparian Forest Cover

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:

$$HSI = \frac{(V1 \times V3 \times V4)^{1/3} + (V2 \times V5)^{1/2}}{2}$$

HABITAT SUITABILITY INDEX MODEL FOR THE SCRUB-SHRUB COVER-TYPE, RIPARIAN AREAS OF THE SACRAMENTO RIVER SYSTEM

Formulated by the HEP team evaluating impacts of the Sacramento River Bank Protection Project, Contract 45

August 1989

BACKGROUND: The Sacramento River Bank Protection Project is an ongoing project of the U. S. Army Corps of Engineers (construction agency) and State Reclamation Board (local sponsor). As it is presently constructed, the project entails traditional riprapping, whereby earthen levees and riverbanks are made uniform (by cutting and filling) and then covered with quarry rock. Construction usually involves the removal of any riparian vegetation which may be present; substantial modifications are generally also made to the nearshore aquatic zone. To analyze the impacts of the Bank Protection Project to fish and wildlife, the Fish and Wildlife Service has recently begun evaluating each construction contract using the Service's Habitat Evaluation Procedures (HEP). For the HEP application a series of cover-type models -- one model for each impacted cover type--has been developed.

The cover-type model described here is for Scrub-Shrub Cover. This cover type is defined as a stand of woody trees or shrubs averaging less than 20-feet-tall.

The Scrub-Shrub community model identifies and quantifies characteristics of this cover type which are important to a wide array of fish and wildlife. Thus, the model may not portray exactly the needs of any one species, but it should broadly portray the needs of many species or species groups of the Sacramento River System's riparian zones.

Among the species whose needs were considered in developing this model were the following; songbirds, such as the yellow warbler; gamebirds, such as the pheasant and California quail; the heron and egret family; and furbearing aquatic mammals.

The single Habitat Suitability Index (HSI) value which is derived using the Scrub-Shrub cover-type model is, therefore, not an exact measure of the habitat value for any single wildlife species. Instead, the HSI indicates the overall, broad quality of this cover-type to a broad array of the most important species which inhabit the scrubby areas of the Sacramento River's riparian zone. 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. Comparisons using actual HSI data collected from Scrub-Shrub Cover along the Sacramento River strongly suggest that this assumption is correct.

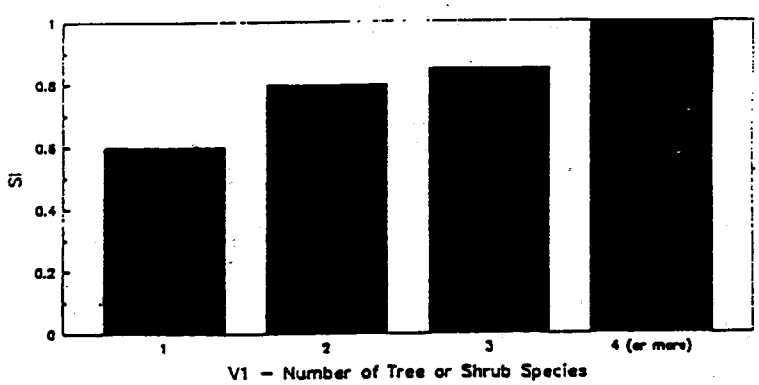
AREA OF APPLICABILITY: Riparian Scrub-Shrub Cover along the Sacramento River system.

VARIABLES:

V1 -- Number of tree or shrub species.

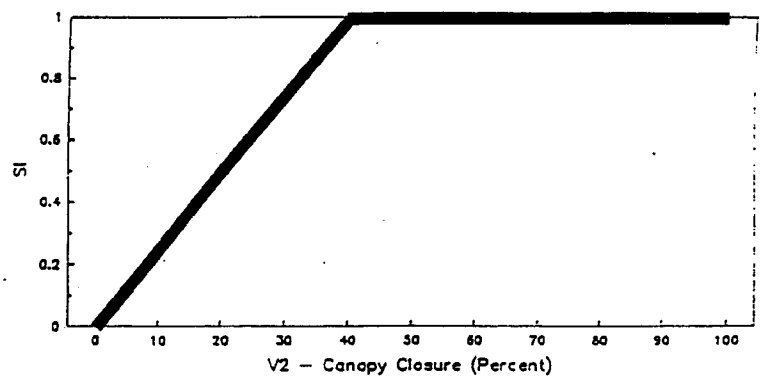
V2 -- Percent of canopy closure.
V3 -- Average width of stand(s).

V1 -- Number of tree or shrub species. Suitability Index (SI) determination. Assumptions: The greater the habitat diversity, as indicated by the number of tree or shrub species making up the stand(s), the greater the values to fish and wildlife. Four or more species of trees or shrubs are considered the optimal condition.



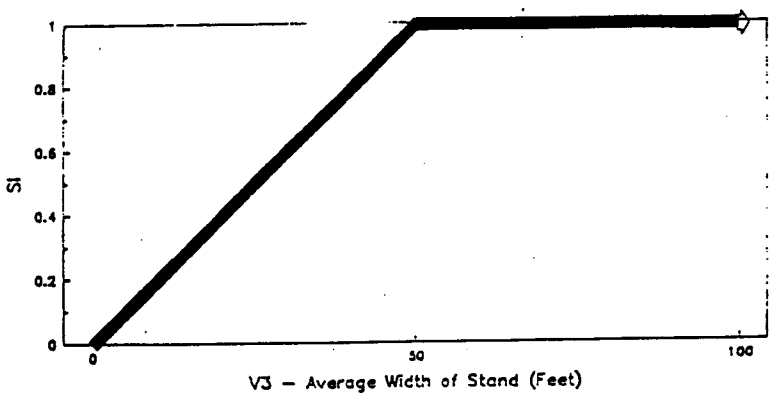
Scrub-Shrub Cover

V2 -- Percent of canopy closure. Suitability Index (SI) determination. Assumptions: In general, the greater the Scrub-Shrub density, as measured by percentage of canopy closure of the trees or shrubs, the greater the values for fish and wildlife. For relatively narrow stands, optimal canopy closure is 40-100 percent; for wider stands, optimal closure is 40-75 percent.



Scrub-Shrub Cover

V3 -- Average width of stand(s). Suitability Index (SI) determination. Assumptions: The wider the stand, the greater the values for fish and wildlife. Stands at least 50-feet-wide are considered optimal.



Scrub-Shrub Cover

HABITAT SUITABILITY INDEX (HSI): The three variables are closely related and about equally important in determining the HSI.

$$HSI = (V1 \times V2 \times V3)^{1/3}$$

Appendix A-II

HEP Assumptions and Future Scenarios

DATA ANALYSIS ASSUMPTIONS
KAWEAH RIVER BASIN INVESTIGATION

GRAY FOX (Oak woodland)
V1 - % herbaceous ground cover
V2 - distance to cover
V3 - density of shrub understory
V4 - # den sites per acre

Without project (PA1)

```
TY0     Baseline conditions. 38 acres.
        V1      88.3%           SI = 1.0
        V2      50'             SI = 1.0        HSI = (((V1 + V2)/2) + ((V3 + V4)/2))/2 =  0.78
        V3      12.5%           SI = 0.10
        V4      >4              SI = 1.0
TY1     No change from TY0.
TY102   No change from TY0.
```

With project (PA2)

```
TY0     Baseline Conditions. 38 acres.
TY1     Oak Woodland removed; all values go to zero.
TY102   Same as TY1.
```

Without LSID Management Plan (MP1)

```
TY0     Baseline conditions.  25 acres.
        V1      80%             SI = 1.0
        V2      300'            SI = 0.4        HSI = (((V1 + V2)/2) + ((V3 + V4)/2))/2 =  0.37
        V3      10%             SI = 0.0
        V4      0.2             SI = 0.1
TY102   Same as TY1.
```

With LSID Management Plan (MP2)

```
TY0     Baseline conditions same as MP1.  25 acres.
TY1,2   Same as TY0.  Replanting plan implemented.
TY20    V1      80%             SI = 1.0
        V2      250'            SI = 0.55
        V3      20%             SI = 0.25
        V4      0.5             SI = 0.20       HSI = (((V1 + V2)/2) + ((V3 + V4)/2))/2 = 0.50
TY50    V1      80%             SI = 1.0
        V2      100'            SI = 0.89
        V3      20%             SI = 0.25
        V4      2               SI = 0.70       HSI = (((V1 + V2)/2) + ((V3 + V4)/2))/2 = 0.71
TY102   V1      80%             SI = 1.0
        V2      100'            SI = 1.0
        V3      30%             SI = 0.5
        V4      3               SI = 1.0        HSI = (((V1 + V2)/2) + ((V3 + V4)/2))/2 = 0.88
```

PLAIN TITMOUSE (Oak woodland)
V1 - tree diameter
V2 - trees per acre
V3 - % oak trees

Without Project Conditions (PA1)

```
TY0     Baseline conditions.  38 acres.
        V1      6.43"           SI = 0.60
        V2      57              SI = 0.84       HSI = (V1 + V2 + V3)/3 =  0.81
        V3      100%            SI = 1.00
TY1     No change from TY0.
TY102   No change from TY0.
```

With Project Conditions (PA2)

```
TY0     Baseline conditions.  38 acres.
TY1     Oak woodland removed; all values go to zero.
TY102   Same as TY1.
```

Without LSID Management Plan (MP1)

```
TY0     Baseline conditions.  25 acres.
        V1      0"              SI = 0.0
        V2      0               SI = 0.0        HSI = (V1 + V2 + V3)/3 =  0.0
        V3      0%              SI = 0.0
TY102   Same as TY1.
```

With LSID Management Plan (MP2)

TY0	Baseline conditions same as MP1. 25 acres.			
TY1,2	Same as TY0. Replanting plan implemented.			
TY20	V1	5"	SI = 0.20	
	V2	30	SI = 0.50	
	V3	50%	SI = 0.71	HSI = (V1 + V2 + V3)/3 = 0.47
TY50	V1	12"	SI = 0.60	
	V2	50	SI = 0.83	
	V3	60%	SI = 0.86	HSI = (V1 + V2 + V3)/3 = 0.76
TY102	V1	18"	SI = 0.60	
	V2	50	SI = 0.83	
	V3	70%	SI = 1.00	HSI = (V1 + V2 + V3)/3 = 0.81

GRAY FOX (Oak savannah)

V1 - % herbaceous ground cover
V2 - distance to cover

Without Project Conditions (PA1)

TY0	Baseline conditions. 132 acres.			
	V1	84.6%	SI = 1.00	
	V2	75	SI = 0.91	$HSI_{feeding}$ = (V1 + V2)/2 = 0.95
TY1	Same as TY0.			
TY102	Same as TY0.			

With Project Conditions (PA2)

TY0	Baseline conditions. 132 acres.
TY1	Oak savannah removed; HSI value to zero.
TY102	Same as TY1.

Without LSID Management Plan (MP1)

TY0	Baseline conditions. 50 acres.			
	V1	80%	SI = 1.0	
	V2	500'	SI = 0.0	$HSI_{feeding}$ = (V1 + V2)/2 = 0.50
TY102	Same as TY1.			

With LSID Management Plan (MP2)

TY0	Baseline conditions same as MP1. 50 acres.			
TY1,2	Same as TY0. Replanting plan implemented.			
TY20	V1	80%	SI = 1.0	
	V2	250'	SI = 0.55	$HSI_{feeding}$ = (V1 + V2)/2 = 0.77
TY50	V1	80%	SI = 1.0	
	V2	100'	SI = 0.89	$HSI_{feeding}$ = (V1 + V2)/2 = 0.96
TY102	V1	80%	SI = 1.0	
	V2	100'	SI = 0.89	$HSI_{feeding}$ = (V1 + V2)/2 = 0.96

PLAIN TITMOUSE (Oak savannah)

V1 - tree diameter
V2 - trees per acre
V3 - % oak trees

Without Project Conditions (PA1)

TY0	Baseline conditions. 132 acres.			
	V1	9.78"	SI = 0.60	
	V2	18	SI = 0.30	HSI = (V1 + V2 + V3)/3 = 0.63
	V3	100%	SI = 1.00	
TY1	No change from TY0.			
TY102	No change from TY0.			

With Project Conditions (PA2)

TY0	Baseline conditions. 132 acres.
TY1	Oak savannah removed; all values go to zero.
TY102	Same as TY1.

Without LSID Management Plan (MP1)

TY0	Baseline conditions. 50 acres.			
	V1	0"	SI = 0.0	
	V2	0	SI = 0.0	HSI = (V1 + V2 + V3)/3 = 0.0
	V3	0%	SI = 0.0	
TY102	Same as TY1.			

With LSID Management Plan (MP2)

TY0	Baseline conditions same as MP1. 50 acres.			
TY1,2	Same as TY0. Oak savannah planting plan implemented.			
TY20	V1	5"	SI = 0.2	
	V2	12	SI = 0.2	
	V3	50%	SI = 0.71	HSI = (V1 + V2 + V3)/3 = 0.37
TY50	V1	12"	SI = 0.6	
	V2	25	SI = 0.42	
	V3	70%	SI = 1.0	HSI = (V1 + V2 + V3)/3 = 0.67
TY102	V1	18"	SI = 0.6	
	V2	25	SI = 0.42	
	V3	70%	SI = 1.0	HSI = (V1 + V2 + V3)/3 = 0.67

CALIFORNIA VOLE (Oak savannah)

V1 - height herbaceous vegetation
V2 - % herbaceous cover
V3 - soil type
V4 - presence of logs and other cover

Without Project Conditions (PA1)

TY0	Baseline conditions. 132 acres.			
	V1	7.9"	SI = 1.00	
	V2	92%	SI = 0.87	HSI = (2V1 + 2V2 + V3 + V4)/6 = 0.86
	V3	loam	SI = 0.75	
	V4		SI = 0.70	
TY1	No change from TY0.			
TY102	No change from TY0.			

With Project Conditions (PA2)

TY0	Baseline conditions. 132 acres.
TY1	Loss of oak savannah; grassland, but not savannah values remain.
TY102	No change from TY1.

Without LSID Management Plan (MP1)

TY0	Baseline conditions. 50 acres.			
	V1	2"	SI = 0.33	
	V2	80%	SI = 0.70	
	V3	loam	SI = 1.00	HSI = (2V1 + 2V2 + V3 + V4)/6 = 0.52
	V4		SI = 0.10	
TY102	Same as TY1.			

With LSID Management Plan (MP2)

TY0	Baseline conditions same as MP1. 50 acres.			
TY1,2	Same as TY0. Oak savannah planting plan implemented.			
TY20	V1	6"	SI = 1.00	
	V2	90	SI = 0.84	
	V3	loam	SI = 1.00	
	V4		SI = 0.40	HSI = (2V1 + 2V2 + V3 + V4)/6 = 0.85
TY50	V1	6"	SI = 1.00	
	V2	90	SI = 0.84	
	V3	loam	SI = 1.00	
	V4		SI = 0.70	HSI = (2V1 + 2V2 + V3 + V4)/6 = 0.90
TY102	V1	6"	SI = 1.00	
	V2	90	SI = 0.84	
	V3	loam	SI = 1.00	
	V4		SI = 1.00	HSI = (2V1 + 2V2 + V3 + V4)/6 = 0.95

CALIFORNIA VOLE (Grasslands)

V1 - height herbaceous vegetation
V2 - % herbaceous cover
V3 - soil type
V4 - presence of logs and other cover

Without Project Conditions (PA1)

TY0	Baseline conditions. 98 acres.			
	V1	6.3"	SI = 0.94	
	V2	78%	SI = 0.68	HSI = (2V1 + 2V2 + V3 + V4)/6 = 0.74
	V3	mix	SI = 0.70	
	V4		SI = 0.55	
TY1	No change from TY0.			
TY102	No change from TY0.			

With Project Conditions (PA2)

TY0 Baseline conditions. 98 acres.
TY1 Acreage increase to 288 with loss of oak woodlands/savannah. 30 percent decrease in value due to intermittent inundation.

V1	5"	SI = 0.80	
V2	60%	SI = 0.40	HSI = 0.7(2V1 + 2V2 + V3 + V4)/6 = 0.45
V3	loam	SI = 0.75	
V4		SI = 0.70	

TY102 No change from TY1.

WESTERN MEADOWLARK (Grasslands)

V1 - distance to water
V2 - height/density of herbaceous vegetation
V3 - abundance of singing perches

Without Project Conditions (PA1)

TY0 Baseline conditions. 98 acres.

V1	450'	SI = 1.00	
V2	6.4/78 SI = 0.65		HSI = (V1 + V2 + V3)/3 = 0.88
V3	>4	SI = 1.00	

TY1 No change from TY0.
TY102 No change from TY0.

With Project Conditions (PA2)

TY0 Baselins conditions. 98 acres.
TY1 Acreage increase to 288 with loss of oak woodlands/savannah. 10 percent decrease due to inundation.

V1	300'	SI = 1.00	
V2		SI = 0.80	HSI = 0.9(V1 + V2 + V3)/3 = 0.59
V3	1	SI = 0.20	

TY102 No change from TY1.

RIPARIAN FOREST

V1 - avg. Tree height
V2 - avg. canopy width
V3 - tree canopy closure
V4 - # tree/shrub species
V5 - understory density

Without Project Conditions (PA1)

TY0 Baseline conditions. 70 acres.

V1	45'	SI = 0.75	
V2	100	SI = 1.00	HSI = ((V1 * V3 * V4)$^{1/3}$ + (V2 * V5)$^{1/2}$)/2 = 0.96
V3	35/65	SI = 0.85	
V4	>4	SI = 1.00	
V5	35/30	SI = 1.00	

TY1 No change from TY0.
TY102 No change from TY0.

With Project Conditions (PA2)

TY0 Baseline conditions. 70 acres.
TY1 Degradation impacts.
TY2 Same as TY1.

TY20 V1	30'	SI = 0.50	
V2	75	SI = 1.00	HSI = ((V1 * V3 * V4)$^{1/3}$ + (V2 * V5)$^{1/2}$)/2 = 0.78
V3	35	SI = 0.70	
V4	4	SI = 1.00	
V5	20	SI = 0.73	

TY102 No change from TY20.

Without LSID Management Plan (MP1)

TY0 Baseline conditions. 25 acres.

V1	0	SI = 0.00	
V2	0	SI = 0.00	
V3	0%	SI = 0.00	
V4	0	SI = 0.00	
V5	0%	SI = 0.20	HSI = ((V1 * V3 * V4)$^{1/3}$ + (V2 * V5)$^{1/2}$)/2 = 0.00

TY102 Same as TY1.

With LSID Management Plan (MP2)

TY0	Baseline conditions same as MP1. 25 acres.			
TY1,2	Same as TY0. Riparian forest planting plan implemented.			
TY10	V1	10'	SI = 0.17	
	V2	40'	SI = 0.45	
	V3	20%	SI = 0.40	
	V4	4	SI = 1.00	
	V5	30%	SI = 1.00	$HSI = ((V1 * V3 * V4)^{1/3} + (V2 * V5)^{1/2})/2 = 0.54$
TY30	V1	40'	SI = 0.67	
	V2	60'	SI = 0.75	
	V3	30%	SI = 0.60	
	V4	4	SI = 1.00	
	V5	40%	SI = 1.00	$HSI = ((V1 * V3 * V4)^{1/3} + (V2 * V5)^{1/2})/2 = 0.80$
TY50	V1	45'	SI = 0.75	
	V2	75'	SI = 1.00	
	V3	40%	SI = 0.80	
	V4	4	SI = 1.00	
	V5	40%	SI = 1.00	$HSI = ((V1 * V3 * V4)^{1/3} + (V2 * V5)^{1/2})/2 = 0.92$
TY102	V1	45'	SI = 0.75	
	V2	75'	SI = 1.00	
	V3	50%	SI = 1.00	
	V4	4	SI = 1.00	
	V5	30%	SI = 1.00	$HSI = ((V1 * V3 * V4)^{1/3} + (V2 * V5)^{1/2})/2 = 0.95$

RIPARIAN SCRUB

V1 - # tree/shrub species
V2 - canopy closure
V3 - avg. stand width

Without Project Conditions (PA1)

TY0	Baseline conditions. 92 acres.			
	V1	1.25	SI = 0.65	
	V2	40%	SI = 1.00	$HSI = (V1 * V2 * V3)^{1/3} = 0.87$
	V3	50'	SI = 1.00	
TY1	No change from TY0.			
TY102	No change from TY0.			

With Project Conditions (PA2)

TY0	Baseline conditions. 92 acres.			
TY2	Same as TY0.			
TY20	Inundation impacts complete. 82 acres remain, degraded quality.			
	V1	1.25	SI = 0.65	
	V2	30%	SI = 0.75	$HSI = ((V1 * V2 * V3)^{1/3} = 0.73$
	V3	40'	SI = 0.80	
TY102	No change from TY20.			

Scrub Compensation Area Without Management (MP3)

TY0	Baseline conditions. 20 acres. Zero HSI for riparian scrub.
TY1	No change from TY0.
TY102	No change from TY0.

Scrub Compensation Area With Management (MP4)

TY0	Baseline conditions. 20 acres. Zero HSI for riparian scrub.			
TY1	No change from TY0. Replanting, management begins.			
TY10	V1	2	SI = 0.80	
	V2	30%	SI = 0.75	$HSI = ((V1 * V2 * V3)^{1/3} = 0.84$
	V3	50'	SI = 1.0	
TY20	V1	2	SI = 0.80	
	V2	50%	SI = 1.0	$HSI = ((V1 * V2 * V3)^{1/3} = 0.93$
	V3	50'	SI = 1.0	
TY102	Same as TY20.			

SUMMER WATERBIRD GUILD

V1 - Average annual acres inundated or saturated by water
V2 - Average annual duration of inundation or soil saturation
V3 - Presence/absense of islands/significant edge habitat (Present = 1.0, absent = 0.5)
V4 - Presence/absence of significant water cycling (Present = 1.0, absent = 0.5)

Without Project Conditions (PA1)

```
TY0     Baseline conditions.  Average annual acres affected total 1139 acres in Wilbur/Hacienda
        (W/H), 273 acres in Tulare Lakebed (TLB) agricultural areas.
        V1 (W/H)        1139 ac
        V1 (TLB)        273 ac                  HUs = V1 * (V2/365) * V3 *V4 = 11.97  (TLB)
        V2 (W/H)        45 days                                             = 140.42 (W/H)
        V2 (TLB)        16 days
        V3 = 1.0
        V4 = 1.0
TY1     No change from TY0.                     AAHUs = 11.97 (TLB)
TY102   No change from TY0.                     AAHUs = 140.42 (W/H)
```

With Project Conditions (PA2)

```
TY0     Baseline conditions.
TY2     Inundation frequencies change to lose all habitat described in PA1.
        V1      0.00    V3 = 0.0
        V2      0.00    V4 = 0.0
TY102   No change from TY2.
```

Tulare Basin Wetlands Compensation Area Without Management (MP5)

```
TY0     Baseline conditions are degraded agricultural lands, de-watered duck club, or lands
        similar to those in the Wilbur/Hacienda areas.  All are assumed to receive no
        spring/summer flood waters. (i.e., 0 HUs).
TY102   Same as TY0.                            AAHUs = 0
```

Tulare Basin Wetlands Compensation Area With 45-day Management (MP6)

```
TY0     Same as MP5 Baseline Conditions.  1412 acre site.
TY1     Site flooded for 45 days, replacing actual annual average project decreases of flood
        acreage and duration.
        V1 (TLB)        273             HUs (TLB) = 33.6
        V1 (W/H)        1139            HUs (W/H) = 140.42
        V2 (TLB)        45
        V2 (W/H)        45
        V3 = 1.0    V4 = 1.0
TY102   Same as TY1.                    AAHUs (TLB) = 33.6
                                        AAHUs (W/H) = 140.42
```

Tulare Basin Wetlands Compensation Area With 152-day Management Plan (MP7)

```
TY0     Same as MP5 Baseline Conditions, but a 366-acre site, of which about 29 acres is prepared
        for waterfowl management and 337 acres for shorebirds.
TY1     Site flooded for 152 days annually, from February 15 to July 15.
        V1 (TLB)        29              HUs (TLB) = 11.97
        V1 (W/H)        1139            HUs (W/H) = 140.42
        V2 (TLB)        152
        V2 (W/H)        152
        V3 = 1.0    V4 = 1.0
TY102   Same as TY1.                    AAHUs (TLB) = 11.97
                                        AAHUs (W/H) = 140.42
```

Appendix A-III

HEP Analysis Form D's

Form D: Net Change in AAHU's — Date: 01/11/1996

Study Name: KAWEAH RIVER BASIN INVESTIG.
Action: PA 2 (with project) — WITH PROJECT
Compared To: PA 1 (without project) — WITHOUT PROJECT
Period of analysis: 102

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	GRAY FOX (OW)	0.10	29.64	-29.54
2	PLAIN TITMOUSE (OW)	0.10	30.78	-30.68
3	GRAY FOX (OS)	0.61	125.40	-124.79
4	PLAIN TITMOUSE (OS)	0.27	83.16	-82.89
5	CALIF. VOLE (OS)	0.37	113.52	-113.15
6	CALIF. VOLE (GR)	129.41	72.52	56.89
7	W. MEADOWLARK (GR)	169.60	86.24	83.36
8	RIPARIAN FOREST	57.47	67.20	-9.73
9	RIPARIAN SCRUB	62.00	80.04	-18.04

Form D: Net Change in AAHU's — Date: 01/11/1996

Study Name: KAWEAH RIVER BASIN INVESTIG.
Action: MP 2 (with project) — LSID (OW & OS)
Compared To: MP 1 (without project) — LSID - NO MGMT
Period of analysis: 102

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
1	GRAY FOX (OW)	16.68	9.25	7.43
2	PLAIN TITMOUSE (OW)	15.56	0.00	15.56
3	GRAY FOX (OS)	44.36	25.00	19.36
4	PLAIN TITMOUSE (OS)	26.36	0.00	26.36
5	CALIF. VOLE (OS)	43.65	26.00	17.65

Form D: Net Change in AAHU's — Date: 01/11/1996

Study Name: KAWEAH RIVER BASIN INVESTIG.
Action: MP 3 (with project) LSID (RIP.FOR.)
Compared To: MP 1 (without project) LSID - NO MGMT
Period of analysis: 102

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
8	RIPARIAN FOREST	19.95	0.00	19.95

Form D: Net Change in AAHU's — Date: 01/11/1996

Study Name: KAWEAH RIVER BASIN INVESTIG.
Action: MP 4 (with project) SCRUB REPLANTS
Compared To: MP 1 (without project) LSID - NO MGMT
Period of analysis: 102

Evaluation Species ID#	Name	AAHU's With Action	AAHU's Without Action	Net Change
9	RIPARIAN SCRUB	17.43	0.00	17.43

Area Needed For In-Kind Compensation (Form H Results) — Date: 01/11/1996

Study Name: KAWEAH RIVER BASIN INVESTIG.
Plan Alternative: PA 2 (with project) WITH PROJECT
Compared To: PA 1 (without project) WITHOUT PROJECT
Management Plan: MP 2 (with project) LSID (OW & OS)
Compared To: MP 1 (without project) LSID - NO MGMT
Candidate Management Area Size: 25 ~~80~~.00

Net Change In AAHU's

Evaluation Species ID#	Name	Plan Alternative	Management Plan	Area Needed For Compensation
1	GRAY FOX (OW)	-29.54	7.43	77.37 ~~108.77~~
2	PLAIN TITMOUSE (OW)	-30.68	15.56	49.28 ~~98.56~~
3	GRAY FOX (OS)	-124.79	19.36	322.23
4	PLAIN TITMOUSE (OS)	-82.89	26.36	157.24
5	CALIF. VOLE (OS)	-113.15	17.65	320.59

Area Needed For In-Kind Compensation
(Form H Results)

Date: 01/11/1996

Study Name:	KAWEAH RIVER BASIN INVESTIG.		
Plan Alternative:	PA 2	(with project)	WITH PROJECT
Compared To:	PA 1	(without project)	WITHOUT PROJECT
Management Plan:	MP 3	(with project)	LSID (RIP.FOR.)
Compared To:	MP 1	(without project)	LSID - NO MGMT
Candidate Management Area Size:		25.00	

Net Change In AAHU's

Evaluation Species ID#	Name	Plan Alternative	Management Plan	Area Needed For Compensation
8	RIPARIAN FOREST	-9.73	19.95	12.19

Area Needed For In-Kind Compensation
(Form H Results)

Date: 01/11/1996

Study Name:	KAWEAH RIVER BASIN INVESTIG.		
Plan Alternative:	PA 2	(with project)	WITH PROJECT
Compared To:	PA 1	(without project)	WITHOUT PROJECT
Management Plan:	MP 4	(with project)	SCRUB REPLANTS
Compared To:	MP 1	(without project)	LSID - NO MGMT
Candidate Management Area Size:		20.00	

Net Change In AAHU's

Evaluation Species ID#	Name	Plan Alternative	Management Plan	Area Needed For Compensation
9	RIPARIAN SCRUB	-18.04	17.43	20.71

ELEVATION PROJECT LOCAL PLAN (with parameter, 0 AF Min Pool) 2050 CONDITIONS

WATER YEAR		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1966	MIN	565.59	565.63								562.00	562.00	562.00
1967	MIN	562.00	564.12				520.00	520.00	578.87				
1968	MIN	567.49	567.96								562.00	562.00	562.00
1969	MIN	562.00	566.35										
1970	MIN	568.64	569.31									564.14	563.97
1971	MIN	564.63	565.22									565.76	564.35
1972	MIN	564.71	565.79							562.00	562.00	562.00	562.00
1973	MIN	562.00	565.73										569.06
1974	MIN	566.24	567.64										565.67
1975	MIN	565.04	569.22										566.02
1976	MIN	565.31	572.64							562.00	562.00	562.00	562.00
1977	MIN	565.09	565.13							562.00	562.00	562.00	562.00
1978	MIN	562.00	562.00	564.62		562.00							
1979	MIN												565.46
1980	MIN	565.34											
1981	MIN	567.19	567.76								562.00	562.00	562.00
1982	MIN	563.34	569.27			562.00	562.00						
1983	MIN								520.00				
1984	MIN												568.47
1985	MIN	566.36	569.59									565.65	565.08
1986	MIN	565.95	568.05			562.00							573.64
1987	MIN	567.41	568.04								562.00	562.00	562.00
1988	MIN	562.00	564.03								562.00	562.00	562.00
1989	MIN	562.00	563.79		568.92						562.00	562.00	562.00
1990	MIN	562.00	567.00							562.00	562.00	562.00	562.00
1991	MIN	562.00	562.00	564.12	565.05	562.00	562.00						566.83
1992	MIN	564.00	567.97							562.00	562.00	562.00	562.00
MEAN		567.49	569.65	579.53	584.16	588.55	596.73	616.06	646.18	649.93	626.99	597.82	576.61
MAX		607.72	607.43	628.40	650.54	644.49	651.76	651.00	691.59	710.60	709.23	677.27	642.50
MIN		562.00	562.00	564.12	565.05	562.00	520.00	520.00	520.00	562.00	562.00	562.00	562.00

ELEVATION EXISTING (without parameter, 0 AF Min Pool) 2050 CONDITIONS

WATER YEAR		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1966	MIN	523.52	530.49	538.86	540.23	540.79	543.05				520.00	521.95	525.51
1967	MIN	525.46	525.48	551.26		520.00	520.00	520.00	520.00				
1968	MIN	530.97	533.77	538.45	538.77	541.59	551.20				520.00	526.33	525.36
1969	MIN	525.67	532.67	532.82	541.12		566.00	520.00	520.00				
1970	MIN	535.04	535.11	534.37	538.04	566.58	568.98					523.60	523.33
1971	MIN	527.12	529.97	540.24	539.54	544.51	543.63				545.76	530.52	525.32
1972	MIN	527.31	531.23	532.79	538.04	538.24	543.11			520.00	520.00	523.25	526.43
1973	MIN	526.59	531.06	535.86	536.19	547.35	560.28						530.51
1974	MIN	530.25	534.88	541.48	547.52	533.20	532.55						528.01
1975	MIN	527.77	533.73	533.12	533.19	533.21	546.22					570.62	530.08
1976	MIN	529.18	534.11	534.30	531.31	531.11	545.17			520.00	520.00	522.99	523.46
1977	MIN	528.46	528.67	528.62	530.21	531.02	534.21	542.20	556.34	520.00	520.00	520.00	522.04
1978	MIN	522.55	524.25	526.93	551.23	520.00							
1979	MIN	534.37	536.23	536.34	537.94	544.18	560.29					541.39	528.39
1980	MIN	529.96	536.15	532.60	540.08								540.99
1981	MIN	532.00	533.14	532.89	532.64	543.02	545.16				520.00	523.99	525.29
1982	MIN	526.12	539.15	534.89	550.18	520.00	520.00	537.55					557.84
1983	MIN	542.13						520.00	520.00				
1984	MIN	545.70	548.29									540.63	531.28
1985	MIN	531.44	538.58	541.57	541.09	541.41	551.03				584.59	526.56	526.45
1986	MIN	531.15	535.86	541.69	545.04	520.00							532.31
1987	MIN	533.97	533.68	532.88	533.45	535.35	539.06				520.00	520.00	524.91
1988	MIN	525.13	531.78	531.22	535.19	540.06	546.80			520.00	520.00	523.00	525.75
1989	MIN	524.96	525.41	532.55	534.88	536.92	546.19				520.00	521.17	522.20
1990	MIN	526.34	529.41	529.27	529.23	534.08	540.36			520.00	520.00	522.68	522.33
1991	MIN	524.01	524.22	526.69	529.47	520.00	520.00						530.13
1992	MIN	524.51	533.00	527.92	532.10	531.92	546.98			520.00	520.00	523.83	522.90
MEAN		529.32	534.91	539.95	547.65	548.78	559.21	594.79	629.36	625.60	593.89	560.66	538.29
MAX		545.70	592.29	617.82	636.27	631.27	640.89	640.07	681.13	692.79	689.30	649.64	617.20
MIN		522.55	524.22	526.69	529.23	520.00	520.00	520.00	520.00	520.00	520.00	520.00	522.04

ELEVATION PROJECT NED PLAN (with parameter, 0 AF Min Pool) 2050 CONDITIONS

WATER YEAR		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1966	MIN	563.92	563.96	566.39	565.84	569.59					562.00	562.00	562.00
1967	MIN	562.00	563.58				520.00	520.00					
1968	MIN	563.98	564.84	566.27							562.00	562.00	562.00
1969	MIN	562.00	564.70	565.93	565.52								
1970	MIN	564.50	565.23									563.32	563.39
1971	MIN	563.70	563.98	565.24	565.32	569.94						563.89	563.48
1972	MIN	563.67	564.24	565.91	565.02					562.00	562.00	562.00	562.00
1973	MIN	562.00	564.15	564.82	567.37	569.39							563.99
1974	MIN	563.86	564.78	566.15	567.47	567.17							563.74
1975	MIN	563.72	566.16			565.27	567.79						563.88
1976	MIN	563.82	567.89							562.00	562.00	562.00	562.00
1977	MIN	563.71	563.77							562.00	562.00	562.00	562.00
1978	MIN	562.00	562.00	563.77	567.41	520.00							
1979	MIN	564.53	565.42			566.68	569.87						563.75
1980	MIN	563.84	565.43										
1981	MIN	564.19	564.94			565.90	571.95				562.00	562.00	562.00
1982	MIN	563.34	566.18		567.39	562.00	562.00	573.53					
1983	MIN								520.00				
1984	MIN												564.03
1985	MIN	564.11	565.61	565.78	566.53	568.27						563.64	563.64
1986	MIN	564.02	564.95	565.61	567.74	557.50							565.32
1987	MIN	564.41	565.09			565.94	569.96				562.00	562.00	562.00
1988	MIN	562.00	563.89	568.65	565.60	565.56				562.00	562.00	562.00	562.00
1989	MIN	562.00	563.58	564.68	564.48	565.87					562.00	562.00	562.00
1990	MIN	562.00	564.59			565.28				562.00	562.00	562.00	562.00
1991	MIN	562.00	562.00	563.65	564.01	562.00	562.00						563.89
1992	MIN	563.51	564.84			565.86	568.95			562.00	562.00	562.00	562.00
MEAN		565.58	567.60	572.43	575.29	577.08	583.59	610.77	643.05	647.47	626.12	596.21	574.56
MAX		602.73	607.09	628.16	646.57	640.61	647.78	647.08	691.68	710.40	709.18	677.27	639.68
MIN		562.00	562.00	563.65	564.01	520.00	520.00	520.00	520.00	562.00	562.00	562.00	562.00

ELEVATION PROJECT LOCAL PLAN (with parameter, 0 AF Min Pool) 2050 CONDITIONS

WATER YEAR		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1966	MAX											546.85	557.91
1967	MAX	564.10											
1968	MAX		584.57									551.52	560.18
1969	MAX	567.18	584.19										
1970	MAX												564.99
1971	MAX	565.11											565.66
1972	MAX	565.60									523.62	540.56	560.57
1973	MAX	565.58											
1974	MAX	568.27											
1975	MAX	568.04											
1976	MAX										528.74	549.81	574.85
1977	MAX										520.00	541.66	546.06
1978	MAX	553.30	565.19										
1979	MAX												
1980	MAX												
1981	MAX											554.60	563.08
1982	MAX	568.15					566.17						
1983	MAX												
1984	MAX												
1985	MAX	569.69											567.75
1986	MAX	567.99											
1987	MAX											541.29	551.09
1988	MAX	563.36										545.14	557.39
1989	MAX	563.67										542.49	560.61
1990	MAX	566.86									520.00	543.24	550.97
1991	MAX	556.80	563.98	564.74		574.61							
1992	MAX	568.22									523.21	543.30	548.04
MEAN		579.30	583.33	592.35	603.75	608.49	622.81	651.75	679.22	686.97	651.89	620.35	595.43
MAX		641.97	624.05	705.72	692.65	682.46	660.32	689.55	714.95	714.95	714.95	714.95	675.23
MIN		553.30	563.98	564.74	576.65	574.61	566.17	592.51	608.55	589.77	520.00	540.56	546.06

LAKE KAWEAH ELEVATIONS IN FEET
2050 CONDITIONS

ELEVATION PROJECT LOCAL PLAN (with parameter, 0 AF Min Pool) 2050 CONDITIONS

WATER YEAR		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1966	AVG											540.66	553.78
1967	AVG	561.70	569.40				559.63	562.31					
1968	AVG										549.90	542.98	556.27
1969	AVG	564.40											
1970	AVG												564.76
1971	AVG	564.78											564.73
1972	AVG	565.16									520.16	533.97	553.40
1973	AVG	564.05											
1974	AVG												
1975	AVG												
1976	AVG										520.44	544.74	569.61
1977	AVG									543.86	520.00	529.58	544.42
1978	AVG	550.34	560.05										
1979	AVG												
1980	AVG												
1981	AVG											544.88	559.37
1982	AVG	565.47				553.70	550.46						
1983	AVG								556.28				
1984	AVG												
1985	AVG												566.88
1986	AVG	566.98											
1987	AVG										532.87	530.76	546.63
1988	AVG	558.01									524.93	535.12	552.74
1989	AVG	560.82	567.74								567.90	535.42	550.10
1990	AVG	564.18	569.94								520.00	537.74	546.43
1991	AVG	554.04	560.49	564.53		535.09							
1992	AVG										520.14	536.82	546.08
MEAN		604.78	593.57	588.39	593.23	597.73	610.52	634.96	662.76	669.29	630.12	609.90	607.98
MAX		664.05	648.49	660.08	652.45	656.45	654.36	659.77	705.31	713.72	714.48	714.82	704.93
MIN		550.34	560.05	564.53	573.10	535.09	550.46	562.31	556.28	543.86	520.00	529.58	544.42

Table B-5. Number of years, based on simulated operation data, that Lake Kaweah minimum monthly elevations would exceed 570' msl and 585' msl.

	Without Project		LPP		NED		Difference: LPP-Without		Difference: NED-Without	
	Exceeds 570'	Exceeds 585'	Exceeds 570'	Exceeds 585'	Exceeds 570'	Exceeds 585'	Exceeds 570'	Exceeds 585'	Exceeds 570'	Exceeds 585'
October	0	0	1	2	0	2	1	2	0	6
November	0	1	2	2	0	2	2	1	0	8
December	0	2	21	4	12	2	21	2	12	15
January	0	3	18	7	11	3	18	4	11	18
February	0	4	13	10	5	4	13	6	5	20
March	0	5	2	22	13	6	2	17	13	21
April	1	21	1	25	1	24	0	4	0	6
May	0	23	0	25	2	24	0	2	2	4
June	0	21	1	21	0	21	1	0	0	6
July	0	14	0	16	1	15	0	2	1	7
August	1	9	0	13	0	13	-1	4	-1	7
September	1	3	0	6	0	6	-1	3	-1	10
Totals	3	106	59	153	45	122	56	47	42	128

FLOW TO TULARE LAKEBED PROJECT (without parameter, 0 AF Min. Pool) 2100 CONDITIONS (acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	110000	0	6000	12000	9000	12000	2000	0	0	0	151000
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	55000	116000	96000	74000	62000	40000	0	0	0	463000
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	5000	16000	6000	7000	6000	0	0	0	40000
1979	0	0	0	0	0	0	0	5000	0	0	0	0	5000
1980	0	0	0	44000	68000	37000	0	0	0	0	0	0	149000
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	2000	3000	5000	0	0	0	15000
1983	0	0	30000	48000	77000	122000	73000	58000	36000	0	0	0	442000
1984	0	0	12000	0	0	0	0	0	0	0	0	0	12000
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	45000	91500	8500	0	0	0	0	0	145000
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
# Fld Mos/Yrs	0	0	3	3	6	6	6	6	5	0	0	0	35/9
Mean All Yrs	0	0	5830	6370	11741	13870	6389	6370	3296	0	0	0	52567
Mean Fld Yrs	ERR	ERR	50667	48333	52833	62417	28750	28667	17800	ERR	ERR	ERR	158000
Min Fld	0	0	12000	44000	5000	12000	2000	5000	2000	0	0	0	5000
Max Fld	0	0	110000	55000	116000	122000	74000	62000	40000	0	0	0	463000

FLOW TO TULARE LAKEBED EXISTING (without parameter, 0 AF Min. Pool) 2100 CONDITIONS (acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	119000	0	11000	14200	22200	31200	11200	0	0	0	208800
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	51000	120000	102200	75200	96200	50200	0	0	0	504800
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	3000	9800	0	0	0	12800
1974	0	0	0	0	0	0	0	3400	4400	0	0	0	7800
1975	0	0	0	0	0	0	0	0	5800	0	0	0	5800
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	11000	26200	16200	16200	10200	0	0	0	79800
1979	0	0	0	0	0	0	0	11800	0	0	0	0	11800
1980	0	0	0	54000	67000	38600	0	2200	0	0	0	0	161800
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	5000	10600	24600	6800	0	0	0	0	46800
1983	0	0	30000	42000	80000	118200	78200	61200	62200	15000	0	0	486800
1984	0	0	0	8000	1000	0	0	0	5800	0	0	0	14800
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	54000	91200	8200	2200	6200	0	0	0	161800
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
# Fld Mos/Yrs	0	0	2	4	8	7	6	10	9	1	0	0	47/12
Mean All Yrs	0	0	5519	6111	12926	14859	8319	8667	6141	556	0	0	63098
Mean Fld Yrs	ERR	ERR	74500	41250	43,325	57314	37433	23400	18422	15000	ERR	ERR	141967
Min Fld	0	0	30000	8000	1000	10600	8200	2200	4400	15000	0	0	5800
Max Fld	0	0	119000	51000	120000	118200	78200	96200	62200	15000	0	0	504800

FLOW TO TULARE LAKEBED PROJECT (with parameter, 0 AF Min Pool) 2050 CONDITIONS (acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	114000	0	6000	12000	6000	11000	1000	0	0	0	152000
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	58000	117000	95000	73000	61000	40000	0	0	0	462000
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	5000	15000	5000	6000	6000	0	0	0	37000
1979	0	0	0	0	0	0	0	2000	0	0	0	0	2000
1980	0	0	0	50000	68000	34000	0	0	0	0	0	0	152000
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	1000	7000	4000	0	0	0	12000
1983	0	0	30000	46000	77000	121000	72000	57000	35000	0	0	0	438000
1984	0	0	15000	0	0	0	0	0	0	0	0	0	15000
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	45000	90000	7000	0	0	0	0	0	142000
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
# Fld Mos/Yrs	0	0	3	3	6	6	6	6	6	0	0	0	35/6
Mean All Yrs	0	0	5889	5630	11778	13593	6148	6074	3145	0	0	0	52256
Mean Fld Yrs	ERR	ERR	63000	50667	53000	61167	27667	27333	17200	ERR	ERR	ERR	156889
Min Fld	0	0	15000	46000	5000	12000	1000	2000	1000	0	0	0	2000
Max Fld	0	0	114000	58000	117000	121000	73000	61000	40000	0	0	0	462000

FLOW TO TULARE LAKEBED EXISTING (without parameter, 0 AF Min. Pool) 2050 CONDITIONS (acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	119000	0	11000	13000	21000	30000	10000	0	0	0	204000
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	61000	120000	101000	74000	95000	49000	0	0	0	500000
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	1000	7000	0	0	0	8000
1974	0	0	0	0	0	0	0	1000	2000	0	0	0	3000
1975	0	0	0	0	0	0	0	0	1000	0	0	0	1000
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	11000	25000	15000	15000	9000	0	0	0	75000
1979	0	0	0	0	0	0	0	7000	0	0	0	0	7000
1980	0	0	0	54000	67000	35000	0	1000	0	0	0	0	157000
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	8000	9000	23000	5000	0	0	0	0	42000
1983	0	0	30000	42000	80000	117000	77000	60000	61000	15000	0	0	482000
1984	0	0	0	8000	1000	0	0	0	1000	0	0	0	10000
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	54000	90000	7000	1000	5000	0	0	0	157000
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
# Fld Mos/Yrs	0	0	2	4	8	7	6	10	9	1	0	0	47/12
Mean All Yrs	0	0	8519	6111	12926	14444	8057	8000	5370	556	0	0	60983
Mean Fld Yrs	ERR	ERR	74500	41250	43625	58714	38167	21600	16111	15000	ERR	ERR	137167
Min Fld	0	0	30000	8000	1000	9000	7000	1000	1000	15000	0	0	1000
Max Fld	0	0	119000	61000	120000	117000	77000	95000	61000	15000	0	0	500000

FLOW TO TULARE LAKEBED PROJECT (with parameter, 0 AF Min. Pool) 2000 CONDITIONS (acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	114000	0	6000	12000	7000	10000	0	0	0	0	149000
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	56000	117000	95000	72000	60000	39000	0	0	0	459000
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	0	0	0	0	0
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	5000	15000	4000	5000	5000	0	0	0	34000
1979	0	0	0	0	0	0	0	0	0	0	0	0	0
1980	0	0	0	50000	68000	31000	0	0	0	0	0	0	149000
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	6000	3000	0	0	0	9000
1983	0	0	30000	46000	77000	121000	71000	56000	34000	0	0	0	435000
1984	0	0	15000	0	0	0	0	0	0	0	0	0	15000
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	46000	88500	5500	0	0	0	0	0	139000
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
# Fld Mos/Yrs	0	0	3	3	6	6	5	5	4	0	0	0	32/6
Mean All Yrs	0	0	5889	8830	11778	13426	5907	5815	3000	0	0	0	51444
Mean Fld Yrs	ERR	ERR	53000	50667	63000	60417	31900	31400	20250	ERR	ERR	ERR	173625
Min Fld	0	0	15000	46000	5000	12000	4000	5000	3000	0	0	0	9000
Max Fld	0	0	114000	56000	117000	121000	72000	60000	39000	0	0	0	459000

FLOW TO TULARE LAKEBED EXISTING (with parameter, 0 AF Min. Pool) 2000 CONDITIONS (acre-feet)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1966	0	0	0	0	0	0	0	0	0	0	0	0	0
1967	0	0	124000	0	11000	11800	19800	28800	8800	0	0	0	204200
1968	0	0	0	0	0	0	0	0	0	0	0	0	0
1969	0	0	0	62000	120000	99800	72800	93800	47800	0	0	0	496200
1970	0	0	0	0	0	0	0	0	0	0	0	0	0
1971	0	0	0	0	0	0	0	0	0	0	0	0	0
1972	0	0	0	0	0	0	0	0	0	0	0	0	0
1973	0	0	0	0	0	0	0	0	3200	0	0	0	3200
1974	0	0	0	0	0	0	0	0	0	0	0	0	0
1975	0	0	0	0	0	0	0	0	0	0	0	0	0
1976	0	0	0	0	0	0	0	0	0	0	0	0	0
1977	0	0	0	0	0	0	0	0	0	0	0	0	0
1978	0	0	0	0	11000	23800	13800	13800	7800	0	0	0	70200
1979	0	0	0	0	0	0	0	2200	0	0	0	0	2200
1980	0	0	0	60000	67000	31200	0	0	0	0	0	0	158200
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	3800	7800	21800	3800	0	0	0	37200
1983	0	0	28000	42000	80000	115800	75800	58800	59800	15000	0	0	476200
1984	0	0	12000	1000	0	0	0	0	0	0	0	0	13000
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	55000	88800	5800	0	3800	0	0	0	153200
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
# Fld Mos/Yrs	0	0	3	4	6	7	6	6	7	1	0	0	40/10
Mean All Yrs	0	0	6111	6111	12741	13889	7252	8119	4889	666	0	0	59770
Mean Fld Yrs	ERR	ERR	55000	41250	57333	53571	32583	36833	19257	15000	ERR	ERR	161380
Min Fld	0	0	12000	1000	11000	3800	5800	2200	3200	15000	0	0	3200
Max Fld	0	0	124000	62000	120000	115800	75800	93800	59800	15000	0	0	496200

DETERMINATION OF AREAS AFFECTED IN THE TULARE BASIN DUE TO OPERATION OF THE PROPOSED KAWEAH RIVER BASIN INVESTIGATION PROJECT

The extent of flooding in the Tulare Lakebed and in the Wilbur and Hacienda areas was first evaluated by determining how flooding frequency, duration, and timing would be altered by the project. Based on discussions with Corps staff, and evaluation of the Corps' hydrological simulations of reservoir operations and Tulare Lakebed flooding, we determined that most flood reductions would occur in the spring/summer months. This would result in significant impacts to summer resident waterfowl, shorebirds, and other waterbirds which utilize both the Tulare Lakebed agricultural lands and other wetted areas, such as the Wilbur and Hacienda areas for feeding. The Wilbur/Hacienda areas are also used as waterbird nesting sites in some years.

For this analysis, the Service only had estimates of project-induced changes in flooding for four different historical water years, which ranged from a 5.1-year flood event to a 10.5 year event (see Attachment 1 on the following pages). Primary project impacts were determined to result from reductions in frequency, acreage, and duration of the relatively frequent, smaller flood events occurring in the Lakebed. Larger flood events would also be reduced, but we determined that the effects of these more infrequent events would largely be compensated by providing perennial mitigation for the smaller events.

For the Wilbur and Hacienda areas, we determined that flood events with greater than 10 percent exceedance frequencies would provide the most accurate prediction of the project's effects, and that these "typical" flood years

should be used in our evaluation. Thus, these analyses are based on the assumption that project impacts can be fully expressed by evaluating the impacts of the more frequently-occurring flood events.

The Table included on the following page (Attachment 1) provides the numerical basis for our estimates. (The flood year 1984 was not used because, for that year, the Corps simulations show that *increased* flooding would occur with project implementation.) We calculated separate "annual acres affected" figures for the both Tulare Lakebed agricultural lands and the Wilbur/Hacienda (i.e., South) areas. Attachment one shows that, the largest flooding acreage differences, hence largest impacts, occur during low level flood years like 1978 and 1982. We used the average of these 2 years (6890 acres flooded for 45 days) to assess the impacts of reduced flooding to the Wilbur and Hacienda areas. This number was divided by the frequency of occurrence of these floods (about a 6-year event) to determine an approximation of the losses from these high-frequency flood events. We thus derived an average annual acreage and duration (1139 acres for 45 days) for such impacts.

Similar calculations were done for the agricultural areas within the Lakebed, but all four flood years on Attachment 1 were used in the analysis. We obtained an average annual flood reduction area of 273 acres and duration of 16 days for the Lakebed agricultural lands. These numbers were then used in our impacts assessment (i.e., HEP) analyses.

Flooded Area and Flood Durations at Tulare Lakebed

Based on 75/25 Flow Split (South Area/Main Lakebed) to Represent Past Flood Conditions

	WITHOUT-PROJECT CONDITION[1]								WITH-PROJECT CONDITION[2]								Difference With & Without-Project				
																	Δ Area Flooded (1000's acres)			Δ Duration (days)	
Year[3]	Actual[4] Storage (1000's acre-ft)	Storage South Area (1000's acre-ft)	Storage Main Lakebed (1000's acre-ft)	Area[5] Flooded (1000's acres)	Area Flooded South Area (1000's acres)	Area Flooded Main Lakebed (1000's acres)	Flood[6] Duration South Area (days)	Flood[6] Duration Main Lakebed (days)	Actual Storage (1000's acre-ft)	Storage South Area (1000's acre-ft)	Storage Main Lakebed (1000's acre-ft)	Area[5] Flooded (1000's acres)	Area Flooded South Area (1000's acres)	Area Flooded Main Lakebed (1000's acres)	Flood[6] Duration South Area (days)	Flood[6] Duration Main Lakebed (days)	Total	South Area	Main Lakebed	South Area	Main Lakebed
1978	141.0	99.8	41.2	21.95	20.93	8.02	115.0	33.6	69.5	52.1	17.4	20.4	13.45	6.95	56.7	14.2	-8.55	-7.48	-1.07	-58	-19.4
1980	301.0	99.8	201.2	49.78	20.93	28.85	245.5	164.1	289.6	99.8	189.8	48.03	20.93	27.1	236.2	154.8	-1.75	0	-1.75	-9.3	-9.3
1982	78.3	58.7	19.6	21.50	14.33	7.17	42.0	16.0	22.0	16.5	5.5	13.61	8.00	5.61	9.7	2.4	-7.89	-6.3	-1.59	-32.3	-13.6
1984	18.5	13.9	4.6	12.24	7.35	4.89	8.1	2.0	27.3	20.5	6.8	14.95	8.71	6.24	12.1	3.0	+2.71	+1.36	+1.35	+4.0	+1.0
1986	301.0	99.8	201.2	49.78	20.93	28.85	245.5	164.1	274.6	99.8	174.8	44.37	20.93	23.44	224.0	142.6	-5.41	0	-5.41	-21.5	-21.5

1/ Without precipitation parameter, year 2050, simulation of Terminus Dam operations from 1966-1992.
2/ With precipitation parameter, year 2050, simulation of Terminus Dam operations from 1966-1992.
3/ Flood years selected by USFWS at 21 Dec 93 meeting.
4/ Computed by adding Kaweah inflow to "other sources inflow" (from nomograph correlating Kaweah River flows with Other Sources). A 12% loss rate was applied.
5/ Flooded area based on 75/25 flow split (South Area/Cropped Area) and represents past flood condition at lakebed. Area-capacity curve was modified to reflect 75/25 flow split.
6/ Durations computed by dividing volumes by average dewatering rates. For volumes > 42,000 acre-ft, a dewatering rate of 1,236 acre-ft/day is used. For volumes ≤ 42,000 acre-ft, a dewatering rate of 2,241 acre-ft/day is used. Durations for initially transferring flood water from the main lakebed to the south area to obtain a 75/25 flow split (south area/main lakebed) have not been considered.
Flood durations in the south area are a summation of the dewatering period for the main lakebed and the dewatering period for the south area. Dewatering is assumed to occur sequentially—the main lakebed is dewatered first and the south area is dewatered last. As the main lakebed is dewatered, the south area is continually filled to maximum capacity.
7/ Durations for main lakebed are computed by dividing the volume in main lakebed by a dewatering rate as defined in previous footnote. Main lakebed is assumed to be dewatered first. Durations for initially transferring flood water from the main lakebed to the south area to obtain a 75/25 flow split (south area/main lakebed) have not been considered.

Attachment 1

Appendix C

Endangered Species Information

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 verified with the Service. No irreversible commitment of resources is to be made during the BA process which would foreclose reasonable and prudent alternatives to protect endangered species. Planning, design, and administrative actions may proceed; however, no construction may begin.

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

---

[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 A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OR MAY BE AFFECTED BY PROJECTS IN THE AREA OF THE KAWEAH RIVER BASIN INVESTIGATION KINGS, TULARE, AND FRESNO COUNTIES, CALIFORNIA (1-1-95-SP-0360, January 30, 1995)

Listed Species

Fish
delta smelt, *Hypomesus transpacificus* (T)

Reptiles
blunt-nosed leopard lizard, *Gambelia silus* (E)
giant garter snake, *Thamnophis gigas* (T)

Birds
bald eagle, *Haliaeetus leucocephalus* (E)

Mammals
San Joaquin kit fox, *Vulpes macrotis mutica* (E)
Tipton kangaroo rat, *Dipodomys nitratoides nitratoides* (E)

Invertebrates
valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)
vernal pool fairy shrimp, *Branchinecta lynchi* (T)

Plants
California jewelflower, *Caulanthus californicus* (E)

Proposed Species

Fish
Sacramento splittail, *Pogonichthys macrolepidotus* (PT)

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

Plants
Hoover's spurge, *Chamaesyce hooveri* (PT)
Springville clarkia, *Clarkia springvillensis* (PT)
San Joaquin Valley Orcutt grass, *Orcuttia inaequalis* (PE)
San Joaquin adobe sunburst, *Pseudobahia peirsonii* (PE)
Greene's tuctoria, *Tuctoria greenei* (PE)

Candidate Species

Fish
longfin smelt, *Spirinchus thaleichthys* (2)
Kern brook lamprey, *Lampetra hubbsi* (2)

Amphibians
California tiger salamander, *Ambystoma californiense* (1)
western spadefoot toad, *Scaphiopus hammondi* (2)
foothill yellow-legged frog, *Rana boylii* (2)
Mount Lyell salamander, *Hydromantes platycephalus* (2)
southwestern pond turtle, *Clemmys marmorata pallida* (2)

Birds
tricolored blackbird, *Agelaius tricolor* (2)
white-faced ibis, *Plegadis chihi* (2)
mountain plover, *Charadrius montanus* (2)
western snowy plover, interior population, *Charadrius alexandrinus nivosus* (2[redacted])

Mammals
Pacific western big-eared bat, *Plecotus townsendii townsendii* (2)
greater western mastiff-bat, *Eumops perotis californicus* (2)
Nelson's antelope ground squirrel, *Ammospermophilus nelsoni* (1)
spotted bat, *Euderma maculatum* (2)
short-nosed kangaroo rat, *Dipodomys nitratoides brevinasus* (1)

Invertebrates
Ciervo aegialian scarab beetle, *Aegialia concinna* (1)
San Joaquin tiger beetle, *Cicindella tranquebarica* (2)
Doyen's trigonoscuta dune weevil, *Trigonoscuts sp.* (2)

Plants
Ramshaw sand-verbena, *Abronia alpina* (1)
Bodie Hills rock-cress, Arabis bodiensis (2)
heartscale, *Atriplex cordulata* (2)
brittlescale, *Atriplex depressa* (2R)
lesser saltscale, *Atriplex minuscula* (2R)
Lost Hills saltbush, *Atriplex vallicola* (2)
Kaweah brodiaea, *Brodiaea insignis* (2)
Shirley Meadows mariposa, *Calochortus westonii* (1)
slough thistle, *Cirsium crassicaule* (2)
recurved larkspur, *Delphinium recurvatum* (2)
Pierpoint Springs liveforever, *Dudleya cymosa ssp. costafolia* (1)
Kern River daisy, *Erigeron multiceps* (2)
mouse buckwheat, *Eriogonum nudum var. murinum* (2)
spiny-sepaled coyote-thistle, *Eryngium spinosepalum* (2)
Hockett Meadows lupine, *Lupinus culbertsonii ssp. culbertsonii* (2)
DeDecker's lupine, *Lupinus padre-crowleyi* (2)
Sequoia gooseberry, *Ribes tularense* (2)

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

State of California | The Resources Agency

Memorandum

To: Mike Fris
U.S. Fish and Wildlife Service

Date: March 11, 1994

From: Department of Fish and Game
Gail Presley, R-4

Subject: Sensitive Species List for Kaweah Reservoir Project

Attached is an edited list of sensitive species produced by the Wildlife Habitat Relationships System (WHR). I deleted the species that are very unlikely to occur in the area, and retained the species know to occur or with a potential to occur. The list includes 32 species that are recognized by WHR as sensitive, which includes both listed and "watch list" species.

The California Natural Diversity Data Base program Rarefind indicates that the following sensitive plant species have been documented for the Kaweah USGS quad sheet:

Species	Listed Status
Kaweah brodiaea (*Brodiaea insignis*)	State endangered
mouse buckwheat (*Eriogonum nudum var. murinum*)	Federal candidate 2
spiny-sepaled button celery (*Eryngium spinosepalum*)	Federal candidate 2
Kaweah monkeyflower (*Mimulus norrisii*)	Federal candidate 2

Please consider this supplemental information to any other lists you may have received from the Department. Please keep me updated on the status of this project.

encl.
cc: DFG, Fresno

RECEIVED
MAR 16 1994
ECOLOGICAL SERVICES
SACRAMENTO FIELD OFFICE

CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS SYSTEM
Supported by the
CALIFORNIA INTERAGENCY WILDLIFE TASK GROUP
and maintained by the
CALIFORNIA DEPARMENT OF FISH AND GAME
Database Version: 5.0

NOTICE

The lists of animals generated by the California Wildlife Habitat Relationships (WHR) Database provide predictions for all of the regularly occurring species of terrestrial vertebrates potentially found in the habitat(s), geographic location(s) and season(s) specified. In most cases, the number of species predicted by the database exceeds the number detected in field studies. However, the probability of detecting all predicted species increases when larger land areas and longer time periods are considered. Differences between predicted and observed lists is due, in part, to the underlying assumptions of the WHR system (see Airola 1988). The assumptions most influencing the species list are: (1) habitats are available in the proper mix for species requiring a juxtaposition of two or more habitats; (2) all special habitat elements are present in adequate amounts for species requiring the elements; and (3) adequate amounts of habitat are available.

Therefore, the user should compare the species lists produced by the compter database with the species accounts in the appropriate volume of California's Wildlife (Zeiner et al. 1988, Zeiner et al. 1990). The accounts allow WHR users to refine the predicted species list by eliminating species unlikely to occur in the study area because, for example, a special habitat element is absent, or the area is outside the species' known geographic range.

Finally, it must be acknowledged that wildlife populations are inherently dynamic in space and time, and competition, barriers, and historic overharvesting also influence wildlife populations. Therefore, differences between predicted and observed species lists will occur. The predicted species lists are intended to be used by qualified Wildlife Biologists in conjunction with the supporting WHR publications (Airola 1988, Mayer and Laudenslayer 1988, Zeiner et al. 1988, Zeiner et al. 1990). At a minimum, field observations of the study area are needed to identify WHR habitat types and stages and special habitat elements.

CALIFORNIA WILDLIFE HABITAT RELATIONSHIPS SYSTEM
Supported by the
CALIFORNIA INTERAGENCY WILDLIFE TASK GROUP
and maintained by the
CALIFORNIA DEPARMENT OF FISH AND GAME
Database Version: 5.0

SENSITIVE SPECIES SUMMARY LIST

SELECTION CRITERIA:

Locations: TULARE COUNTY

Habitats:

1	BLUE OAK WOODLAND	MED/LARGE TREE	SPARSE	10-24%	(5S)
2	BLUE OAK WOODLAND	MED/LARGE TREE	OPEN	25-39%	(5P)
3	BLUE OAK WOODLAND	MED/LARGE TREE	MODRTE	40-59%	(5M)
4	VALLEY-FOOTHILL RIPARIAN	SMALL TREE	MODRTE	40-59%	(4M)
5	VALLEY-FOOTHILL RIPARIAN	MED/LARGE TREE	OPEN	25-39%	(5P)
6	VALLEY-FOOTHILL RIPARIAN	MED/LARGE TREE	MODRTE	40-59%	(5M)
7	VALLEY-FOOTHILL RIPARIAN	MED/LARGE TREE	DENSE	60-100%	(5D)
8	ANNUAL GRASS	TALL HERB	MODRTE	40-59%	(2M)
9	ANNUAL GRASS	TALL HERB	DENSE	60-100%	(2D)
10	RIVERINE	OPEN WATER			(1)
11	RIVERINE	SHORE	ORGANIC		(4O)
12	RIVERINE	SHORE	MUD		(4M)
13	RIVERINE	SHORE	SAND		(4S)
14	RIVERINE	SHORE	GRAVEL/COBBLE		(4G)
15	RIVERINE	SHORE	RUBBLE/BOULDERS		(4R)

Special Status:

1. FE: Federally Endangered
2. FT: Federally Threatened
3. CE: California Endangered
4. CT: California Threatened
5. CP: California Protected
6. CS: California Special Concern
7. FS: Forest Service Sensitive
8. BS: BLM Sensitive
9. H : Harvest
   P : Candidate or Proposed Candidate Species

ID	SPECIES NAME	SCIENTIFIC NAME	FAMILY	STATUS 123456789 FFCCCCFBHP ETETPSSS
A028	WESTERN SPADEFOOT	Scaphiopus hammondi	PELOBATIDAE	6
A043	FTHL YELLOW-LEGGED FROG	Rana boylei	RANIDAE	6
B044	DOUBLE-CRESTED CORMORANT	Phalacrocorax auritus	PHALACROCORACIDAE	6
B109	CALIFORNIA CONDOR	Gymnogyps californianus	CATHARTIDAE	1 3 5
B110	OSPREY	Pandion haliaetus	ACCIPITRIDAE	67
B111	BLACK-SHOULDERED KITE	Elanus caeruleus	ACCIPITRIDAE	5
B113	BALD EAGLE	Haliaeetus leucocephalus	ACCIPITRIDAE	1 3 5
B114	NORTHERN HARRIER	Circus cyaneus	ACCIPITRIDAE	6
B115	SHARP-SHINNED HAWK	Accipiter striatus	ACCIPITRIDAE	6
B116	COOPER'S HAWK	Accipiter cooperii	ACCIPITRIDAE	6
B117	NORTHERN GOSHAWK	Accipiter gentilis	ACCIPITRIDAE	678
B124	FERRUGINOUS HAWK	Buteo regalis	ACCIPITRIDAE	6
B126	GOLDEN EAGLE	Aquila chrysaetos	ACCIPITRIDAE	567
B128	MERLIN	Falco columbarius	FALCONIDAE	6
B129	PEREGRINE FALCON	Falco peregrinus	FALCONIDAE	1 3 5
B269	BURROWING OWL	Athene cunicularia	STRIGIDAE	6
B272	LONG-EARED OWL	Asio otus	STRIGIDAE	6
B273	SHORT-EARED OWL	Asio flammeus	STRIGIDAE	6
B279	BLACK SWIFT	Cypseloides niger	APODIDAE	6
B315	WILLOW FLYCATCHER	Empidowax traillii	TYRANNIDAE	6
B338	PURPLE MARTIN	Progne subis	HIRUNDINIDAE	6
B430	YELLOW WARBLER	Dendroica petechia	EMBERIZIDAE	6
M036	SPOTTED BAT	Euderma maculatum	VESPERTILIONIDAE	6
M037	TOWNSEND'S BIG-EARED BAT	Plecotus townsendii	VESPERTILIONIDAE	6
M038	PALLID BAT	Antrozous pallidus	VESPERTILIONIDAE	6
M042	WESTERN MASTIFF BAT	Eumops perotis	MOLOSSIDAE	6
M045	BRUSH RABBIT	Sylvilagus bachmani	LEPORIDAE	6 9
M087	SAN JOAQUIN POCKET MOUSE	Perognathus inornatus	HETEROMYIDAE	6
M127	DUSKY-FOOTED WOODRAT	Neotoma fuscipes	CRICETIDAE	6
M152	RINGTAIL	Bassariscus astutus	PROCYONIDAE	5
M160	BADGER	Taxidea taxus	MUSTELIDAE	6 9
R004	WESTERN POND TURTLE	Clemmys marmorata	EMYDIDAE	6
			TOTAL SPECIES:	32

Appendix D

Vegetation Monitoring Plan

DRAFT GUADALUPE RIVER RIPARIAN VEGETATION MONITORING PLAN AND CRITERIA FOR SUCCESS
TABLE OF CONTENTS

PAGE

1.0 Introduction 560

2.0 Goals 560

3.0 Success Criteria, Trend Characteristics and Schedules
- 3.1 Year 5 Success Criteria/Schedules 560
- 3.2 Long Term Success Criteria. 561

Sampling Methodology
- 4.1 Introduction 562
- 4.2 Survivorship of Plantings 563
- 4.3 Species Composition 564
- 4.4 Plant Vigor and Health 564
- 4.5 Plant Height 564
- 4.6 Tree Basal Area 564
- 4.7 Natural Reproduction/Recruitment 564
- 4.8 Species Diversity 564
- 4.9 Root Development 565
- 4.10 Percent Cover. 565
- 4.11 Photodocumentation 565

5.0 Data Analysis
- 5.1 Introduction 566
- 5.2 Survivorship of Plantings. 566
- 5.3 Species Composition. 566
- 5.4 Plant Vigor and Health 566
- 5.5 Plant Height 567
- 5.6 Tree Basal Area. 567
- 5.7 Natural Reproduction/Recruitment 567
- 5.8 Species Diversity. 567
- 5.9 Root Development 567
- 5.10 Percent Cover. 567
- 5.11 Photodocumentation 568

6.0 Reporting 568

7.0 Contingencies and Remedial Actions
- 7.1 Monitoring Procedures Adjustments 569
- 7.2 Separate Monitoring of Replantings 569
- 7.3 Vegetation Monitoring-Maintenance Linkage. 569
- 7.4 Project Failure Contingency Plan 569

8.0 References 570

1.0 INTRODUCTION

This mitigation and related monitoring plan is to be implemented as compensation for impacts to riparian vegetation to be caused by the construction of the Guadalupe River Project. This plan is based on a monitoring plan for Los Gatos Creek (Harvey and Associates 1991) and has been adapted to suit the Guadalupe River site. This plan also updates the conceptual mitigation plan contained in the Environmental Analysis of the Final General Design Memorandum, dated December 1991, for the Guadalupe River Project.

It is currently planned that the 20.05-acre mitigation site, located downstream of Coleman Avenue, will undergo construction starting in the fall of 1992. Monitoring of the site's performance will begin immediately following planting. The Corps of Engineers and local sponsors will be responsible for monitoring the site's plantings for 3 years to ensure that the contractor properly implements the final design, and that maintenance and replanting occurs as described in the design specifications. Monitoring after the Corps' 3-year establishment period will be the sole responsibility of the local sponsor.

2.0 GOALS

The Guadalupe River riparian mitigation project is designed to create 20.05 acres of native riparian habitat on a site located on the river between Interstate Highway 880 and Coleman Avenue, and 2.4 acres of riparian vegetation along currently unspecified locations within the project reaches. In addition, more riparian trees are to be planted along riverbanks to provide streamside vegetation and shading for fisheries mitigation. Once established, this vegetation would provide a functional habitat for a variety of wildlife species commonly found in riparian areas of the Santa Clara Valley. The project will require extensive reworking of the site's topography and the installation and establishment of large numbers of native riparian trees, shrubs and ground covers.

The goal of this project is to create habitat values at the restored site which will be equal to or greater than those for the various sites impacted by the project construction.

This plan is designed to assess the mitigation site's habitat development from the time of construction until the project has met or exceeded all the success criteria, or until, by mutual agreement of the Corps and the resource agencies, the site is ensured of fully meeting the success criteria, with little or no eminent chance of failure. The numeric and qualitative success criteria include: survival, species composition, percent cover, plant vigor and health, root development, plant height, natural reproduction/recruitment, species diversity and tree basal area. The success criteria constitute the means by which the mitigation site's performance will be evaluated.

3.0 SUCCESS CRITERIA AND SCHEDULES

3.1 YEAR 5 SUCCESS CRITERIA/SCHEDULES

There are two types of success criteria which will be applied to survival of the plantings. The first is overall survival, which includes replants installed where original plants died. The second is cumulative survival which is calculated based only on the original plants installed. The success criteria are as follows:

	Overall Survival	Cumulative Survival
Survival of floodplain and streamside plant association (includes trees and shrubs)	85%	70%

If at any point in time during the first 5 years cumulative survival of any species falls below the cumulative success criteria, then replanting must take place and the monitoring period shall restart for that plant species. Monitoring of both criteria will continue until they are met for 5 consecutive years.

Species composition will also be monitored. At the end of year 5, composition for each species shall not vary by more than 25 percent from the original planting composition. (For example, if the site's original plans include 20 percent red willows, then the final composition of red willows should be 20 ± 1/4(20), or between 15 and 25 percent.) This success criteria will therefore take into account natural reproduction/recolonization of shrubs and trees on the site.

Once the above listed success criteria are met, survival and species composition will be eliminated as success criteria and percent vegetative cover will become the primary success criterion. There are several reasons to support this change. The first is that as natural recruitment and replanting occurs it will gradually become logistically impracticable to track the survival of individual plants in an accurate fashion, as the recruits and replants get mixed in with the original plants. The second reason is that as the site develops, there will be natural competition between individual plants, with some prospering, others stunting, and some dying. Such adjustments occur in naturally functioning plant communities and therefore should be tolerated at the mitigation site as long as overall habitat values are steadily increasing.

The following site characteristics will also be monitored, commencing immediately after planting:

- Percent cover (through the end of monitoring)
- Tree basal area (through the end of monitoring)
- Species diversity (through the end of monitoring)
- Plant height (through the end of monitoring)
- Plant vigor and health (through year 10)
- Root development vis-a-vis the water table (through year 6 or until root development is adequate)
- Natural reproduction/recruitment (through year 10)

Due to the difficulty of establishing specific goals for some of these site characteristics, the progressive or regressive trend of each parameter will be quantitatively monitored over time. The overall results for all parameters combined can then be reviewed and discussed in a qualitative manner in the annual monitoring reports as an indicator of the overall performance of the site. The success of the mitigation will be evaluated both on its own merits and in comparison to a reference site.

3.2 LONG-TERM SUCCESS CRITERIA

Prior to the onset of construction activities, a site will be selected for use as a reference site for the species diversity and tree basal area success criteria. The site will be approved by the Corps, local sponsor and resource agencies involved. The site shall be in close proximity to the replanted

areas, and shall possess those characteristics generally desired for the replanted sites.

After the fifth year, percent cover by trees and shrubs will be monitored as the prime indicator of increasing habitat values. Percent vegetative cover should show a steady trend after year 5 towards reaching the ultimate goals of 75% cover for trees and 45% cover for shrubs.

Mean basal area per acre at the mitigation site should show a steady trend toward reaching an ultimate goal which is equal to that of the reference site area. It should be noted that much of the vegetation which will be impacted on the Guadalupe River is mature riparian trees 75-100 or more years old. As such, the basal area of the mitigation site is not expected to be close to that of the impact site until 50 or more years of growth.

Height of the tree species installed should also show a steady increase toward the ultimate goals for each of the species. The tree height success criterion should be derived from the reference site. If not all tree species are available at the reference site, the following mean tree heights will serve as the long-term success criteria (Little 1980; Faber and Holland 1988):

White Alder	70'
Oregon Ash	70'
Fremont Cottonwood	80'
Black Cottonwood	110'
Red Willow	40'
Yellowtree Willow	40'
Arroyo Willow	25'
Box Elder	45'

The Shannon-Weaver species diversity index (see Begon et al. 1990) should be used to determine the species diversity of the plants at the reference site. The species diversity index value derived from the reference site will be used for comparison with the progress of species diversity at the mitigation site. Species diversity will therefore be a qualitative long-term success criterion.

4.0 SAMPLING METHODOLOGY

4.1 INTRODUCTION

4.1.1 Time Zero Landscape Plans

Within 6 weeks following the completion of plant installation on the mitigation site, the monitoring biologist will prepare marked up "time zero" landscaping plans showing any field adjustments to the position of plants shown in the final landscaping plans. The time zero landscape plans will include as-built grading plans.

4.1.2 Sampling Site Selection

Sampling sites will be determined by randomly choosing, according to methods described below, 50-by-50 foot permanent plots along transects run across the width of the site. Transects will run parallel to one another and be oriented towards the stream bed. This orientation will ensure that the transects will cover different elevations, aspects, and hydrologic regimes, thus allowing for a more representative characterization of the entire site.

Permanent plots will be established according to the following protocol:

A baseline transect will be established adjacent to and approximately parallel to the walking path on the boundary of the revegetation area.

Approximately 50 transects will emanate from this line at 100-foot intervals. Each transect will be unobtrusively but permanently marked with metal stakes and clearly mapped. Even if vegetation eventually covers the stake it could be located using a metal detector.

Plot locations will be determined by dividing the transects into 50 foot sections, and then using a random numbers table to locate 18 sections at random. Each selected 50-foot section will become the permanent side of one 50-by-50 foot plot which will be marked with metal stakes and clearly mapped. Thus, 18 permanent plots, or approximately 5 percent of the total area will be established for sampling.

The general slope inclination, aspect, and distance to stream channel of each plot will also be estimated during the initial characterization of the sample plots. Slope inclination could be broadly categorized as moderate, gentle and flat. Aspect would be broadly categorized as north, south, east, or west-facing. The noting of each of these parameters will allow for future correlation to plant survival.

In addition to permanent plot sampling, a qualitative assessment of the entire site will also be undertaken to assess the performance of areas outside the sampling plots. This visual reconnaissance could reveal aspects of site performance not exhibited in the sampling plots. Key indicators to be observed would be such factors as clusters of mortality or stunting, erosion, and changes in channel configuration.

4.1.3 Time Zero Sampling

Time zero sampling will be conducted as soon as possible following the preparation of the time zero plans. This collection of baseline data will provide the basis against which the methodology described above shall be implemented. All trees and shrubs planted within the plots will be permanently tagged, numbered and identified to species. Those plants on which root development testing will be performed (both control and experimental plants), will also be tagged.

As a part of the time zero sampling, photodocumentation points will be selected throughout the site which will provide thorough visual coverage of the area. These points will be mapped and staked, and a series of baseline photos will be taken.

4.1.4 Monitoring Schedule

Once time zero sampling has been completed, monitoring activities will proceed as described in sections 4.2 through 5.11. A monitoring schedule shall be included in the Final Mitigation and Monitoring Plan.

4.2 SURVIVORSHIP OF PLANTINGS

The survivorship of plantings (and replanted stock) for years 1-5 will be determined by counts of all plantings within the permanent sampling plots. All shrub and tree plantings within the plots shall be tagged, numbered and identified to species. In August or September of each year, a full count of all tagged plants shall be made, with each individual scored as either dead or living.

Replanting of dead plants will take place with the same species and, whenever possible, the same stock size and location as the dead plant. Replanted stock will be monitored separately from those plants installed at time zero. This will be necessary because the inclusion of replanted stock into the original sample would invalidate the statistical analyses of tree growth parameters. The replanting monitoring program would examine the same site factors as the

original monitoring program and would be conducted on the same schedule from year 5 through the end of the monitoring period.

4.3 SPECIES COMPOSITION

Species composition of the site will be evaluated during years 0-5. Each year, the numbers of all tree and shrub individuals in all plots will be counted, identified to species and compared with the numbers and species of the original plantings. Replanted stock will be included in the measurement and analysis of species composition.

4.4 PLANT VIGOR AND HEALTH

Trends in plant vigor and health will be evaluated each year during years 0-10. A qualitative assessment of overall plant vigor and health will be made in addition to monitoring signs of herbivory, drought stress, and fungal/insect infestation. The latter factors shall only be determined in a general fashion, and recorded as either absent or present. Overall health and vigor will be rated as high, medium and low, based on the following criteria:

High =	67-100% healthy foliage
Medium =	34-66% healthy foliage
Low =	0-33% healthy foliage

Trees and shrubs within each plot will be examined for health and vigor. At least 50 percent of the individuals of each species should be randomly chosen for examination. These same individuals will also be monitored for plant growth and (for tree) basal area. The plants monitored will be tagged and numbered. Results will be reported by species.

4.5 PLANT HEIGHT

Plant growth will be measured annually through year 5 and in years 6, 8, 10, and every 5 years thereafter until the end of the monitoring period. Tree and shrub height will be determined for 50 percent of all original plantings within each of the sampling plots. Heights will be measured using a telescoping measuring pole and/or a clinometer. Results will be reported by species and will be compared to those of the mature trees sampled at the reference site.

4.6 TREE BASAL AREA

The diameter at breast height (DBH) of 50 percent of all trees at least 5 feet in height within each sampling plot will be measured annually through year 5, at years 6, 8, 10, and thereafter at 5-year intervals until the end of the monitoring period. Results will be reported by species and compared in summary to the mean basal area at the reference site.

4.7 NATURAL REPRODUCTION/RECRUITMENT

Natural reproduction/recruitment will be measured annually through year 5, at years 6, 8, 10, and thereafter at 5-year intervals until the end of the monitoring period. All woody seedlings, and saplings which become established in the sampling plots through natural recruitment will be counted and identified to species.

4.8 SPECIES DIVERSITY

Species diversity will be measured from time zero to the end of the monitoring period. It will be determined from plots using counts of individuals of all

woody species (both plantings and recruits) within the sampling plots, and calculated using the Shannon-Weaver Diversity Index. The mitigation site species diversity index value will be compared to that of the reference site. This species diversity index value will not be used as a fixed criterion, only as a basis for comparison with the progress of the species diversity at the mitigation site. Species diversity will therefore be a qualitative, long-term success criterion.

In addition to replanted species diversity, a list of birds utilizing the reference site and the mitigation sites shall be prepared. Monitoring biologists shall conduct bird surveys at least twice per year and prepare a bird list for inclusion in the annual reports. Each bird survey shall be performed by qualified biologists and observation periods should be no less than 2 days (16 hours) in duration. Bird utilization will be used as an overall, qualitative evaluation of the site's ability to support wildlife. Data shall be compared to bird diversity data from the reference site. It will be assumed that the greater the number of bird species seen, the greater the biological diversity and carrying capacity of the site.

4.9 ROOT DEVELOPMENT

Root development of the predominant tree species installed will be evaluated from the end of year 4 through year 6. By the end of year 4 the trees should have had maximum time allowable (after the discontinuation of irrigation) to develop their roots and tap into subterranean water sources. The plants on which this monitoring will be performed will be located outside of the permanent sampling plots. Samples of each species will be randomly chosen, tagged and mapped at the time of installation. The plants used for testing root development will be installed at the same time, using the same stock, and with the same installation methods as all other similar species used at the mitigation site. <u>They will be installed in addition to all mitigation plantings.</u> Another 50 percent over the number of experimental plants needed for root development monitoring shall also be installed. These additional plantings will provide a safety margin against mortality reducing the number of experimental plants by year 4 to below the 16 plants per species required.

At the end of year 4, four plants of each of the species will be tagged. Half of the tagged plants will be randomly chosen and irrigation will be discontinued (experimental group). Those individuals will be compared to the remaining tagged plants of the same species which will have continued irrigation (control group). Plants will be monitored every 2 months, from April-October, for a duration of 2 years. Survival and plant health/vigor will be monitored. Statistical analysis will be based on the last set of data collected each year.

To the extent practicable the plants used for testing root development will be located such that adjacent irrigation points will not affect their roots.

4.10 PERCENT COVER

Percent cover of trees and shrubs will be measured annually from time zero to the end of the monitoring period. Cover will be measured using the line intercept method. Cover will be determined for the shrub and tree layers separately by determining canopy cover along the entire length of all transects. Percent cover will be reported for each plant association and for the entire site as a whole. However, this success criterion will only be applied to the site as a whole in determining whether the project is progressing acceptably.

4.11 PHOTODOCUMENTATION

Photodocumentation of the site will be conducted bi-annually, in June and December, each year from time zero to the end of the monitoring period. Color photographs will be taken on the site from the locations selected during baseline sampling. The majority of photographs will be taken with a 50 mm lens on a 35 mm camera to avoid the distortion caused by wide-angle and telephoto lenses. Some additional photos may be taken with a wide-angle lens to provide broader overviews.

In addition to the standard site photographs to be taken from pre-selected locations, photographs will be taken to record any events which significantly effect the site such as fire, flooding, erosion, or vandalism.

Aerial photographs of the site will also be taken to provide an overhead perspective of the site's progress. These aerial photographs will be taken starting in August of year 4 and every 2 years thereafter until the end of the monitoring period. These photographs will also be used to verify the percent cover measurements taken along the transects and to provide an overview from which an additional estimate of vegetative cover over the entire site can be made.

5.0 DATA ANALYSIS

5.1 INTRODUCTION

Data analysis will be conducted as soon as possible following collection of field data. Minimizing delays between data collection and data analysis provides an opportunity to return to the site to verify any discrepancies encountered in the original data set and to conduct further sampling as necessary before the site evolves significantly. Data analysis will be conducted using standard spreadsheet, data base, and statistical computer applications as may be appropriate. Data input will be spot-checked and results will be carefully reviewed by the project supervisor. Sections 5.2 through 5.11 describe the recommended data analysis procedures. While it is not essential that these procedures be explicitly followed, any similar procedures used must be, overall, no less vigorous, replicable and documentable than those given.

5.2 SURVIVORSHIP OF PLANTINGS

After each year's field sampling, survival rates will be determined and reported as a mean, range and variance for each species. Results will be presented for original plantings and re-plants on a separate basis. Significant differences in survival rates between years and plant associations will be tested for using Analysis of Variance (ANOVA) procedures. A Tukey's test will be used to test for significant differences between individual years, and plant associations.

5.3 SPECIES COMPOSITION

Tree and shrub species composition will be measured as the percentage of each individual species, both planted and naturally established, encountered in each plot in comparison to the original species composition. Species composition values will be reported as a mean percentage for each species over the entire site, and will include range and variance values. In addition, information will be provided as to whether individual species numbers are within 25 percent of the number originally planted.

5.4 PLANT VIGOR AND HEALTH

Plant vigor will be reported for each species as the proportion of individuals classified into each of the general categories (i.e., high, medium and low)

outlined in section 4.4. Changes in the overall health and vigor of individual species over time will be evaluated. Information will also be provided regarding suspected causes for declines in vigor and health (i.e., presence/absence of herbivory, etc.) over time, as appropriate.

5.5 PLANT HEIGHT

Plant growth will be reported for each species as the mean percentage change in height at each sampling date over the previous year's total height. The mean growth rates, ranges and variances for the height of each species will be reported as well as the results of tests for significant differences between sampling dates by ANCOVA (analysis of covariance). The previous year's height will be the covariate. Significant differences between individual years will be tested for using a Tukey's test.

5.6 TREE BASAL AREA

Tree basal area will be reported as mean basal area per acre for the entire site and, for each species.

5.7 NATURAL REPRODUCTION/RECRUITMENT

Natural recruitment rates will be recorded annually on the basis of recruit density and frequency for all woody species within the study site. Mean, range and variances for recruit densities and absolute and relative frequencies will be presented separately for native and non-native species. Trends in recruitment will be evaluated by testing for significant differences between years using an ANOVA. A Tukey's test will be used to test for significant differences between individual years.

5.8 SPECIES DIVERSITY

Species diversity will be reported as a diversity index value for the entire mitigation site on an annual basis. Trends in changes in species diversity will be monitored by subjective comparison of index values over the duration of the study. Species diversity of the mitigation site will be compared to the species diversity value of the reference site. The reference site's species diversity value will serve as a point of reference, not a fixed success criterion which must be attained by the mitigation site.

5.9 ROOT DEVELOPMENT

Root development will be evaluated based upon the survival/mortality rates and plant health and vigor of those individuals to which irrigation had been discontinued. Survival will be reported as the number of individuals of each species which survive without irrigation. Testing for significant differences in survival between the non-irrigated (experimental) and irrigated (control) groups will be accomplished by utilizing a chi-square analysis. A separate chi-square analysis will be conducted for each species. Plant health and vigor will be reported as the proportion of individuals classified into each of the general categories (i.e., high, medium, and low) as outlined in section 4.4.

5.10 PERCENT COVER

Mean percent cover of all tree and shrub species will be determined over the entire mitigation site. Results will be reported as mean percentage cover values for each sample period, plant association, and as percent change in cover from the previous year. Cover values for all native tree species will be combined and reported together as a single value, as will cover values for native shrubs as a group. Non-native tree and shrub cover will be reported

separately in a similar fashion. Mean percent cover for trees and shrubs will also be monitored to ensure that trends are towards the ultimate goals of 75 percent cover for trees and 45 percent cover for shrubs.

5.11 PHOTODOCUMENTATION

The aerial photographs will be visually evaluated to verify the findings of the percent cover field data collection. Vegetation can be delineated and the total of canopy cover can be planimetered to provide an estimate of total cover. These aerials, and the other photographs taken of the site, will provide valuable visual information as a complement to the myriad of graphs, figures and narrative material which will be presented in the monitoring reports.

6.0 REPORTING

Annual data collection will take place primarily in August and September of each monitoring year, although sampling for root development in year 4 will take place from May through September. Data analysis will require a variable amount of time, depending on the number of workers and their experience; within the first year more time may be required due to the need to become familiar with procedures and to set up the appropriate spreadsheet and data-base programs. Copies of photodocumentation will be provided along with the reports in the form of half-tone reproductions.

Initially, just after the mitigation site construction and planting is complete, a report will be prepared. This report will include a copy of the time zero as-built plans and will provide a thorough description of the status of the mitigation site, including any adjustments made to the final mitigation plans. This report will be completed within 2 months after the completion of all plantings.

Thereafter, monitoring reports will be completed and submitted for agency review within 3 months after the end of the prior monitoring period's activities. For all years except year 4, reports will be submitted by December 15.

A year 5 report, summarizing the mitigation project, evaluating the site's overall performance, and describing the long-term management and protection plan will be prepared and submitted within 60 days prior to the end of the 5-year survivorship monitoring. Monitoring will cease when the site has met all the success criteria, or by mutual agreement of the Corps and the resource agencies. At that time, the site should be expected to eventually meet the success criteria, with little or no chance of failure.

Reports will be prepared in the following format:

1. Abstract
2. Introduction
3. Materials/Methods
4. Results
5. Discussion
6. Recommendations
7. References
8. Appendices

Upon completion, the reports will be provided to all reviewing agencies, including the U.S. Fish and Wildlife Service (2800 Cottage Way, Room E-1803, Sacramento, CA, 95825), the California Department of Fish and Game (Region 3, P.O. Box 47, Yountville, CA 94599), National Marine Fisheries Service (777 Sonoma Ave., Room 325, Santa Rosa, CA 95404), the Regional Water Quality

Control Board (2101 Webster St., Room 500, Oakland, CA 94623), and other interested parties as may be added.

About 1 month after submittal of each annual report, the monitoring agency will host a field site inspection for the Corps, the U.S. Fish and Wildlife Service, California Department of Fish and Game, National Marine Fisheries Service, Regional Water Quality Control Board and the State Water Resources Control Board. The agencies shall thus provide comments, if necessary, on the basis of both the annual reports and the site visits.

7.0 CONTINGENCIES AND REMEDIAL ACTIONS

7.1 MONITORING PROCEDURES ADJUSTMENTS

The protocol and results of the monitoring program will be reviewed annually by the monitoring biologists of the involved agencies. Adjustments to monitoring procedures may be required as the site changes over time, or if logistical problems render a procedure unduly difficult or costly to conduct. Such adjustments would be proposed to the reviewing agencies for approval prior to application. After reviewing annual reports, the agencies may also have suggestions for adjustments to the monitoring program. Agency suggestions will be reviewed, and if appropriate will be incorporated into the following year's monitoring program. The key is to anticipate that the monitoring program may need occasional adjustments to remain an accurate, complete and feasible means of assessing the mitigation success.

7.2 REPLANTING

Until the end of year 5, replanting will be performed if plant mortality of any species exceeds the survival goal. If cumulative survival for a given species falls below the cumulative survival success criterion, monitoring of that plant association will start good.

7.3 VEGETATION MONITORING-MAINTENANCE LINKAGE

The results of monitoring will be conveyed to the landscape contractor and Corps or local agencies' biological staff and resident engineer to allow them to review the information into their ongoing maintenance program. For example, if the results of the root development monitoring indicate that the site's trees are not yet able to survive without irrigation it would be recommended that irrigation be continued beyond the 5-year plant establishment period.

Not only will annual reports be provided to those associated with site maintenance, but if monitoring shows notice significant problems related to site maintenance and performance, then verbal reporting will be initiated to facilitate remediation.

7.4 PROJECT FAILURE CONTINGENCY PLAN

In the event that, after remedial actions on the site, it becomes apparent to the reviewing agencies that the site will not sustain the level of riparian vegetation necessary to provide suitable mitigation, the reviewing agencies may determine that another site or sites should be replanted to replace habitat values not likely to be conveyed by the initial mitigation effort. A potential site for such remedial actions, located on the Guadalupe River, should be delineated prior to the onset of project construction. Full funding for acquisition, replanting and monitoring of the remedial site should be procured and set aside for such actions, if deemed necessary by the resource agencies and the Corps of Engineers.

There are several means by which the funds could be procured for remedial replanting. The local sponsor could submit a performance bond or letter of credit to the Corps of Engineers, as assurance of completion of the project goals. These funds should be in the full amount necessary to provide lands or easements, planning, construction, replanting and monitoring for the remedial action. Should the remedial action not be necessary, the performance bond or letter of credit would be returned to the local sponsor.

8.0 REFERENCES

Begon, M., J.L. Harper and C.R. Townsend. 1990. Ecology: individuals, populations and communities. Second edition. Blackwell Scientific Publications, Cambridge, MA. 945 pp.

Faber, P.M. and R. F. Holland. 1988. Common riparian plants of California. Pickleweed Press, Mill Valley, California. 140 pp.

H. T. Harvey and Associates. 1991. Los Gatos Creek Mitigation Project, Final Site Performance Monitoring Plan. Prepared for Orsee Design Associates and the Santa Clara County Traffic Authority. H.T. Harvey and Associates. Alviso, California.

Little, E. L. 1980. The Audubon Society field guide to North American trees. Chanticleer Press Inc., New York. 639 pp.

Appendix E

Westlake Farms Wetland Demonstration Project

H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

DRAFT

WESTLAKE FARMS WETLAND DEMONSTRATION PROJECT DEVELOPMENT AND MANAGEMENT PLAN FOR SECTION 16

Prepared by

H.T. HARVEY AND ASSOCIATES

Ronald R. Duke, M.A., President
David Hartesveldt, Wetlands Division Head
Scott B. Terrill, Ph.D., Wildlife Division Head (408) 262-1814
Andrew G. Gordus, Ph.D., Wildlife Biologist/Ecotoxicologist
Jeff L. Seay, Wildlife Biologist

Prepared for

Westlake Farms, Inc.
23311 Newton Ave.
Stratford, CA 93266

January 17 1994

File No. 749-02

423 W. FALLBROOK ST., SUITE 207 • FRESNO, CA 93711 • (209) 449-1423
FAX: (209) 449-9243

TABLE OF CONTENTS

1.0 Executive Summary 573

2.0 Introduction 574

3.0 Existing Conditions 577

- 3.1 Physical Topography 577
- 3.2 Vegetation 577
- 3.3 Wildlife Resources 577

4.0 Proposed Plan 581

- 4.1 Wetland Habitats 581
  - 4.1.1 General Pond Design 581
- 4.2 Shorebird Pond Design 583
  - 4.2.1 Shorebird Nesting and Loafing Island Design 584
  - 4.2.2 Water Management 586
- 4.3 Waterfowl Brood Pond Design 586
  - 4.3.1 Waterfowl Nesting Islands 586
  - 4.3.2 Water Management 586

5.0 Waterfowl Nesting Habitat 589

7.0 Water Supply Sources and Delivery Mechanisms 590

8.0 Demonstration Project Monitoring 593

- 8.1 Habitat Characterization 593
- 8.2 Wildlife Monitoring 593

Literature Cited 596

Personal Communications 598

Appendix A: Vertebrate Species List 600

Appendix B: Waterbird Census Data: Section 16 602

1.0 EXECUTIVE SUMMARY

Westlake Farms, Inc., proposes to dedicate the lands within Section 16 (T22N R19E) for creation of a Wetland Demonstration Project. The goals and objectives of this wetland will be to provide optimal habitat for breeding shorebirds and waterfowl. Further, the goals include evaluating the effectiveness and value of creating various wetland habitats to water-dependent wildlife (primarily avian) in the southern San Joaquin Valley.

The following plan has been developed for review by the project Management Committee. Westlake Farms, Inc. proposes to develop 455 acres for shorebird habitat and 185 acres for waterfowl habitat. The plan includes seven 35 to 270 acre ponds (checks) with large and small islands for nest sites and loafing areas. The proposed plan will provide optimal, shallow open-water habitat for shorebirds, and "hemi-marsh" brood ponds (90 acres) and waterfowl nesting habitat (95 acres). While the shorebird habitat is designed specifically for American Avocets and Black-necked Stilts, the proposed ponds will favor numerous species of shorebirds, waterfowl, and other waterbirds. Proposed water management will encourage the growth of aquatic vegetation for invertebrate and seed production, while minimizing the risk of avian botulism.

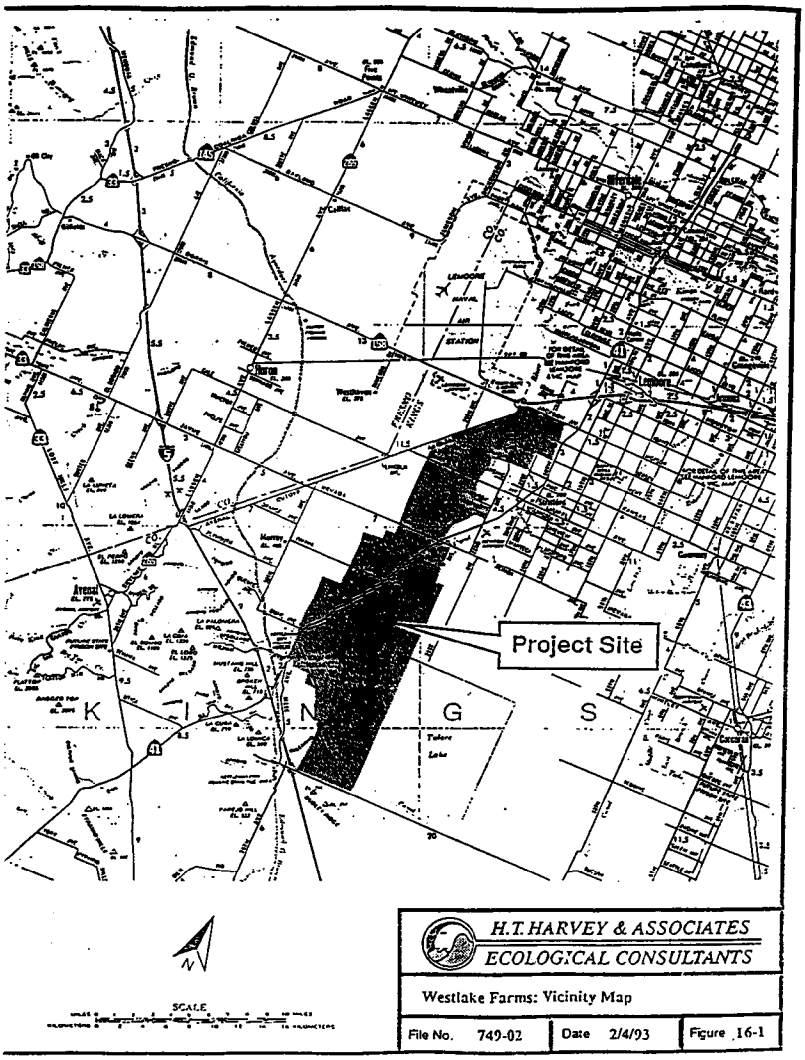
A basic monitoring plan is proposed. However, the final monitoring plan will be produced by the Demonstration Project Management Committee.

2.0 INTRODUCTION

Westlake Farms is approximately 60,000 acre farm, located in the southwest San Joaquin Valley (Figure 16-1). The California Regional Water Quality Control Board Central Valley Region (RWQCB) issued Waste Discharge Requirements (WDRs) for Westlake Farms, Inc. North and South Evaporation Basin, Kings County on 6 August 1993. In agreement with Provision C-7, of the WDR, Westlake Farms, Inc., proposes to dedicate the lands within Section 16 (T.22N R.19E) for the creation of wetland habitats for a period of five years (Figure 16-2). These newly created wetlands will serve as a Wetland Demonstration Project which will provide optimal breeding habitat for shorebirds and waterfowl on Westlake Farms. Westlake will enter into a cooperative agreement with the California Department of Fish and Game, California Department of Water Resources, U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, and other interested agencies. These agencies will provide water and wildlife management expertise for the wetland demonstration project and personnel to participate in all functions of an inter-agency Management Committee including, but not limited to, design of the project wetlands, coordination of all research activities associated with the project wetland, preparation of a coordinated project monitoring plan, establishment of an operation plan, preparation of annual reports and preparation of a final project evaluation report.

The goals and objectives of the Demonstration Project will be to provide optimal habitat for breeding and migrating shorebirds and waterfowl. These objectives will be monitored and evaluated with respect to the effectiveness of the project wetlands in providing foraging and breeding habitat for these waterbirds. The project will be located within a few miles of existing evaporation drainage ponds. This setting will enable researchers to evaluate the effect of alternative wetland habitat on bird-use and condition under such a scenario. In addition to the alternative habitat that will be provided in Section 16, alternative wetland habitat exists on a section (Section 3) located much closer to the evaporation basins at the south end of Westlake Farms. The positioning of alternative wetlands at varying distances from the evaporation basins will allow research on the effectiveness of alternate wetlands at different distances from evaporation basins.

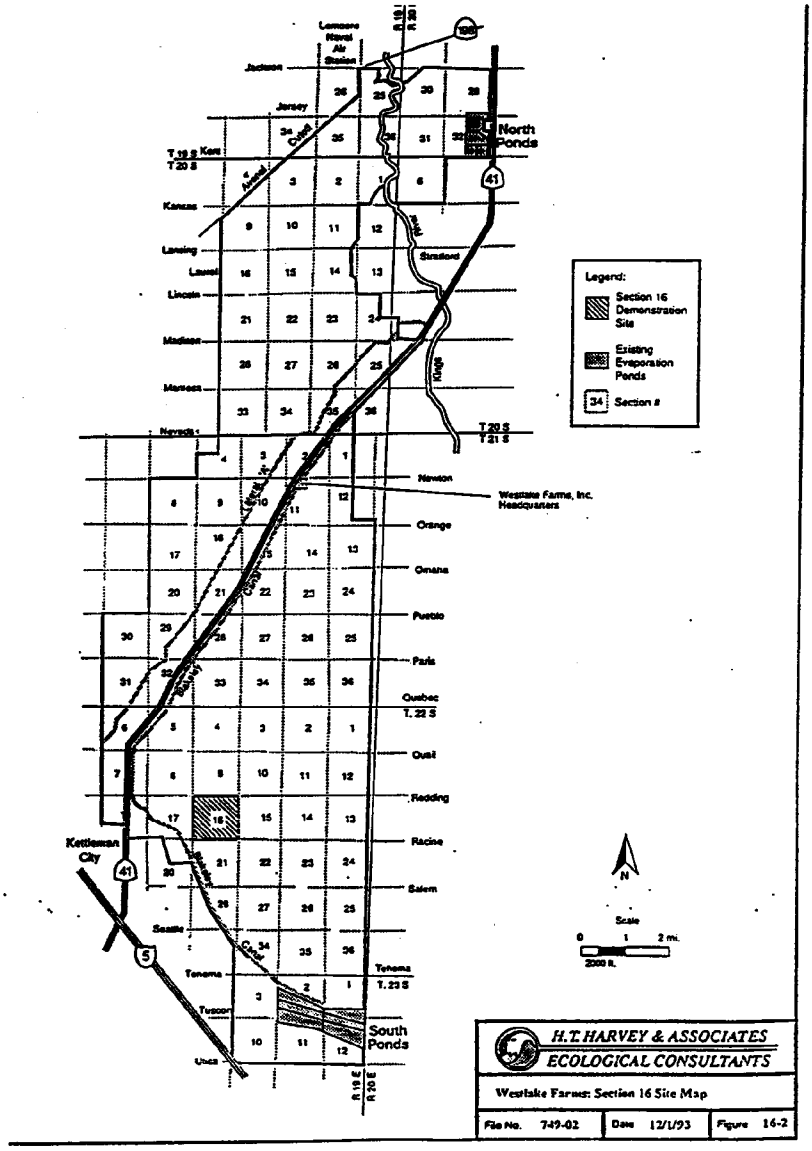
This report describes the existing conditions, and proposes a development and management plan for the Demonstration Project. This plan includes design and management of shorebird breeding and migration habitat, waterfowl brooding habitat, water delivery and water management, and makes recommendations for basic monitoring of wildlife, the habitat, and avian disease.



H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Westlake Farms: Vicinity Map

File No. 749-02	Date 2/4/93	Figure 16-1


Lemoore Naval Air Station
Jackson
Jersey
Kern
Kansas
Lansing
Laurel
Lincoln
Madison
Manteca
Nevada
Newton
Orange
Omaha
Pueblo
Paris
Quebec
Quail
Redding
Racine
Salem
Seattle
Tenema
Tuscon
Utica
Stratford
Kings
Kettleman City
North Ponds
South Ponds
Westlake Farms, Inc. Headquarters
T 19 S
T 20 S
T 21 S
T. 22 S
T. 23 S
R 19 E
R 20 E
Legend:
Section 16 Demonstration Site
Existing Evaporation Ponds
Section #
N
Scale
0 1 2 mi.
2000 ft.
H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Westlake Farms: Section 16 Site Map
File No. 749-02
Date 12/1/93
Figure 16-2

3.0 EXISTING CONDITIONS

3.1 PHYSICAL TOPOGRAPHY

Section 16 is essentially flat with a very gentle slope from the southwest to northeast. The maximum elevation is 188 feet, National Geodetic Vertical Datum (NGVD) which is located in the southwest corner. The minimum elevation of 184 feet (NGVD) is in the northeast corner (Figure 16-3). This section has been surveyed and the spot elevations have been recorded. Currently, there are five contour border dikes running northwest to southeast spaced approximately 0.2 mile apart, which create six checks (Figure 16-4). The elevational drop is approximately 6 inches between each border dike.

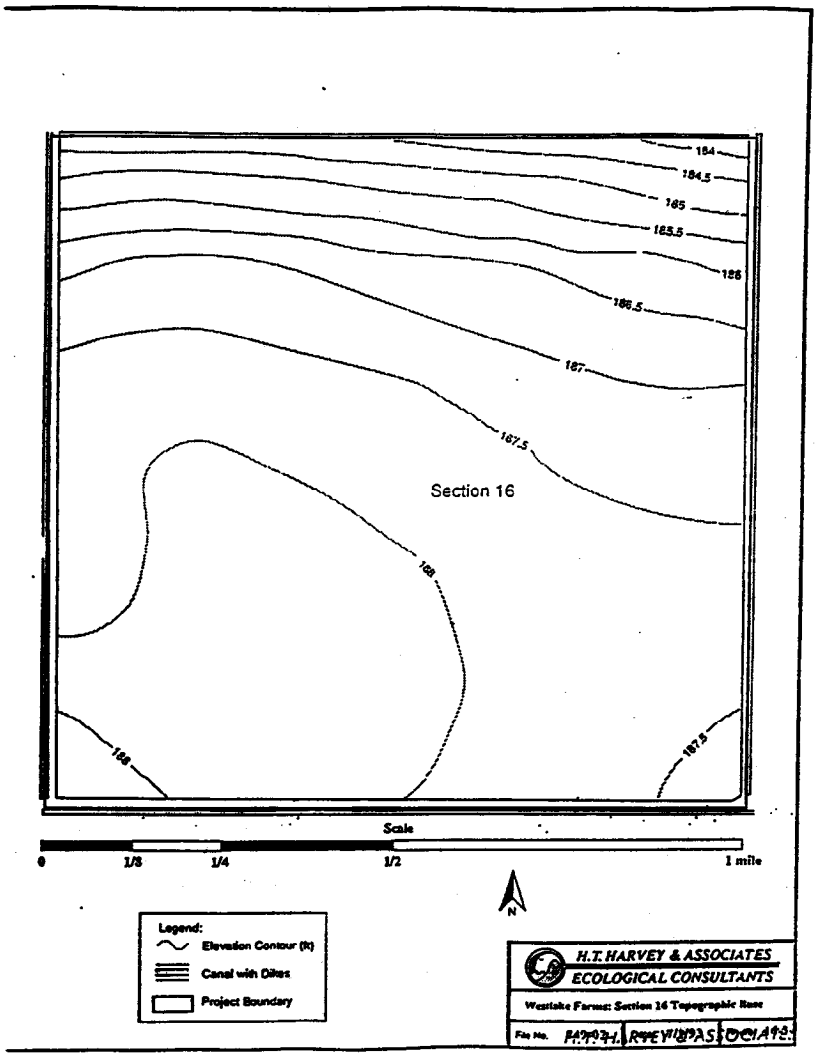
Section 16 has three water delivery canals. These canals are located on the south (Racine Ave.), west, and east sides of the section. Water is delivered to Section 16 via lift pumps from the west canal and the checks are drained into the east canal.

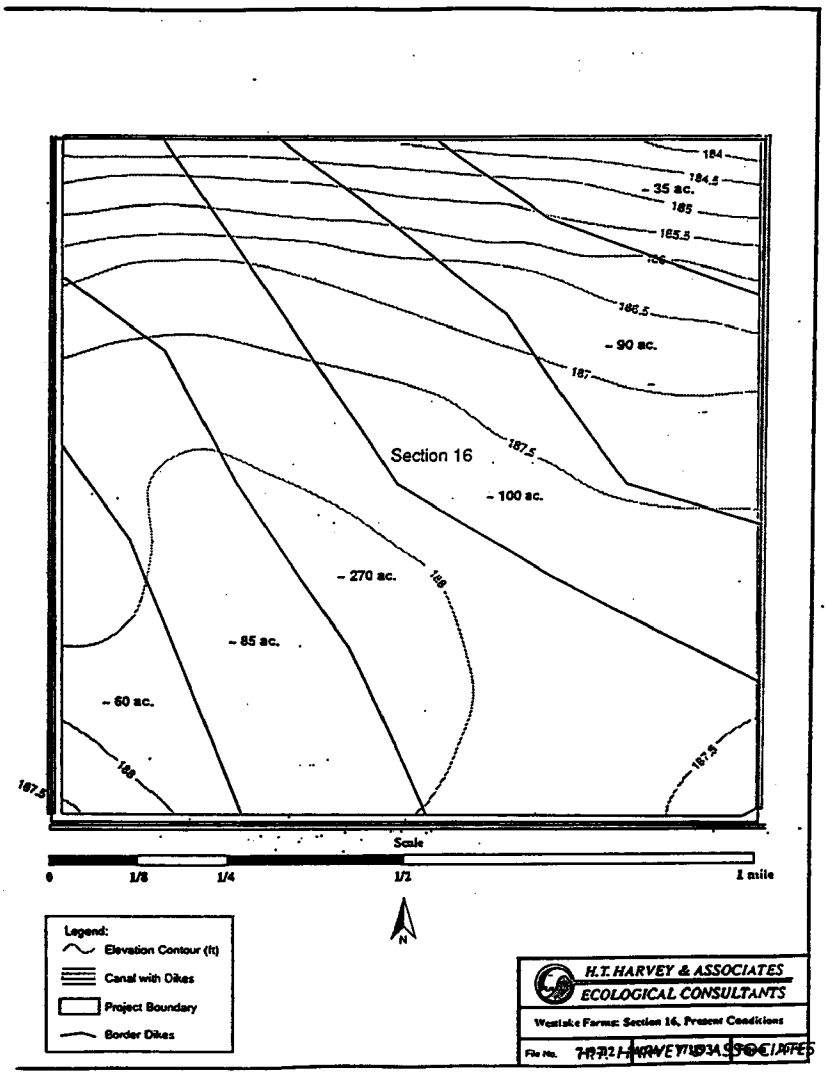
3.2 VEGETATION

In the recent past, Section 16 has been managed for agriculture. In 1993, safflower was planted in Section 16 and the cultivated field was relatively weed free. During the late winter and early spring, the margins of cultivated fields, the dike banks and road shoulders were dominated by London rocket (*Sysimbrium irio*), red-stemmed filaree (*Erodium cicutarium*), burclover (*Medicago polymorpha*), salt marsh sandspurrey (*Spergularia marina*), and common groundsel (*Senecio vulgare*). During the late spring and early summer, barnyard barley (*Hordeum leporinum*), cheeseweed (*Malva parviflora*), and five-hook bassia were observed around the margins of the field.

3.3 WILDLIFE RESOURCES

Due to cultivation, Section 16 is currently of relatively low value to wildlife. However, various species persist under cultivated conditions (Appendix A). Gopher snakes (*Pituophis melanoleucus*) and common king snakes (*Lampropeltis getulus*) may forage in the cropland for small mammals such as various species of mice or gophers. Western fence lizard (*Sceloporus occidentalis*) and western whiptails (*Cnemidophorus tigris*) are present in the ruderal vegetation of the field edges. Since the canal banks are kept clean of vegetative cover, they are utilized by few reptiles and amphibians. Western toads (*Bufo boreas*) may use these canals for breeding if enough water is being held in the spring and early summer.


184
184.5
185
185.5
186
186.5
187
187.5
188
188
187.5
Section 16
Scale
0
1/8
1/4
1/2
1 mile
N
Legend:
Elevation Contour (ft)
Canal with Dikes
Project Boundary
H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Westlake Farms: Section 16 Topographic Base


184
184.5
~ 35 ac.
185
185.5
186
186.5
~ 90 ac.
187
187.5
Section 16
~ 100 ac.
~ 270 ac.
188
~ 85 ac.
~ 60 ac.
188
187.5
187.5
Scale
0
1/8
1/4
1/2
1 mile
N
Legend:
Elevation Contour (ft)
Canal with Dikes
Project Boundary
Border Dikes
H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Westlake Farms: Section 16, Present Conditions
File No.

Several mammals are also expected to use agricultural lands even though the area is frequently disturbed. Some of the mammalian species expected on the project site are common even in disturbed or non-native habitats. These species include striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*) and coyote (*Canis latrans*). Small mammals that frequently utilize agricultural areas include, black-tailed jackrabbit (*Lepus californicus*), Botta's pocket gopher (*Thomomys bottae*) and western harvest mouse (*Reithrodontomys megalotis*). The tracks of California ground squirrels (*Spermophilus beecheyi*) and other small mammals seen on the inside of the levees leading down to the water indicate that canal water is being used as a source of drinking water.

Though often lacking the physical characteristics to provide cover and breeding habitat, croplands can provide a concentrated foraging opportunity for several bird species common to the Central Valley. Brewer's Blackbird (*Euphagus cyanocephalus*), Western Meadowlark (*Sturnella neglecta*), Mourning Dove (*Zeniada macroura*), are a few of the expected residents. Among the most likely winter visitors are American Pipit (*Anthus rubescens*), and Mountain Plover (*Charadrius montanus*) which are especially attracted to plowed fields. Fish-eating species such as Pied-billed Grebe (*Podilymbus podiceps*), Great Blue Heron (*Ardea herodias*), Snowy Egret (*Egretta thula*), Great Egret (*Casmerodias albus*), and Caspian Tern (*Sterna caspia*) have all been observed foraging in the canals that surround Section 16.

During March and April 1993, the entire section was flooded to a depth between 12 and 18 inches. H.T. Harvey and Associates ornithologists monitored Section 16 on a biweekly basis between 4 March and 4 May 1993 (Appendix B). Waterbird use peaked on 19 April when over 18,000 birds were observed. The bird population included over 1,000 ducks, 2,500 Whimbrels (*Numenius phaeopus*) and 13,600 Western Sandpipers (*Calidris mauri*). During this census date, the water level had receded so that most of the section was in a sheetwater/mudflat stage. On 4 May the checks were dry and only 6 waterbirds were observed in Section 16.

4.0 PROPOSED PLAN

Six hundred forty acres in Section 16 (T.22S R.19E) are proposed for two types of wetland habitat for the demonstration project on Westlake Farms. One habitat would comprise open, shallow, freshwater ponds for breeding shorebirds and the second habitat would provide a freshwater marsh for breeding waterfowl. Four hundred fifty-five acres are proposed for shorebird habitat and 185 acres are proposed for development of waterfowl habitat. Although the design of these wetlands targets specific types of waterbirds, both kinds of wetlands will be used by a broad variety of waterbirds.

4.1 WETLAND HABITATS

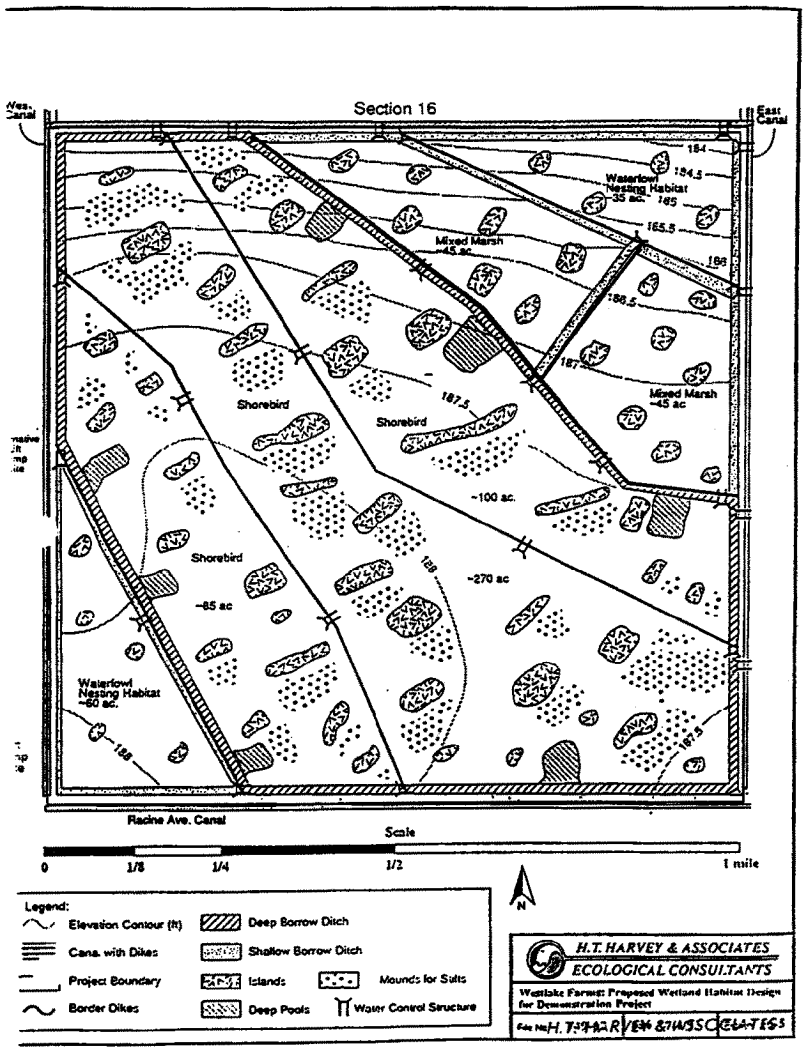
4.1.1 General Pond Design.

The Section 16 design includes a mosaic of shallow freshwater ponds containing large and small islands (Figure 16-5). The proposed design will serve four purposes: 1) it will provide optimal breeding and foraging habitat for shorebirds, waterfowl and other waterbirds during the reproductive period; 2) it will efficiently use water; 3) it will create a diverse wetland; and 4) it will promote the control of avian disease, especially avian botulism.

Design features of the shallow pond habitat include the following:

(1) **Pond Size.** The 640 acres will be subdivided into seven 35 to 270 acre ponds (checks) by contour or minor border dikes. Four hundred fifty-five acres are proposed for shorebird habitat, 90 acres for breeding waterfowl habitat, and 95 acres for upland habitat. The entire section will be enclosed by a perimeter dike.

(2) **Border Dikes.** Border dikes with 8:1 to 10:1 slopes (Steel and Bradford 1991) will divide the wetland into seven checks. These dikes will be engineered to follow the natural contour of the land. One additional dike to divide the mixed marsh waterfowl brooding pond into two 45 acre units is proposed. Border dikes provide important habitat for shorebirds and waterfowl because they provide nesting and loafing areas.


Section 16
West Canal
East Canal
Waterfowl Nesting Habitat ~35 ac.
Mixed Marsh ~45 ac.
Mixed Marsh ~45 ac
Shorebird
Shorebird
Shorebird
~100 ac.
~270 ac
~65 ac
Waterfowl Nesting Habitat ~60 ac.
Racine Ave. Canal
Scale
0
1/8
1/4
1/2
1 mile
N
Legend:
Elevation Contour (ft)
Canal with Dikes
Project Boundary
Border Dikes
Deep Borrow Ditch
Shallow Borrow Ditch
Islands
Mounds for Silts
Deep Pools
Water Control Structure
H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Westlake Farms: Proposed Wetland Habitat Design for Demonstration Project

(3) **Perimeter Dikes.** The perimeter dike will be steeply sloped (2:1) to reduce the threat of avian botulism (Locke and Friend 1989).

(4) **Islands.** Clusters of islands of various sizes will be created within each pond. Many of these islands will be rectangular to elongate. Each island will have gradual 8:1 to 10:1 slopes (design features which will create additional nesting and loafing areas for waterbirds). These islands are discussed in greater detail in Sections 4.2.1 and 4.3.1).

(5) **Pond Depth.** These ponds will vary in depth from 1 to 8 inches (average 3 inches) for shorebirds (Bradford 1992); and from 6 to 12 inches (average 9 inches) for breeding waterfowl. Pond bottoms will be uneven. Water will be maintained in most of these ponds throughout the breeding period from mid-February through early August.

(6) **Water Control Structures.** Water control structures (flashboards) will be strategically located for efficient water delivery and drainage. (See Sections 4.2.2, and 4.3.2 for more detail).

(7) **Drainage Ditch.** A level-bottom drainage ditch will be parallel to and outside of the north main periphery dike. This ditch can be constructed with a "ditch plow" and will drain water from the ponds to the west canal for water recirculation back to Section 16 or to the east canal draining the water away from Section 16.

(8) **Predator Control Ditch.** A predator control ditch 4 to 6 feet deep and 10 feet wide (minimum) is recommended as a barrier to predators attempting to reach the shorebird nesting islands (pers. comm. D. Barnum, USFWS).

4.2 SHOREBIRD POND DESIGN

The shorebird habitat will provide optimal nesting, foraging, and loafing areas for breeding shorebirds. This habitat will comprise 455 acres and will be divided by two contour dikes to form three ponds ranging from 85 to 270 acres (Figure 16-5). The design includes approximately 10 acres of permanent deep-water marsh. The borrow ditch, which will surround the shorebird pond, will be approximately 4 acres in size (10 feet by 3.5 miles) and is designed to prevent predators from reaching the shorebird breeding areas. The remaining six acres of deep water pools will range in size from 0.5 to 2 acres. These deep pools will be located alongside the borrow ditch. Soil removed for the development of the deep-water

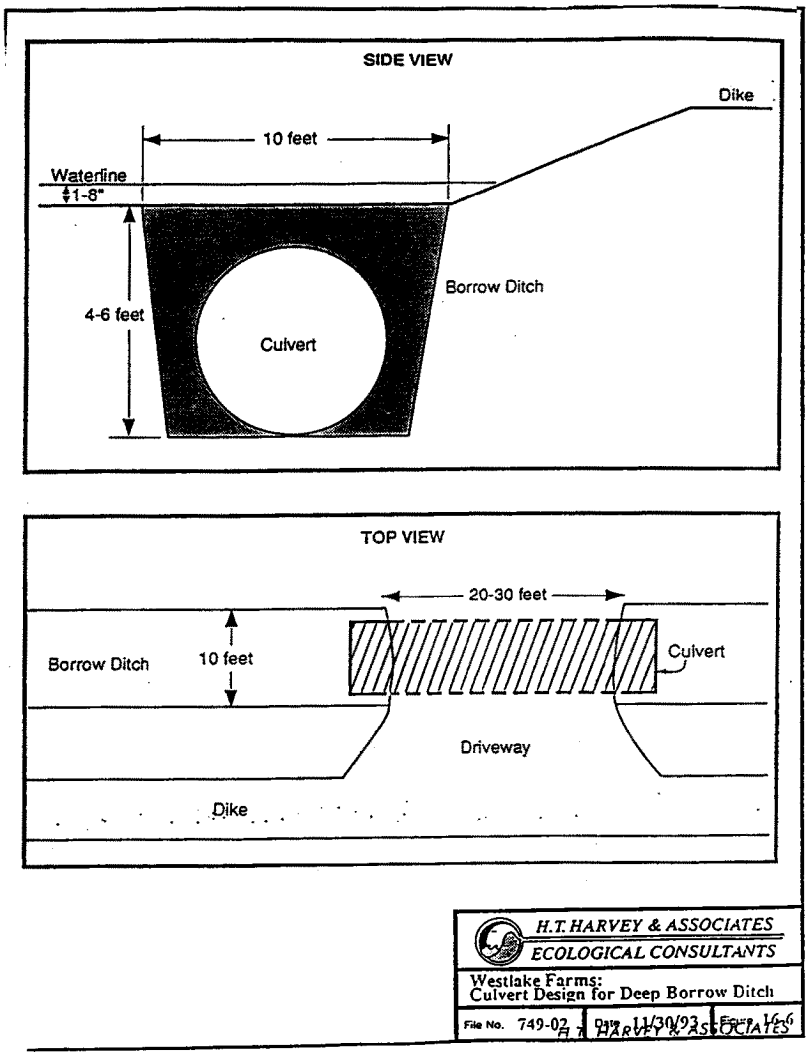
areas will be used to construct the large islands. Access to the interior checks within the shorebird ponds will be provided by partially filling the deep borrow ditch (Figure 16-6) and connecting the two sides of the fill with an open culvert. The top elevation of the fill will be approximately at grade with the surface of the check (Figure 16-6).

4.2.1 Shorebird Nesting and Loafing Island Design

The islands will be designed to provide optimal nesting and loafing habitat for American Avocets (*Recurvirostra americana*) and Black-necked Stilts (*Himantopus mexicanus*). American Avocets prefer large, centrally located islands, while Black-necked Stilts favor smaller, more secluded islands (Rigney and Rigney 1981). Therefore, islands of two sizes will be constructed in clusters within the shallow ponds (Figure 16-5). These islands will be 300 feet or more from the perimeter dike (Giroux 1981).

The large islands will be 6 to 120 feet wide and will vary in length from a few to several hundred feet (Gibson 1971, Hamilton 1975). The orientation of these islands will be perpendicular to the prevailing winds of the Tulare basin (south-southwest to north-northeast), an orientation that will provide birds with maximum protection from the wind. Cattails or tules will be planted on the windward side of the islands to prevent erosion. The islands will have a maximum elevation of 12 to 24 inches above the high water line of each pond (pers. comm. Doug Barnum, USFWS). Their banks will be gradually sloped (8:1 to 10:1) with zero crown. The islands should be constructed using a bulldozer and paddle wheel scrapper. This method of construction will produce gently sloped banks and a flat crown.

Cover provided by vegetation will not exceed 20%. Iodine bush (*Allenrolfea occidentalis*), a plant typical of alkaline sink habitats in the Central Valley, provides escape cover for both nesting American Avocets and Black-necked Stilts at the Los Banos Wildlife Management Area operated by the California Department of Fish and Game (pers. comm. John Beam, CDFG). Because it occurs locally, a sparse cover of iodine bush would be appropriate for these islands.


SIDE VIEW
Dike
10 feet
Waterline
1-8"
Borrow Ditch
4-6 feet
Culvert
TOP VIEW
20-30 feet
Borrow Ditch
10 feet
Culvert
Driveway
Dike
H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS
Westlake Farms:
Culvert Design for Deep Borrow Ditch
File No. 749-02
Date 11/30/93
Figure 16-6
H.T. HARVEY & ASSOCIATES

The small islands will vary from one to several square feet in size. These smaller islands will be located on the downwind side of the large islands to protect them from erosion and nesting birds from the prevailing winds (Hamilton 1975). The maximum elevation of these small islands will be 12 inches above the high water mark within each pond. The small islands can be constructed with a "border disc." Borders can be constructed parallel to the large islands. Sections of the border can be randomly knocked down with a small blade attached to a tractor, leaving a series of varied sized small islands for shorebirds.

4.2.2 Water Management

Water management will be consistent with the ecological requirements of breeding waterbirds occurring on Westlake Farms. Water levels will be maintained at depths of 1 to 8 inches (average 3 inches) during the breeding season (Gibson 1971, pers. comm. Doug Barnum, USFWS). Water will be applied in mid-February and added through mid-July. Evaporation should completely dry the shorebird ponds by mid-August (or earlier).

After the check is dry, heavy equipment can enter the check to spot disc the densely vegetative areas, for example, cattails (*Typha* spp.). Levee maintenance, etc. can also be performed during the dry period.

4.3 WATERFOWL BROOD-POND DESIGN

The waterfowl brooding ponds (also referred to as "semi-permanent" wetland) will provide optimal habitat for nesting, foraging, and brooding waterfowl. With proper aquatic plant management, this unit will provide escape cover and high protein (freshwater invertebrates) feeding areas for the hens and their broods. The open fresh-water shorebird habitat will also provide brooding areas for the ducklings.

The waterfowl brooding unit will be two 45 acre ponds located in the northeast corner of Section 16. Optimal habitat for breeding ducks are wetlands that have a 50:50 ratio of cover to open water (or 50:50 "hemi-marsh" state) (Kaminski and Prince 1981).

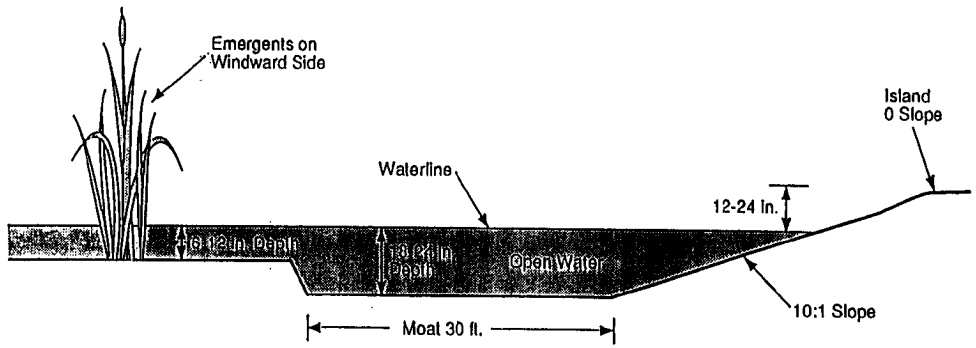
4.3.1 Waterfowl Nesting Islands

Most dabbling ducks prefer to nest in densely vegetated upland areas or on islands. The islands should be a minimum of 50 feet in diameter and be greater than 0.25 acres. The

islands should have a rectangular shape, rather than being circular, elliptical or square. Islands should be approximately 80 feet wide by 135 feet long, have 10:1 sloped sides, flat crown, and be 12 to 24 inches above the water line. Each island should be completely surrounded by a moat to provide open water for brooding females and young. The water surrounding each island will also discourage predators from reaching them and allow birds to see approaching predators. The moat should be 18 to 24 inches deep and 30 feet wide (Figure 16-7). The islands can be constructed with a bulldozer blade. The soil should be pushed up to form islands and borrow areas around islands will serve as the moat. Emergent vegetation should be allowed to grow on the windward side of the island/moat to prevent erosion. The islands should be at least 300 feet apart and at least 300 feet from the periphery if a deep borrow ditch is not present. The island vegetation, as well as the dikes, will include annual and perennial grasses and flowering plants.

4.3.2 Water Management

Water management will provide optimal marsh habitat requirements for breeding waterfowl on Westlake Farms. The ponds will be flooded from mid-February through mid-July. During this period the water will be maintained between 6 and 12 inches deep (average 9 inches).



H.T. HARVEY & ASSOCIATES
ECOLOGICAL CONSULTANTS

Westlake Farms: Waterfowl Breeding Island
Design with Open Water Moat Surrounding Island

File No.	Date	Figure
749-02	7/13/93	16-7

5.0 WATERFOWL NESTING HABITAT

Ninety-five acres of waterfowl nesting habitat will be managed to provide escape cover, nesting cover, and food for breeding waterfowl (Figure 16-5). Waterfowl breeding habitat adjacent to shallow ponds provides optimal nesting habitat for Mallards, Northern Pintail, Gadwall, and Cinnamon Teal. The close proximity of the mixed marsh to the adjacent uplands will facilitate the easy movement of hens and ducklings to brooding areas away from predators. This habitat type will also meet essential needs for other upland avian species as well as for mammals.

A variety of plant species will volunteer, but a light seeding of annual and perennial rye grasses, mustards, barley, and vetch is recommended to get a stand established. The seed should be planted in the late fall before the winter rains to assure germination. The first irrigation should be in February, with additional irrigations in April and late June. The upland habitat should be irrigated using 60 inch furrows. When irrigation is needed during the nesting season, ground nesting bird nests (primarily those of ducks) would not be flooded, because females generally select high spots between furrows for nest sites.

Planting and encouraging growth of terrestrial plants along the dike banks of the waterfowl units provides soil stabilization and habitat for wildlife. Lenscale (*Atriplex lentiformis* ssp *torreyi*) (also known as saltbush) should be established along the waterfowl area dikes to provide cover habitat for birds and mammals (CDFG 1968, Ermacoff 1969). Lenscale requires at least one irrigation per summer in dry climates, but two to three are preferable (CDFG 1968). For maximum coverage lenscale should be seeded at a rate of seven pounds per acre. A rate lower than this will be adequate for establishing patches of cover habitat on the dikes. Lenscale seed can be planted by drilling or broadcast (followed by a light harrowing) during the late winter (January and February), to insure that the seed will receive at least two rains adequate for seed germination. The dikes and upland areas should also include annual and perennial grasses and flowering plants.

7.0 WATER SUPPLY SOURCES AND DELIVERY MECHANISMS

Water for Section 16 will be supplied by the California Department of Water Resources and the U.S. Bureau of Reclamation through a Memorandum of Understanding (MOU) now being developed. Water will be delivered into Section 16 from the west side via lift pumps (Figure 16-5). The water will then be delivered to the other ponds by gravity flow. After the water flows through all the ponds, it will be drained into the newly constructed north ditch and be recirculated back to the ponds via the lift pumps located at the south end of the west canal.

The proposed wetland habitat plan will require approximately 1,675 acre-feet of water per year (Table 1). This amount of water is needed primarily to offset the high evaporation rate during the late spring and summer months (Table 2). The shorebird habitat will require 1,405 acre-feet of water annually to provide a 3 inch average water depth for 455 acres. This figure includes 40 acre-feet for initial flooding of the borrow ditch and deep pools, and 1,365 acre-feet in annual evaporation loss. The waterfowl brooding ponds will require 270 acre-feet of water.

The U.S Bureau of Reclamation and the California Department of Water Resources will provide up to a total of 1,500 acre feet of the water allocated to Bureau of Reclamation lands at Arroyo Pasajero. The water will be used on Westlake agricultural lands to enable Westlake to use its other water sources for the project wetlands. The actual water provided to Westlake Farms shall be determined annually by the Bureau of Reclamation and the Department of Water Resources. The design presented here requires a total of 1,675 acre-feet of water. Westlake Farms will provide the 175 acre-feet difference between the habitat requirement and the amount allocated by the agencies.

Westlake Farms, Inc., will consult with the Goals and Management Committee with respect to analyzing the delivered water for trace elements and organic compounds.

Table 1

Water Requirement for Providing Shorebird and Waterfowl Breeding Habitat from February 15 to July 15 for the Proposed Wetland Demonstration Project in Section 16 at Westlake Farms, Inc., Kings County, California

Area (Acres)	Period	Depth or Water Loss (feet)	Water (ac–ft)	Comment
Shorebird Habitat				
10	Feb 15–July 15	4	40	Initial flooding of Borrow ditch
455	Feb 15–July 15	3	1365	Input & Evaporation loss
Subtotal			1405	Required
Waterfowl Brooding Habitat				
90	Feb 15–July 15	3	270	Input & Evaporation loss
Total			1675	Minimum Required
			1500	Amount Available
			175	Deficit

Table 2
Monthly Evaporation Rates at Kettleman City, Kings County, California
(CDWR 1979)

Month	Rate (inches)
October	5.32
November	2.55
December	1.32
January	1.32
February	2.13
March	4.14
April	6.05
May	8.6
June	10.2
July	11.8
August	10.44
September	7.73
Total	71.6 (5.97 feet)

8.0 DEMONSTRATION PROJECT MONITORING.

The Management Committee will oversee the management and monitoring of the Demonstration Project. The Committee will prepare a coordinated project monitoring plan. In addition, personnel from the various agencies with representatives on the Management Committee will help coordinate monitoring and contribute technical support and services to the actual monitoring of the project wetlands. The plan will likely include (but not necessarily be limited to) the following general monitoring objectives.

8.1 DEMONSTRATION PROJECT HABITAT CHARACTERIZATION PROGRAM

Initially, only the pond water will be characterized, as the influent waters are presumed to be irrigation water. A program similar to that conducted on the evaporation ponds is appropriate and summarized below.

Composite sampling stations shall be established at appropriate locations for the measurement and collection of representative samples. Table 16 presents the pond monitoring program adopted at the evaporation basin and at the alternative habitat present in Section 3.

WILDLIFE MONITORING

The wildlife monitoring program will be developed by the Management Committee. The study of the effectiveness of the alternate habitats may take several cooperative forms, which have not yet been developed. However, Westlake Farms anticipates that the following programs will likely be included in the final monitoring design.

Breeding Birds

Monitoring will consist of semi-monthly counts of nests, eggs, and young for the months of March-June (with adjustments based on the field indications of the onset and end of breeding). Nests will be located by a combination of walking surveys and spotting scopes. Levees will be walked, and each nest counted and mapped. Where possible, counts of eggs will be taken. Young birds will also be counted. These counts will provide a comparison of the numbers of birds nesting at the basins versus those at the alternative habitats. Concurrently, biweekly counts will be taken of all birds at the Demonstration Project Wetlands. Spotting scopes and binoculars will be used to identify and count birds.

Table 16-. Westlake Farms Alternative Pond Monitoring Program

Item	Unit	Type of Sample	Sampling Frequency
Average Depth of Water	Feet (tenths)	Staff gauge	Weekly
Specific Electrical Conductance @ 25°C	umhos/cm	Grab	Monthly
Minerals[1]	mg/l	Grab	Annually
Nitrogen (total TKN)	mg/l	Grab	Annually
Trace Elements			
Arsenic	ug/l	Grab	Semiannually
Boron	mg/l	Grab	Semiannually
Molybdenum	ug/l	Grab	Semiannually
Selenium	ug/l	Grab	Semiannually
Uranium	ug/l	Grab	Semiannually

1. Minerals to include: Major cations and anions sufficient for an ion balance and including at least the following: Calcium, Chloride, Magnesium, Nitrate, Sodium, Sulfate, TDS, pH.

Selenium Content in Eggs Monitoring

The best predictor of the probability of reproductive or hatchability effects in waterbirds has been shown to be the selenium content in eggs. The Management Committee will develop a sampling program to collect data on the selenium content in eggs, and perhaps other tissues or wetland organisms. Proper permits will be obtained before any collection.

Migrating Birds

Semi-monthly counts will be made of all birds using the project habitat. These counts will include migrants as well as permanent residents and breeding species. Counts will be taken by trained ornithologists thoroughly familiar with identification of all transient species.

Waterbird Disease Surveillance

The Demonstration Project will be monitored for sick or dead birds on a weekly basis from mid-May through October. If dead birds are discovered, carcasses will be submitted to the California Department of Fish and Game Wildlife Investigations Laboratory in Rancho Cordova for diagnosis. Upon diagnosis, assistance and advice of the Department will be sought. If sick or dead birds are discovered, monitoring will be increased. If a major outbreak occurs, ponds will be checked daily until 15 days after the end of the outbreak.

Wildlife Monitoring Reporting

A report of the wildlife monitoring program will be submitted with the annual report on February 1 of each year.

LITERATURE CITED

Barnum, D.A., and N.H. Euliss. 1991. Impacts of changing irrigation practices on waterfowl habitat use in the southern San Joaquin Valley, California. California Fish and Game Resource Publication 167. 77:10-21.

Bradford, D.F. 1992. Potential sites and mechanisms for creating wetland habitat in the southern San Joaquin Valley, California. California Department of Water Resources. Contract Number B-58423. 105 pp.

California Department of Fish and Game. 1968. Atriplex a cover plant for wildlife. Game Management Leaflet No. 11. The Resources Agency of California, Department of Fish and Game, 1416 9th Street, Sacramento, California 95814. 11 pp.

California Department of Water Resources. 1979. Evaporation from water surfaces in California. Bulletin No. 73-79. 163 pp.

California Waterfowl Association. 1992. Assessments of rice fields as habitats for ducks wintering in California. California Waterfowl Association, Sacramento, California. 14 pp.

Ermacoff, N. 1969. Marsh and habitat management practices at the Mendota Wildlife Area. Game Management Leaflet No. 12. California Department of Fish and Game, Sacramento, California. 11 pp.

Gibson, F. 1971. The breeding biology of the American Avocet (*Recurvirostra americana*) in central Oregon. The Condor 73:444-454.

Giroux, J.F. 1981. Use of artificial nesting waterfowl in southwest Alberta. The Journal of Wildlife Management 45:669-679.

Hamilton, R.B. 1975. Behavior of avocets and stilts. Ornithological Monographs. No. 17. 98 pp.

Kaminski, R.M., and H.H. Prince. 1981. Dabbling duck and aquatic macroinvertebrate responses to manipulated wetland habitat. The Journal of Wildlife Management 45:1-15.

Locke, L.N., and M. Friend. 1989. Avian botulism. Pages 83-93 *in* Field Guide to Wildlife

Diseases. M. Friend (Ed.). U.S. Department of the Interior, Fish and Wildlife Service, Resource Publication 167.

Rigney, M., and T. Rigney. 1981. A breeding bird survey of the south San Francisco Bay salt pond levee system. Members of the South Bay Institute for Avian Studies. 130 pp.

Steel, N.L.C., and D.F. Bradford. 1991. Habitats, siting, and management of potential wetlands in the southern San Joaquin Valley, California. ESF Report No. 91-07. California Department of Water Resources. Contract Number B-57610. 53 pp.

PERSONAL COMMUNICATIONS

Marsh and Upland Habitat Management

Barnum, Doug. 1992. Wetland habitat management in the Tulare Basin. Memorandum to Joy Winckel, Assistant Environmental Contaminates Coordinator, Fish and Wildlife Enhancement, Sacramento Filed Office. Unpublished Data. USFWS, Northern Prairie Wildlife Research Center, %Kern NWR, P.O. Box 670, Delano, California 93216. (805) 725-2767.

Beam, John. CDFG, Los Banos Wildlife Management Area, 18110 West Henry Miller Ave., Los Banos, California 93635. (209) 826-0463.

Blake, Don (Pete). CDFG, Upper Butte Basin Wildlife Management Area, %Gray Lodge WMA, Gridley, California (916) 982-2169.

Brueggeman, Steve. CDFG, Mendota Wildlife Management Area, 4333 Santa Fe Grade Road, Mendota, CA 93640 (209) 655-4645.

Charmley, Tom. USFWS, Kern NWR, P.O. Box 670, Delano, California 93216. (805) 725-2767.

Connelly, Dan. CDFG, Headquarters Office, 1416 9th Street, Sacramento, California 95813. (916) 653-7664.

Flores, Bob. USFWS, Kern NWR, P.O. Box 670, Delano, California 93216. (805) 725-2767.

Huddleson, Bob. CDFG, Mendota Wildlife Management Area, 4333 Santa Fe Grade Road, Mendota, CA 93640 (209) 655-4645.

McLandress, Robert. California Waterfowl Association, 4630 Northgate Blvd., Suite 150, Sacramento, CA 95834. (800) 927-3825 or (916) 648-1406.

Oring, Lewis. University of Nevada, Ecology, Evolution and Conservation Biology/186, 1000 Valley Road, Reno, NV 89512-0013. (702) 784-4439.

Reid, Fritz. Ducks Unlimited, 9823 Old Winery Place, # 16, Sacramento, CA 95827. (916) 363-8257.

Rigney, Mike. Coyote Creek Riparian Station, Box 1027, Alviso, CA 95002. (408) 262-9204.

Rollins, Glen. CDFG, Headquarters Office, 1416 9th Street, Sacramento, California 95814. (916) 653-1768.

Smith, Dave. CDFG, Wildlife Management Division, 1416 9th Street, Sacramento, CA 95814. (916) 653-1768.

Smith, Ed. CDFG, Region 4 Headquarters, 1234 East Shaw Ave., Fresno, California 93710. (209) 222-3761.

Avian Botulism

Friend, Milton. USFWS, National Wildlife Health Research Center, Madison, Wisconsin 53711. (608) 271-4640.

Rocke, Toni. USFWS, National Wildlife Health Research Center, Madison, Wisconsin 53711. (608) 271-4640.

APPENDIX A: LIST OF TERRESTRIAL VERTEBRATE SPECIES EXPECTED TO OCCUR UNDER THE PRESENT CONDITIONS IN SECTION 16, WESTLAKE FARMS, INC.

CLASS: AMPHIBIA

ORDER: SALIENTIA (Frogs and Toads)

FAMILY: BUFONIDAE (True Toads)
Western Toad, (Bufo boreas)

CLASS: REPTILIA

ORDER: SQUAMATA (Lizards and Snakes)

SUBORDER: SAURIA (Lizards)

FAMILY: IGUANIDAE (Iguanids)
Western Fence Lizard, (Sceloporus occidentalis)
Side-blotched Lizard, (Uta stansburiana)

FAMILY: TEIIDAE (Whiptails and Relatives)
Western Whiptail, (Cnemidophorus tigris)

SUBORDER: SERPENTES (Snakes)

FAMILY: COLUBRIDAE (Colubrids)
Glossy Snake, (Arizona elegans)
Gopher Snake, (Pituophis melanoleucus)
Common Kingsnake, (Lampropeltis getulus)
Long-nosed Snake, (Rhinocheilus lecontei)

FAMILY: VIPERIDAE (Vipers)
Western Rattlesnake, (Crotalus viridis)

CLASS: AVES

ORDER: PODICIPEDIFORMES (Grebes)

FAMILY: PODICIPEDIDAE (Grebes)
Pied-billed Grebe, (Podilymbus podiceps)

ORDER: PELECANIFORMES (Tropicbirds, Pelicans, and Relatives)

FAMILY: PHALACROCORACIDAE (Cormorants)
Double-crested Cormorant, (Phalacrocorax auritus)

ORDER: CICONIIFORMES (Herons, Storks, Ibises, and Relatives)

FAMILY: ARDEIDAE (Herons and Bitterns)
Great Blue Heron, (Ardea herodias)
Great Egret, (Casmerodius albus)
Snowy Egret, (Egretta thula)
Cattle Egret, (Bubulcus ibis)
Green-backed Heron, (Butorides striatus)
Black-crowned Night Heron, (Nycticorax nycticorax)

ORDER: ANSERIFORMES (Screamers, Ducks, and Relatives)

FAMILY: ANATIDAE (Swans, Geese, and Ducks)
Green-winged Teal, (Anas crecca)
Mallard, (Anas platyrhynchos)
Northern Pintail, (Anas acuta)
Cinnamon Teal, (Anas cyanoptera)
Northern Shoveler, (Anas clypeata)
Gadwall, (Anas strepera)

ORDER: FALCONIFORMES (Vultures, Hawks, and Falcons)

FAMILY: CATHARTIDAE (American Vultures)
Turkey Vulture, (Cathartes aura)

FAMILY: ACCIPITRIDAE (Hawks, Old World Vultures, and Harriers)
Black-shouldered Kite, (Elanus caeruleus)
Northern Harrier, (Circus cyaneus)
Swainson's Hawk, (Buteo swainsoni)
Red-tailed Hawk, (Buteo jamaicensis)
Ferruginous Hawk, (Buteo regalis)
Rough-legged Hawk, (Buteo lagopus)
Golden Eagle, (Aquila chrysaetos)

FAMILY: FALCONIDAE (Caracaras and Falcons)
American Kestrel, (Falco sparverius)
Merlin, (Falco columbarius)
Peregrine Falcon, (Falco peregrinus)
Prairie Falcon, (Falco mexicanus)

ORDER: GALLIFORMES (Megapodes, Curassows, Pheasants, and Relatives)

FAMILY: PHASIANIDAE (Quails, Pheasants, and Relatives)
Ring-necked Pheasant, (Phasianus colchicus)

ORDER: GRUIFORMES (Cranes, Rails, and Relatives)

FAMILY: RALLIDAE (Rails, Gallinules, and Coots)
American Coot, (Fulica americana)

FAMILY: GRUIDAE (Cranes)
Sandhill Crane, (Grus canadensis)

ORDER: CHARADRIIFORMES (Shorebirds, Gulls, and Relatives)

FAMILY: CHARADRIIDAE (Plovers and Relatives)
Black-bellied Plover, (Pluvialis squatarola)
Killdeer, (Charadrius vociferus)
Mountain Plover, (Charadrius montanus)

FAMILY: RECURVIROSTRIDAE (Avocets and Stilts)
Black-necked Stilt, (Himantopus mexicanus)
American Avocet, (Recurvirostra americana)

FAMILY: SCOLOPACIDAE (Sandpipers and Relatives)
Greater Yellowlegs, (Tringa melanoleuca)
Lesser Yellowlegs, (Tringa flavipes)
Whimbrel, (Numenius phaeopus)
Long-billed Curlew, (Numenius americanus)

FAMILY: LARIDAE (Gulls and Terns)
Bonaparte's Gull, (Larus philadelphia)
Ring-billed Gull, (Larus delawarensis)
California Gull, (Larus californicus)
Herring Gull, (Larus argentatus)
Caspian Tern, (Sterna caspia)
Forster's Tern, (Sterna forsteri)

ORDER: COLUMBIFORMES (Pigeons and Doves)

FAMILY: COLUMBIDAE (Pigeons and Doves)
Rock Dove, (Columba livia)
Mourning Dove, (Zenaida macroura)

ORDER: STRIGIFORMES (Owls)

FAMILY: TYTONIDAE (Barn Owls)
Barn Owl, (Tyto alba)

FAMILY: STRIGIDAE (Typical Owls)
Great Horned Owl, (Bubo virginianus)
Burrowing Owl, (Athene cunicularia)

ORDER: CAPRIMULGIFORMES (Goatsuckers and Relatives)

FAMILY: CAPRIMULGIDAE (Goatsuckers)
Lesser Nighthawk, (Chordeiles acutipennis)
Common Poor-will, (Phalaenoptilus nuttallii)

ORDER: PASSERIFORMES (Perching Birds)

FAMILY: TYRANNIDAE (Tyrant Flycatchers)
Black Phoebe, (Sayornis nigricans)
Say's Phoebe, (Sayornis saya)
Western Kingbird, (Tyrannus verticalis)

FAMILY: ALAUDIDAE (Larks)
Horned Lark, (Eremophila alpestris)

FAMILY: HIRUNDINIDAE (Swallows)
Tree Swallow, (Tachycineta bicolor)
Violet-green Swallow, (Tachycineta thalassina)
Northern Rough-winged Swallow, (Stelgidopteryx serripennis)
Cliff Swallow, (Hirundo pyrrhonota)
Barn Swallow, (Hirundo rustica)

FAMILY: CORVIDAE (Jays, Magpies, and Crows)
American Crow, (Corvus brachyrhynchos)
Common Raven, (Corvus corax)

FAMILY: TROGLODYTIDAE (Wrens)
Rock Wren (Salpinctes obsoletus)

FAMILY: MOTACILLIDAE (Wagtails and Pipits)
American Pipit, (Anthus rubescens)

FAMILY: LANIIDAE (Shrikes)
Loggerhead Shrike, (Lanius ludovicianus)

FAMILY: STURNIDAE (Starlings)
European Starling, (Sturnus vulgaris)

FAMILY: EMBERIZIDAE (Wood Warblers, Sparrows, Blackbirds, and Relatives)
Savannah Sparrow, (Passerculus sandwichensis)
Song Sparrow, (Melospiza melodia)
White-crowned Sparrow, (Zonotrichia leucophrys)
Red-winged Blackbird, (Agelaius phoeniceus)
Tricolored Blackbird, (Agelaius tricolor)
Western Meadowlark, (Sturnella neglecta)
Yellow-headed Blackbird, (Xanthocephalus xanthocephalus)
Brewer's Blackbird, (Euphagus cyanocephalus)
Brown-headed Cowbird, (Molothrus ater)

FAMILY: FRINGILLIDAE (Finches)
House Finch, (Carpodacus mexicanus)
American Goldfinch, (Carduelis tristis)

FAMILY: PASSERIDAE (Weaver Finches)
House Sparrow, (Passer domesticus)

CLASS: MAMMALIA

ORDER: MARSUPIALIA (Opossums, Kangaroos, and Relatives)

FAMILY: DIDELPHIIDAE (Opossums)

Appendix B: Waterbird Populations in Section 16, Westlake Farms, Inc.

	1993				
Species	Mar.04	Mar.13	Mar.31	Apr.19	May 04
Great Egret			4	3	2
Snowy Egret		3		1	2
Green–winged Teal			12	3	
Mallard	12	2	37	70	
Northern Pintail		4	65	65	
Blue–winged Teal				2	
Cinnamon Teal	4	12	47	176	
Northern Shoveler			344	660	
Gadwall		4	28	42	
American Wigeon					
American Coot			2	4	
Black–bellied Plover				20	
Semipalmated Plover				14	
Killdeer			2		
Black–necked Stilt			74	80	
American Avocet		6	213	330	2
Greater Yellowlegs			116	8	
Lesser Yellowlegs			2	1	
Whimbrel				2500	
Western Sandpiper			1200	13600	
Least Sandpiper	3	250	850		
Dunlin	1		1800	470	
Dowitcher sp.				8	
Ring–billed Gull			18	22	
Herring Gull		5			
Caspian Tern			4	5	
Forster's Tern				1	
TOTAL	20	286	4818	18085	6

APPENDIX B

INCREMENTAL ANALYSIS

KAWEAH RIVER BASIN
INVESTIGATION
DRAFT EIS/EIR

INCREMENTAL ANALYSIS

KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA

Page

1.0 Purpose 606

2.0 Environmental Values 607
2.1 Kaweah Reservoir 607
2.2 Downstream Area 608
2.3 Tulare Lakebed 608

3.0 Project Impacts 609

4.0 Compensation Objectives 610

5.0 Compensation Habitat Sites 611
5.1 Reservoir Area/Riparian Scrub Compensation 612
Riparian Scrub Site #A 612
Riparian Scrub Site #B 612
Riparian Scrub Site #C 613

5.2 Downstream Area/Riparian Forest, Oak Woodland/Savannah Compensation 613
Riparian Forest, Oak Woodland/Savanna Site #D 613
Riparian Forest, Oak Woodland/Savanna Site #E 614

5.3 Tulare Lakebed/Wetlands Compensation 614
Tulare Lakebed Wetlands Site #F 615
Tulare Lakebed Wetlands Site #G 615

6.0 Compensation Strategy Increments 615
Riparian Scrub Compensation Increments A-E 617
Riparian Forest, Oak Woodland/Savanna Compensation Increments A-E 618
Tulare Lakebed Wetlands Compensation Increments A-E 618

7.0 Mitigation Comparisons and Cost Effectiveness 619

8.0 Summary and Recommendations 622

List of Tables

Table 1 Project Effects, HSIs, and HUs Lost 610
Table 2 Riparian Scrub Compensation Increments 1-5 617
Table 3 Riparian Forest, Oak Woodland/Savannah Compensation Increments 1-5 618
Table 4 Tulare Lakebed Wetlands Compensation Increments 1-5 618
Table 5 Mitigation Comparisons Riparian Scrub 619
Table 6 Mitigation Comparisons Riparian Forest, Oak Woodland/Savannah . . . 620
Table 7 Mitigation Comparisons Tulare Lakebed Wetlands 620
Table 5A Cost Comparison for Riparian Scrub Compensation 621
Table 6A Cost Comparison for Riparian Forest, Oak Woodland/Savannah Compensation 621
Table 7A Cost Comparison for Tulare Lakebed Compensation 622
Table 8A Cost-Effective Least-Cost Combinations with Incremental Analysis for Riparian Scrub Habitat 624
Table 8B Cost-Effective Least-Cost Combinations with Incremental Analysis for Riparian Forest, Oak Woodland/Savannah Habitat 624
Table 8C Cost-Effective Least-Cost Combinations with Incremental Analysis for Wetlands Habitat 625
Table 9A Combinations for Final Incremental Analysis for Riparian Scrub Habitat. 625
Table 9B Combinations for Final Incremental Analysis for Riparian Forest, Oak Woodland/Savannah Habitat 625
Table 9c Combinations for Final Incremental Analysis for Wetlands 625
Table 10 Recommended Increment Combination for Compensation 629

List of Figures

Figure 1 Kaweah Riparian Scrub Combinations for Final Incremental Analysis . 626
Figure 2 Kaweah Riparian Forest Oak Woodland/Savannah Combinations for Final Incremental Analysis 627
Figure 3 Kaweah Wetlands Combinations for Final Incremental Analysis 628

1.0 Purpose

The purpose of the incremental analysis is to evaluate mitigation alternatives to compensate for adverse project effects to biological resources resulting from the Kaweah River Basin Investigation. By applying the findings of this analysis, the project proponents propose to compensate for these adverse effects in the most cost-effective manner.

Guidance for developing this incremental cost analysis comes from Engineer Regulations 1105-2-100 and 1105-2-50, Engineer Circular 1105-2-185 and the Institute for Water Resources Report 94-PS-2. The goal of this analysis is to develop, through the economic justification of mitigation alternatives, the "least-cost plan" that still fully compensates for project impacts. The analysis is a two-step process. First, a cost-effectiveness analysis is done to ensure that the least-cost solution is identified for each possible level of environmental mitigation output. This step eliminates economically inefficient and ineffective mitigation solutions. Second, an incremental cost analysis of the least-cost solutions is done to show changes in costs for increasing levels of environmental mitigation output. This second step is termed "justifying the last-added increment of mitigation effort."

The environmental output analysis is based on habitat evaluation procedures (HEP) which defines the relationship between increasing habitat value with each increase in compensation increment features and increases in environmental output. The analysis then compares successive environmental outputs and associated incremental increases in costs. Compensation measures (increments) for each significant habitat are then combined to show their cumulative increase in environmental output and cost. Combinations of increments are developed for each habitat that approximate the habitat value replacement goal developed during the HEP. Each grouping of compensation measures for each habitat type is then combined with other habitat-specific increments to become mitigation proposals for one or more proposed mitigation sites, each of which is habitat specific. Decisions can then be made on selecting the proposal(s) that compensate for adverse effects while being cost effective and incrementally justified.

Under the provisions of the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service has prepared a coordination act report (CAR) that includes the HEP analysis for this project. The purpose of the CAR is to assess project effects to biological resources in the project area. This incremental analysis reflects the findings of the HEP report and incorporates the mitigation strategy developed by the HEP team that identifies the important biological resources that should be

included in the analysis. Also, a major purpose of this incremental analysis is documenting the "steps" taken in identifying mitigation alternatives and developing a recommended compensation plan. The incremental analysis helps ensure compliance with the statutory requirements of the coordination act and agency regulations, both of which state that the project proponents give full consideration to Federal and State agency comments and recommendations resulting from resource agency consultation.

2.0 Environmental Values

Environmental resources in the project area occur in three distinct regions of the study area. The regions are the Kaweah Reservoir, Downstream Area, and the Tulare Lakebed.

2.1 The Kaweah Reservoir. The Kaweah Reservoir area includes oak woodland, oak savannah, grassland, riparian scrub, and riparian forest habitats. The oak woodlands and savannahs are made up of live and blue oaks and exist on all sides of the reservoir and at all elevations above the gross pool elevation of 694 feet, mean sea level (m.s.l.). Denser oak forests exist on the north-facing slopes and along the drainages of south-facing slopes. Outside of the drainages, the vegetation on the south facing slopes of Lake Kaweah is sparser due to the hotter, drier conditions.

Most of the riparian vegetation at Lake Kaweah exists below the present gross pool level. Within the reservoir inundation area, the riparian vegetation is mostly riparian scrub-shrub. The scrub-shrub habitat is composed of willows and scattered buttonbush. Along the Kaweah River and the tributaries feeding the reservoir, there are some well-developed stands of riparian forest consisting of black willow, black cottonwood, Fremont cottonwood, and California sycamore. Cattails occur in some pools along the channels and along the streambanks.

The grassland habitat is composed of a mixture of wild oats, pine bluegrass, California needlegrass, foxtail brome, soft chess, common foxtail, red-stem filarea, and six-weeks fescue. Aside from the riparian scrub-shrub habitat, the repeated annual cycle of inundation and exposure precludes a significant perennial plant cover below the gross pool elevation. Some common broadleaf plant species that are present in the inundation area are stork's-bill and the common cocklebur. Some plant communities surrounding Lake Kaweah, particularly on the northeast side are frequently disturbed or degraded due to cattle grazing.

A variety of wildlife depend on these habitats in and around Lake Kaweah. Species include mule deer, raccoon, bobcat, gray fox, badger and muskrat. Birds include western meadowlark, acorn woodpecker, grebes, and red-shafted flicker. For an additional discussion of wildlife species in the area, see the vegetation and

wildlife section of the Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

2.2 Downstream Area. Habitat in the downstream area includes riparian forest, agriculture, valley oak woodland, valley oak riparian, and willow scrub. Typical riparian plant species, dominated by willow, cottonwood, and sycamore, are found downstream of Terminus Dam. Cattails and other emergent vegetation also occur along the channel banks. As the Kaweah River branches onto the San Joaquin Valley floor, the abundance and density of the riparian vegetation lessen due to the influence of agricultural encroachment and urban development, becoming sparse or absent as the river divides into various distributaries approaching the Tulare lakebed.

Land uses downstream of Terminus Dam are tied very closely to agriculture. Generally, much of the narrow zone of agricultural land between Lake Kaweah and Visalia is planted in citrus and deciduous fruit orchards interspersed with mixed vegetable crops. Small areas of native grassland communities are scattered among the non-native grassland which dominates most of the grassland habitat within the project area (KASCO, 1993).

The downstream area still supports some significant remnants of valley oak woodland, valley oak riparian, mixed riparian, and willow scrub habitats. Valley oak riparian communities consist of riparian forest species, with valley oak dominating the canopy. This habitat is found only in California's Central Valley. Valley oak woodland communities are typically found in drier areas and are characterized by having a relatively open canopy cover. The canopy of mixed riparian forest is dominated by western sycamore and Fremont cottonwood. Mixed riparian forest habitat is found scattered throughout many areas downstream of Terminus Dam, but is usually confined to a thin strip of vegetation immediately adjacent to a watercourse. Remnants of Great Valley willow scrub habitat are also found along the river and stream channels. This community consists of a variety of willow species, as well as Fremont cottonwood, California rose, and California wild grape (KASCO, 1993).

Wildlife in the downstream area relies on these habitat types. Mammals using the riparian corridor include beaver, river otter, mule deer ringtail, mink California vole, and long-tailed weasel. Many bird species inhabit the downstream area. Species include western bluebird, California towhee, black-headed grosbeak, northern oriole, common yellowthroat, red-shouldered hawk, and Cooper's hawk. Various amphibians and reptiles also inhabit the downstream area.

2.3 Tulare Lakebed. The historic permanent and seasonal wetlands of the Tulare lakebed and surrounding areas have been replaced with agricultural fields, floodwater detention basins, evaporation ponds, private duck-hunting clubs, and

State and Federal wildlife refuges. Currently, the Tulare lakebed is exclusively in agricultural production. There is semi-permanently flooded habitat in the lakebed in the Hacienda and Wilbur floodwater storage areas. The flood storage areas total about 21,000 acres with a combined capacity of about 100,000 acre-feet. No substantial native vegetation remains in the lakebed proper due to extensive areas of cultivation, which flood occasionally during major precipitation and snowmelt flood events.

During the winter and spring months, the Tulare lakebed is intermittently flooded by rains and snowmelt flooding from the Kings, Kern, Tule, and Kaweah Rivers. Generally, floodflows from these rivers flow into the lakebed and are then directed to the flood detention areas first until the flood detention areas reach capacity. Then specific agricultural areas or "cells" are flooded in the lakebed.

The wildlife that depends on habitats at the Tulare lakebed include migratory waterfowl, shorebirds, and other waterbirds of the Pacific Flyway. Species include mallard, pintail, cinnamon teal, shoveler, ruddy duck, western grebes, white-faced ibis, snowy plover, long-billed curlew, killdeer, least sandpiper, long-billed dowitcher, Caspian, black and Forester's terns, great, snowy and cattle egrets, black-crowned night-heron, and red-winged blackbirds. Large colonies of black-necked stilts and American avocets are among the most abundant species, representing about 50 to 70 percent of all breeding birds in the area (FWS, 1994).

3.0 Project Impacts

Project impacts were determined by using a HEP, analysis which is a habitat-based evaluation methodology developed for use in impact assessment and mitigation planning. A HEP analysis is based on the assumption that the value of a habitat for selected species or the value of a community can be described in a model which produces a Habitat Suitability Index (HSI). This HSI value (from 0.0 to 1.0) is multiplied by the area of available habitat to obtain Habitat Units (HUs). The HUs over the life of the project are then used in the following 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, various project-related effects can be quantified. This information can also be used for mitigation planning to identify compensation needs. The HUs used for analysis in this report represent the total habitat value and total habitat value replaced over the entire project life. Additional information on the HEP and associated HSI models used for this project are in the draft CAR, Appendix A. Project-related effects, HSIs and HUs lost are presented in Table 1. The project effects in Table 1 would be the same for the NED plan and the locally preferred plan. Additional information on project effects can be found in Chapter 4 of the DEIS/EIR.

4.0 Compensation Objectives

According to ER1105-2-100, the first step in mitigation planning is to avoid effects if possible and then to minimize adverse effects through design modifications. For those project effects that are unavoidable, the compensation objective is to fully restore lost habitat values through reasonable and justifiable in-kind, on site replacement.

The mitigation strategy or objective for this project is te fully replace the habitat values lost due to project implementation. Compensation objectives include in-kind replacement of 551 HUs of riparian scrub, riparian forest, oak savannah/woodland, and wetlands. These compensation objectives would be the same for the tentatively selected plan and the locally preferred plan. The compensation objective includes wetlands which are to be "fully mitigated" through actions to avoid, minimize, and compensate for unavoidable losses to meet the goal of no net loss of wetlands (Water Resources Development Act of 1990, Section 307 (a); ER1105-2-100, paragraph 7-35g). The transitory riparian/oak upland habitats characteristic of the reservoir area support ecologically important and diverse array of species that depend on both wetland riparian and upland habitats. There is biological value associated with these transitional habitats as part of the larger ecosystem of the reservoir. Therefore, the entire ecosystem was considered when determining the mitigation objectives.

Table 1. Project Impacts, HSIs and HUs Lost.

Habitat	Acres Lost/Degraded	Baseline HSI	HUs Lost*
Reservoir - Riparian scrub	93	.87	18
Riparian Forest	70	.96	11
Oak Savannah	132	.95	125
Oak Woodland	38	.81	31
Lakebed - Wetlands	1,412	1.0	366
TOTAL	1,745		551

* Numbers rounded

In accordance with ER1105-2-100, project lands (lands required for authorized project purposes) are considered for mitigation purposes first, followed by public lands (lands owned or otherwise legally entrusted to a local, State or Federal agency), and then private lands. For the this project, project lands were

considered for mitigation when biologically feasible. Three sites were considered for riparian scrub-shrub mitigation including reservoir lands. Two sites were considered for riparian forest and oak woodland/savannah compensation, and two sites were considered for Tulare lakebed mitigation. The compensation areas are discussed in the following section.

5.0 Mitigation Sites

Seven compensation sites were considered for this analysis. These sites are described on pages 6 through 9. When selecting possible mitigation sites, the following key factors were considered:

a. recommendations of the HEP team, whose site selection criteria included finding sites that could provide the habitat lost as close as possible to the site of impact.

b. recommendations from Kaweah Delta Water Conservation District (KDWCD), the non-Federal sponsor which included locating mitigation lands within their service area, if possible.

c. preference for using sites that were disturbed or sites without optimal habitat value.

d. economy of mitigating on as few sites as possible to reduce the overall mitigation costs.

These considerations, especially the different habitat types with their different biological requirements, dictated choosing three distinctly different types of mitigation sites. First, selection of a site close to water and with similar habitat nearby, was the only way to meet the goal of replacing 18 HUs of riparian scrub habitat. Next, a site with a combination of upland and near water area was the only way to meet the goal of replacing 11 HUs of riparian forest, 125 HUs of oak savannah, and 31 HUs of oak woodland habitat. Finally, an area suitable for wetland compensation close to the area of impact and close to a water source and/or water delivery system was the only way to replace 366 HUs of wetland habitat.

The existing habitat values of the potential mitigation sites were considered along with the predicted future conditions at the site. Typically, if an area currently has a low habitat value such as agriculture or grazing land, and is reestablished as a riparian or upland area, the habitat value increases dramatically for the evaluation species. This situation gives the highest return for mitigation effort. Conversely, an area that already exhibits high habitat value for the evaluation species, would show little increase in habitat value even with the

introduction of compensation efforts.

For each of the compensation sites, baseline HSI values were determined for the existing habitat value at the site using HEP-based models. The baseline HSIs are shown in Table 1. Then the ability of the site to support the proposed compensation increments was judged by assessing water availability, soil types, human or other use of the area, and any factors that would infringe on the ability of the site to support the mitigation effort for the life of the project. Finally, using existing baseline HSI values, the increase in HSI value due to the compensation increments was determined by analyzing the increase over time of the habitat value of the site after mitigating compared to existing HSI values before mitigating.

5.1 Reservoir Area/Riparian Scrub Compensation.

Riparian Scrub Site A. This site (21 acres) would be located on existing project lands around Lake Kaweah. As previously stated, existing project lands are preferred by the Corps for use as compensation sites. Often the FWS prefers these sites as well due to the close proximity to the affected areas. Currently, the Corps owns land surrounding the existing reservoir. If the proposed project is constructed, about 600 acres around the new gross pool elevation would be purchased in fee or easement. Although these lands have been considered unsuitable for oak woodland/savannah compensation (see discussion in Chapter 4, section 4.10.3 in the EIS/EIR), suitable lands do exist to replace riparian scrub habitat. Suitable areas in the reservoir area were determined by observations of the location and inundation frequencies of existing riparian scrub vegetation.

Generally, riparian scrub vegetation is located within swales throughout the upper reservoir inundation zones and on some flatter areas within the reservoir between elevations 50 feet and 650 feet, m.s.l. Both areas, when not completely inundated, appear to have good localized moisture retention characteristics. Therefore, the best areas for willow scrub compensation would generally be at the higher elevations such as Greasy Creek (3 acres) and the campground and surrounding area near Horse Creek (18 acres). The Greasy Creek site would have to be fenced to keep cattle out of the area. There are no land costs associated with this site because these lands are already being purchased as part of the project.

Riparian Scrub Site B. This site was selected from a recent study prepared for the city of Visalia and KDWCD entitled "Kaweah River Delta Corridor Enhancement Study", 1993. This study evaluated the environmental restoration potential of a number of sites along the Kaweah and St. Johns Rivers downstream of Terminus Dam. The site selected for riparian scrub mitigation is located north of the lower Kaweah River and immediately east of Road 188. The site consists of 40 acres and is referred to as the Lindsey Strathmore Irrigation District (LSID)

Northeast site. There is a small but significant area of riparian vegetation just west of the railroad tracks. Species include cottonwoods, valley willows, elderberry, and arroyo willow. The lower Kaweah River along the north bank supports western sycamores, cottonwoods, valley willows, Oregon ash and white alder. Riparian scrub compensation would be done adjacent to the existing riparian vegetation. The entire parcel is disturbed due to cattle grazing. This site might be available for sale. The total land costs for this site would be about $120,000.

Riparian Scrub Site C. This site is located along the north bank of the St. Johns River about 4,000 feet downstream of its juncture with the Kaweah River at McKays Point. This site is currently used for sand and gravel extraction by the Kaweah River Rock Company. The site does support some significant stands of willow/cottonwood riparian forest and freshwater emergent marsh in areas where open pits have been excavated below the water table. Most of these areas would be inundated by water if present water removal (by pumping) is stopped. The gravel mining operations at this site are scheduled to be discontinued within the next few years. This area would be suitable for riparian scrub mitigation (30 acres). However, soil and water quality testing would need to be done prior to any use as a compensation area. Restoration responsibilities of the mining operators would need to be determined and implemented prior to use of this area as mitigation. The total land costs for this site would be about $17,400.

5.2 Downstream Area/Riparian Forest, Oak Woodland/Savannah Compensation.

Riparian Forest, Oak Woodland/Savanna Site D. This site was selected from a recent study prepared for the city of Visalia and KDWCD entitled "Kaweah River Delta Corridor Enhancement Study", 1993. This study evaluated the environmental restoration potential of a number of sites along the Kaweah and St. Johns Rivers downstream of Terminus Dam. Two adjacent sites were selected for riparian forest and oak woodland/savannah compensation. The two sites total about 440 acres.

The sites are referred to as LSID Southwest and LSID Northwest. The LSID Southwest site is bounded by the Kaweah River to the north and the Consolidated Peoples Ditch to the south. This site extends from the Santa Fe Railroad track near Yokohl Creek to Exeter Blvd. The LSID-Northwest site is bounded to the south by the Kaweah River and partially to the northwest by Road 188. Together the sites form 440 acres of disturbed grazing land with scattered valley oaks and narrow riparian areas along the Kaweah River. Species include valley oak, western sycamores, Fremont cottonwoods, valley willows, arroyo willow, red willow, and Oregon ash. Significant riparian corridor expansion and oak tree regeneration opportunities are available at this site. The total land costs for this site would be about $880,000.

Riparian Forest, Oak Woodland/Savanna Site E. This site is a combination of two sites. The first is located next to the St. Johns River and is the Kaweah River Rock site previously discussed. The Kaweah River Rock site is 260 acres and is currently disturbed from by extraction. However, the site does support some significant stands of willow/cottonwood riparian forest and freshwater emergent marsh in the areas where open pits have been excavated below the water table. Most of these areas would be inundated by water if pumping to remove the water is stopped. The gravel mining operations are scheduled to be discontinued within the next few years. This site would be suitable for riparian forest mitigation. Due to the highly disturbed land surfaces, oak woodland and/or oak savannah compensation could only be done after grading, recontouring, and adding topsoil. Restoration responsibilities of the mining operators would need to be determined and implemented prior to any mitigation activities.

The purchase of the Kaweah River Rock site may not be successful because the operation is owned by three different owners and it may be difficult to reach an agreement to sell. Additionally, any improvements to the existing habitats at the site from Kaweah River Rock's reclamation plan would affect the "gains" from the compensation increments.

The second site, referred to as the Kaweah Oaks West site, is also part of the "Kaweah River Delta Corridor Enhancement Study". The site is located between Deep Creek and the Tulare Irrigation District canal, directly north of Highway 198. It covers about 150 acres, a portion of which is within the Kaweah Oak Preserve. The majority of the site is agricultural lands and rural residences. The natural lands in the Kaweah Oaks West site consist of extensive valley oak riparian woodland and a large area of non-native grassland. The forest canopy along Deep Creek has historically been very dense and currently ranges from dense to fairly open. Species include valley oak and western sycamore, cottonwoods, Oregon ash, and large willows. The agricultural portion of this site is planted in permanent crops, primarily deciduous fruit and walnuts. The total land costs for this site would be about $690,000.

5.3 Tulare Lakebed/Wetlands Compensation. Two general mitigation scenarios were developed as a result of the HEP analysis for this area. The first scenario included acquiring an area of about 1,200 acres and flooding it at shallow depths for 45 days each year. The second scenario included acquiring an area of about 366 acres and flooding it at shallow depths for 152 days each year. A cost analysis was done for both scenarios using the various compensation increments. Costs for the first scenario ranged from $20 million to $25 million. Additionally, predicted outputs (HUs) were determined for the two scenarios. The first scenario was considered cost prohibitive since the outputs were low when compared to the costs. The costs for the first scenario were higher due to the increased acreage

and water needed, and the outputs were low because 45 days of flooding would not provide successful sustained shorebird mitigation. Therefore, to simplify the analysis and reduce plan combinations, the first scenario was dropped from further consideration.

Tulare Lakebed Wetlands Site F. This site is located 3 miles southeast of the Kern National Wildlife Refuge (NWR) in an area of active and inactive duck clubs called the Kern-Wasco area. The clubs are grouped near Poso Creek between Corcoran Road and Gun Club Road. Poso Creek extends from the Friant-Kern Canal to the Kern NWR. There are at least 3 active duck clubs in the area, El Cinco, Santura and Los Alamos with at least 10 different inactive parcels that are potentially available for purchase. The active duck clubs are currently managed primarily to provide habitat for wintering ducks during the hunting season, with flooding from September to October until about February. This site is about 370 acres of marginal farmland. The site does have a well on it, but it may not be in working condition. A long-term source of uncontaminated water would have to be secured for this site. The total land costs for this site would be about $555,000.

Tulare Lakebed Wetlands Site G. This site is located within KDWCD boundaries in Kings County between Highway 43 and the Santa Fe Railroad, south of Lansing Avenue. Guernsey Slough and Lakeside Ditch run through this 370 acre parcel. This site is available and has working wells. Currently, the site is in agricultural production. The total land costs for this site would be about $740,000.

6.0 Compensation Strategy Increments

According to ER 1105-2-100, a management/compensation plan increment consists of one or more management features. Plan increments may interrelate and complement one another, but they cannot be functionally dependent upon another increment. Low intensity, medium-low intensity, medium intensity, medium-high intensity, and high intensity plan increments were developed for each site. These plan increments are made up of one or more management features.

Compensation increments were developed for use in comparing the increase in HSI values (environmental output) at each potential mitigation site from an increase in habitat value with each increment's additional mitigation features. When deciding on an increment strategy, the following items were considered:

- Five increments provide a full range of planning possibilities for mitigation from little compensation to a logical maximum level of effort while keeping the number of possible measure combinations manageable.

- Each of the five increments can stand alone as a possible mitigation

measure.

- Combining more features into each successive increment is logical since each increment incorporated the previous increment's mitigation features to add its cumulative increase in habitat value.

- Combining compensation features into the five increments and then tailoring the increments to each habitat type being compensated allows the analysis to show the HU gain specific to that habitat.

The cost of each mitigation increment at each site was then calculated based on the combined costs of its mitigation features multiplied by the mitigation site acreage. Each site's compensation costs were then compared by increment with costs of the other mitigation sites. This comparison allows an analysis of each mitigation increment's cost compared to its increase in HSI values between sites. Combinations of increments that approximate the habitat value gain described in the HEP for a particular habitat were then combined with increments from other habitat types. These combinations were then used to identify the most cost-effective combination of incremental measures for a particular level of environmental output.

As a final analysis, the last added increment of mitigation was analyzed for successive outputs and incremental costs of combined measures (increments) to justify the recommended mitigation strategy of increment combinations. The combination of increments and their environmental output determines the potential mitigation sites that will be recommended and helps decide the overall mitigation plan for the project. Compensation increments with varying compensation features were developed for each of the main habitat types affected by project work.

Specific criteria were developed for each habitat type (riparian scrub, riparian forest, oak woodland/savannah, and Tulare lakebed wetlands) to ensure the success of the medium-low to the high intensity compensation increments. These criteria remained constant throughout the analysis and are essential to the long-term biological success of the compensation. Costs for the criteria listed below are included in the planting costs of each increment.

- Riparian scrub-shrub - mulching and/or weed fabric, plant survival success criteria of not more than 30 percent mortality in the first 2 years.

- Riparian forest, oak woodland/savannah - screen cages, weed fabric, plant survival success criteria of not more than 30 percent mortality for the first 2 years, oak-detailed maintenance plan with remedial measures flexible to the requirements of the site, specific oak planting requirements are detailed in the CAR, Appendix A.

- Tulare lakebed wetlands - yearly water, water supply free of contaminates, cover will not exceed 20 percent iodine bush, periodic maintenance for cattails and levees when pond is dry, excavation for perimeter dike and water control structures for water recirculation.

The compensation increments, costs, and outputs by habitat type are shown in the following tables.

Table 2. Riparian Scrub Compensation Increments 1-5.

Compensation Increments	Description
Increment 1 - Low Intensity	Land acquisition, fence entire site, remove cattle grazing, natural revegetation would occur over time.
Increment 2 - Medium-low Intensity	Land acquisition, fence entire site, remove cattle grazing, plant pole cuttings (black willow, 177 per acre).
Increment 3 - Medium Intensity	Land acquisition, fence entire site, remove cattle grazing, plant pole cuttings (black willow, 177 per acre), irrigation (pumping from lake), monitoring for 3 years.
Increment 4 - Medium-high Intensity	Land acquisition, fence entire site, remove cattle grazing, plant pole cuttings (black willow, 350 per acre), irrigation (pump from lake), monitoring for 6 years.
Increment 5 - High Intensity	Land acquisition, fence entire site, remove cattle grazing, plant nursery stock (black willow, 500 per acre), irrigation (well), monitoring 10 years.

Table 3. Riparian Forest, Oak Woodland/Savanna Compensation Increments 1-5.

Compensation Increments	Description
Increment 1 - Low Intensity	Land acquisition, fence entire site, remove cattle grazing, natural revegetation would occur over time.
Increment 2 - Medium-low Intensity	Land acquisition, fence entire site, remove cattle grazing, planting* (riparian and oak species).
Increment 3 - Medium Intensity	Land acquisition, fence entire site, remove cattle grazing, planting* (riparian and oak species), grading for overland flooding (channel about 200 ft long by 10 ft wide) to connect with existing sloughs, supplemental summer irrigation, monitoring for 3 years.
Increment 4 - Medium-high Intensity	Land acquisition, fence entire site, remove cattle grazing, planting** (riparian and oak species), grading for overland flooding channel about 200 ft long by 10 ft wide) and grade existing sloughs, supplemental summer irrigation, monitoring 6 years.
Increment 5 - High Intensity	Land acquisition, fence entire site, remove cattle grazing, planting** (riparian and oak species), grading for overland flooding (channel about 200 ft long by 20 ft wide) grade existing sloughs and create new slough channels at higher ground, supplemental year round irrigation, monitoring 10 years.

Planting schemes - * = riparian - 141 plants per acre, oak woodland - 78 acorns and seedlings per acre, oak savannah - 33 acorns and seedlings per acre ** = riparian - 300 plants per acre, oak woodland - 160 acorns and seedlings per acre, oak savannah - 75 acorns and seedlings per acre. All planting schemes include 30 percent plant mortality.

Table 4. Tulare Lakebed Wetlands Compensation Plan Increments 1-5.

Compensation Increments	Description
Increment 1 - Low Intensity	Land acquisition, apply surface water (1,130 acre-ft) for 152 days each year from February to July.
Increment 2 - Medium-low Intensity	Land acquisition, apply surface water (1,130 acre-ft) for 152 days each year from Feb. to July, construct 5 islands per 100 acres and border dikes to divide the site into three 20- to 150-acre "checks" for shorebird habitat.
Increment 3 - Medium Intensity	Land acquisition, apply surface or well water (1,130 acre-ft) for 152 days each year from Feb. to July, construct 10 islands per 100 acres and border dikes to divide the site into five 20- to 150- acre "checks" for shorebird habitat, monitoring for 3 years.
Increment 4 - Medium-high Intensity	Land acquisition, apply surface or well water (1,130 acre-ft) for 152 days each year from Feb. to July, construct 15 islands per 100 acres and border dikes to divide the site into seven 20- to 150- acre "checks" for shorebird habitat, monitoring 6 years.
Increment 5 - High Intensity	Land acquisition, apply surface or well water (1,130 acre-ft) for 152 days each year from Feb. to July, construct 20 islands per 100 acres and border dikes to divide the site into nine 20- to 150- acre "checks" for shorebird habitat, monitoring 10 years.

7.0 Mitigation Comparisons and Cost Effectiveness

The HSI baseline (without management) and the HSI for the compensation increments (with management) are compared below in Tables 5, 6, and 7. The tables show the gain in HU's (HU gain = HU for increments with management - baseline HU) with each compensation increment. Habitat values are reported as the "number of HU's gained." The cost effectiveness of the compensation increments are compared with habitat values in Tables 5A, 6A, and 7A.

Table 5 Mitigation Comparisons Riparian Scrub (Compensation Objective 18 Hu's gained).

Site	Acreage	HSI w/o mgt	Increment 1		Increment 2		Increment 3	
			HSI w/mgt	HU Gain	HSI w/mgt	HU Gain	HSI w/mgt	HU Gain
A	21	0	0.3	6.3	0.5	10.5	.86	17.8
B	40	0	0.3	12	0.5	40.5	.86	34.4
C	30	0.8	0.8	0	0.8	0	.83	.9

Site	Acreage	HSI w/o mgt	Increment 4		Increment 5	
			HSI w/mgt	HU Gain	HSI w/mgt	HU Gain
A	21	0	.89	18.7	.89	18.7
B	40	0	.89	35.6	.89	35.6
C	30	.8	.85	1.5	.85	1.5

HSI = Habitat Suitable Index
HU = Habitat Units
HU Gain = Difference in HU's between increment and baseline conditions.

Table 6. Mitigation Comparisons Riparian Forest, Oak Woodland, and Oak Savannah (Compensation Objective 167 HU's gained).

Site	Acreage	HSI w/o mgt	Increment 1 HSI w/mgt	Increment 1 HU Gain	Increment 2 HSI w/mgt	Increment 2 HU Gain	Increment 3 HSI w/mgt	Increment 3 HU Gain
A	440	0.50	0.6	44	0.7	88	0.88	167.2
B	410	0.50	0.56	24.6	0.58	32.8	0.75	102

Site	Acreage	HSI w/o mgt	Increment 4 HSI w/mgt	Increment 4 HU Gain	Increment 5 HSI w/mgt	Increment 5 HU Gain
A	440	0.50	0.93	189.2	0.98	211.2
B	410	0.50	0.83	135.3	0.90	164

HSI = Habitat Suitability Index
HU = Habitat Units
HU Gain = Difference in HU's between increment and baseline conditions

Table 7. Mitigation Comparisons Tulare Lakebed Wetlands (Compensation Objective 366 HU's gained).

Site	Acreage	HSI w/o mgt	Increment 1 HSI w/mgt	Increment 1 HU Gain	Increment 2 HSI w/mgt	Increment 2 HU Gain	Increment 3 HSI w/mgt	Increment 3 HU Gain
A	370	0.13	0.5	136.9	0.65	192.4	0.8	247.9
B	366	0	0.5	183	0.65	237.9	0.8	292.8

Site	Acreage	HSI w/o mgt	Increment 4 HSI w/mgt	Increment 4 HU Gain	Increment 5 HSI w/mgt	Increment 5 HU Gain
A	370	0.13	1.0	321.9	1.0	321.9
B	366	0	1.0	366	1.0	366

HSI = Habitat Suitability Index
HU = Habitat Units
HU Gain = Difference in HU's between increment and baseline conditions

Table 5-A. Cost Comparison for Riparian Scrub-Shrub Compensation (Compensation Goal - 18 HUs gained).

Site	Increment 1			Increment 2			Increment 3		
	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$
A	6.3	$5,079	$32,000	10.5	$9,809	$103,000	17.8	$9,606	$171,000
B	12	$27,500	$330,000	40.5	$11,488	$465,300	34.4	$16,549	$569,300
C	0	0	$274,400	0	0	$328,800	0.9	$460,555	$414,500

Site	Increment 4			Increment 5		
	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$
A	18.7	$15,508	$290,000	18.7	$25,882	$484,000
B	35.6	$22,036	$784,500	35.6	$30,926	$1,101,000
C	1.5	$386,666	$580,000	1.5	$502,766	$754,150

Table 6-A. Cost Comparison for Riparian Forest, Oak Woodland/Savannah Compensation (Compensation Goal - 167 HUs gained).

Site	Increment 1			Increment 2			Increment 3		
	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$
D	44	$22,272	$980,000	88	$15,754	$1,386,380	167.2	$8,704	$1,455,450
E	24.6	$35,365	$870,000	32.8	$41,681	$1,367,150	102	$14,325	$1,461,150

Site	Increment 4			Increment 5		
	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$
D	189.2	$10,691	$2,022,775	211.2	$12,148	$2,565,754
E	135.3	$14,936	$2,020,875	164	$15,633	$2,563,854

Table 7-A. Cost Comparison for Tulare Lakebed Wetlands Compensation (Compensation Goal - 366 HUs gained).

Site	Increment 1			Increment 2			Increment 3		
	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$
F	136.9	$42,023	$5,753,000	192.4	$35,369	$6,805,000	247.9	$28,245	$7,002,000
G	183	$32,448	$5,938,000	237.9	$28,573	$6,797,700	292.8	$23,685	$6,935,000

Site	Increment 4			Increment 5		
	HU Gain	Cost/HU Gain	Total $$	HU Gain	Cost/HU Gain	Total $$
F	321.9	$22,196	$7,145,000	321.9	$22,984	$7,398,600
G	366	$19,255	$7,047,400	366	$19,703	$7,211,500

8.0 Summary and Recommendations

The information in Tables 5A, 6A, and 7A was used in the software program, Automated Procedures for Conducting Cost Effectiveness and Incremental Cost Analysis (Beta Version 2.2). This software carries out the mechanical calculations necessary to conduct the cost effectiveness and incremental cost analyses for the evaluation of environmental mitigation plans. The results of this analysis are presented in this section.

The cost effectiveness analysis and incremental cost analysis compare the relevant changes in cost and environmental output upon which compensation decisions can be made. The compensation objective for this project is a total of 551 HUs made up of 18 HUs of riparian scrub habitat, 167 HUs of riparian forest, oak woodland/savannah, and 366 HUs of wetlands. Due to the variety of habitat types identified for mitigation at different locations in the study area, cost effectiveness analysis and incremental analysis were conducted separately for each habitat type.

The first step in the analysis was to identify management measures and various sizes or increments of the management measures. Then, all possible combinations of management measures (increment combinations) were calculated along with the cost and output of each combination. These initial possible combinations were

too numerous to display in this report. The possible combinations of management measures were then screened by using the following two criteria:

a. Least cost combinations for each level of output
b. Cost effective least cost combinations

The least cost combinations for each level of output step deletes those combinations that provide the same level of output as other plans, but at a higher cost. The cost effective least cost combinations step deletes all plans where a higher output level could be provided at less or equal cost by another plan.

Next the cost effective least cost combinations with incremental analysis were calculated. This step calculates the incremental cost, incremental output, and incremental cost per unit of advancing to each successive cost-effective output level. Tables 8 A-C display the cost effective least-cost combinations with incremental analysis data for riparian scrub, riparian forest, oak woodland/ savannah, and wetland habitats.

Tables 9A-C and Figures 1-3 show the combinations for final incremental analysis. The data in Tables 9A-C and Figures 1-3 are the remaining plans from Tables 8A-C after evaluating successive levels of output and the incremental costs beyond the general range of preceding costs. The data in Tables 9A-C were then evaluated to select a suggested compensation plan. The most economical combination that met the project mitigation objectives was considered along with the direction to "fully mitigate" for the loss of wetland habitat (Water Resources Development Act of 1990, Section 307(a); ER 1105-2-100 paragraph 7-35g). Therefore, the selected mitigation plan is A3+D3+G4. The mitigation plan is a combination of each of the habitat types. For riparian scrub habitat, A3 met the compensation goal of 18 HUs for an additional $139,000 over combination A1 which did not come close to meeting the compensation goal. The compensation goal for riparian forest, oak woodland/savannah habitat was met with the combination D3 which is also the most cost-effective combination. The only cost-effective combination in the final incremental analysis array for wetland compensation was increment G4. This combination also met the compensation goal. The selected compensation plan is shown in Table 10.

Table 8A. Cost-Effective Least-Cost Combinations with Incremental Analysis for Riparian Scrub Habitat (Compensation Goal - 18 HUs).

Increment Combinations	Total Costs ($)	Output (HU)	Incremental Cost ($)	Incremental Output	Incremental Cost ($) by Incremental Output
*A0 + D0 + G0	0	0.00	0	0.00	0.00
A1 + B0 + C0	32,000	6.30	32,000	6.30	5,079.37
A2 + B0 + C0	103,000	10.50	71,000	4.20	16,904.76
A3 + B0 + C0	171,000	17.80	68,000	7.30	9,315.07
A4 + B0 + C0	290,000	18.70	119,000	.90	132,222.22
A0 + B2 + C0	465,300	40.50	175,300	21.80	8,041.28

* The first letter represents the site, and the number represents the increment.

Table 8B. Cost-Effective Least-Cost Combinations with Incremental Analysis for Riparian Forest, Oak Woodland/ Savannah Habitat (Compensation Goal - 167 HUs).

Increment Combinations	Total Costs ($)	Output (HU)	Incremental Cost ($)	Incremental Output	Incremental Cost ($) by Incremental Output
D0 + E0	0	0.00	0	0.00	0.00
D0 + E1	870,000	24.60	870,000	24.60	35,365.85
D1 + E0	980,000	44.00	110,000	19.40	5,670.10
D2 + E0	1,386,380	88.00	406,380	44.00	9,235.91
D3 + E0	1,455,450	167.20	69,070	79.20	872.10
D4 + E0	2,022,775	189.20	567,325	22.00	25,787.50
D5 + E0	2,565,754	211.20	542,979	22.00	24,680.86

Table 8C. Cost-Effective Least-Cost Combinations with Incremental Analysis for Wetlands Habitat (Compensation Goal 366 - HUs).

Increment Combinations	Total Costs ($)	Output (HU)	Incremental Cost ($)	Incremental Output	Incremental Cost ($) by Incremental Output
F0 + G0	0	0.00	0	0.00	0.00
F1 + G0	5,753,000	136.90	5,753,000	136.90	42,023.37
F0 + G1	5,938,000	183.00	185,000	46.10	4,013.00
F0 + G2	6,797,700	237.90	859,700	54.90	15,659.91
F0 + G3	6,935,000	292.80	137,300	54.90	2,500.91
F0 + G4	7,047,400	366.00	112,400	73.20	1,535.52

Table 9A. Combinations for Final Incremental Analysis for Riparian Scrub Habitat (Compensation Goal - 18 HUs).

Increment Combinations	Total Costs ($)	Output (HU)	Incremental Cost ($)	Increment al Output	Incremental Cost ($) by Incremental Outp. t
A0 + B0 + C0	0	0.00	0	0.00	0.00
A1 + B0 + C0	32,000	6.30	32,000	6.30	5,079.37
A3 + B0 + C0	171,000	17.80	139,000	11.50	12,086.96
A0 + B2 + C0	465,300	40.50	294,300	22.70	12,964.76

Table 9B. Combinations for Final Incremental Analysis for Riparian Forest, Oak Woodland/Savannah Habitat (Compensation Goal - 167 HUs).

Increment Combinations	Total Costs ($)	Output (HU)	Incremental Cost ($)	Incremental Output	Incremental Cost ($) by Incremental Output
D0 + E0	0	0.00	0	0.00	0.00
D3 + E0	1,455,450	167.20	1,455,450	167.20	8,704.84
D5 + E0	2,565,754	211.20	1,110,304	44.00	25,234.18

Table 9C. Combinations for Final Incremental Analysis for Wetlands (Compensation Goal - 366 HUs).

Incremental Combinations	Total Costs ($)	Output (HU)	Incremental Cost ($)	Incremental Output	Incremental Cost ($) by Incremental Output
F0 + G0	0	0.00	0	0.00	0.00
F0 + G4	7,047,400	366.00	7,047,400	366.00	19,255.19

FIGURE 1

Kaweah Riparian Scrub
Combinations for Final Incremental Analysis

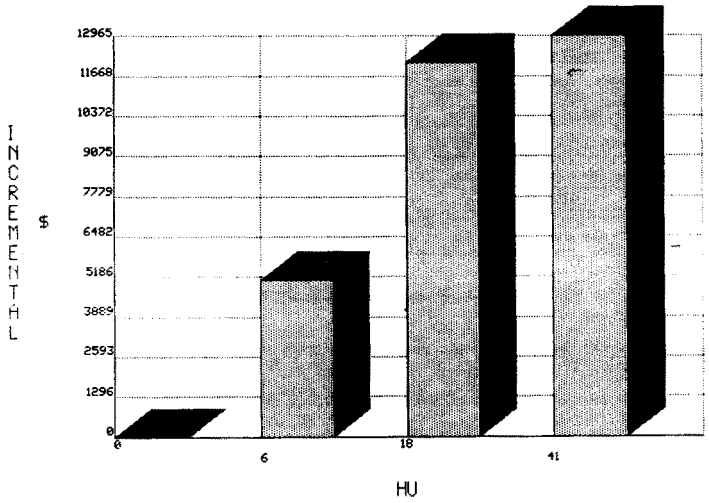


FIGURE 2

Kaweah Rip For/Oak
Combinations for Final Incremental Analysis

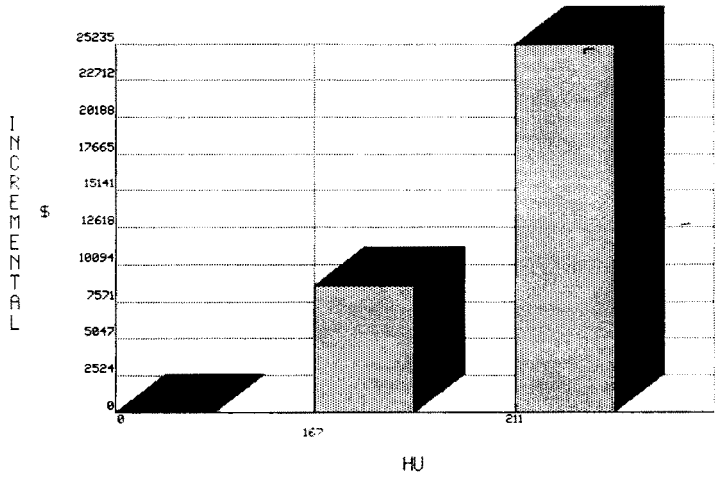


FIGURE 3

Kaweah Wetlands
Combinations for Final Incremental Analysis

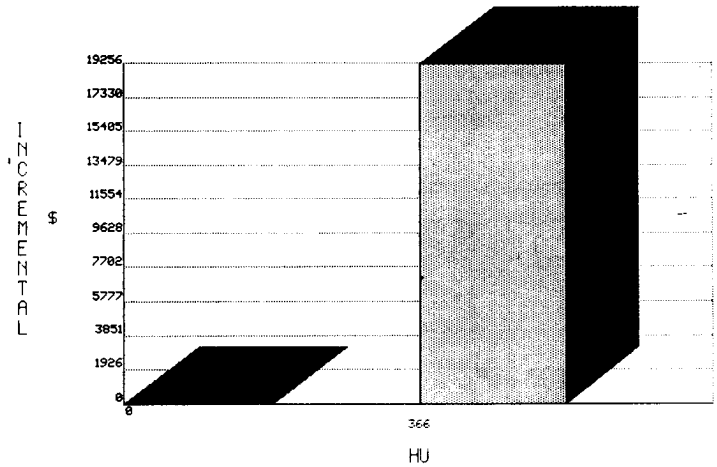


Table 10. Recommended Increment Combination for Compensation

Increment Combinations	Total Costs ($)	Total Habitat Units	Incremental Cost ($)	Incremental Output	Incremental Cost ($) by Incremental Output
A3* + D3* + G4*	8,673,850	551	8,673,850	551	15,742.01

A3 = A3 + B0 + C0; D3 = D3 + E0; G4 = F0 + G4

REFERENCES

Camp, Dresser, and McKee in association with KAS Consultants (KASCO). 1993. Kaweah River Delta Corridor Enhancement Study.

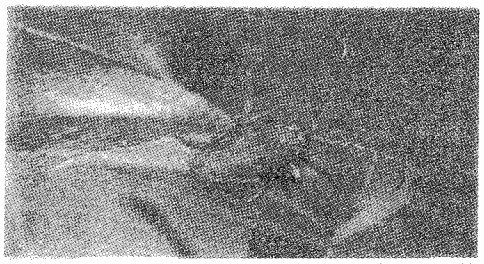
APPENDIX C

BIOLOGICAL DATA REPORT

KAWEAH RIVER BASIN
INVESTIGATION
DRAFT EIS/EIR

BIOLOGICAL DATA REPORT

KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA



Valley elderberry longhorn beetle (Richard A. Arnold)

California Jewelflower

U.S. Corps
of Engineers
Environmental Resources Branch
Sacramento District

February 1996

Biological Data Report
Kaweah River Basin Investigation

Table of Contents

1.0 Introduction 636
1.1 Purpose and Need 636
1.2 Project Area 637
1.3 Project Description 639
1.3.1 Background 639
1.3.2 Construction Alternatives 640

2.0 Methodology 642
2.1 Identification of Species of Special Concern 642
2.2 Literature Search 642
2.3 Surveys for Selected Species 643
2.3.1 Need and Purpose of Surveys 643
2.3.2 Selection of Species to Be Surveyed 643
2.3.3 List of Species to Be Surveyed 644
2.3.4 Field Surveys 645
2.4 Results and Uses of Surveys 645
2.5 Overview of Federally Listed Species 645
2.6 Overview of State Species of Special Concern 646

3.0 Species Accounts for Original Species 657
3.1 Federally Listed Species 657
3.1.1 Fish 657
DELTA SMELT 657
3.1.2 Reptiles 658
BLUNT-NOSED LEOPARD LIZARD 658
GIANT GARTER SNAKE 659
3.1.3 Birds 661
BALD EAGLE 661
3.1.4 Mammals 663
SAN JOAQUIN KIT FOX 663
TIPTON KANGAROO RAT 664
3.1.5 Invertebrates 666
VALLEY ELDERBERRY LONGHORN BEETLE 666
VERNAL POOL FAIRY SHRIMP 668
3.1.6 Plants 669
CALIFORNIA JEWELFLOWER 669

3.2 Federally Proposed Species 670
3.2.1 Fish 670
SACRAMENTO SPLITTAIL 670
3.2.2 Amphibians 671
CALIFORNIA RED-LEGGED FROG 671
3.2.3 Plants 673
HOOVER'S SPURGE 673
SPRINGVILLE CLARKIA 674
SAN JOAQUIN VALLEY ORCUTT GRASS 675
SAN JOAQUIN ADOBE SUNBURST 676
GREENE'S TUCTORIA 677

3.3 Federal Candidate Species 678
3.3.1 Fish 678
LONGFIN SMELT 678
KERN BROOK LAMPREY 679
3.3.2 Amphibians 681
CALIFORNIA TIGER SALAMANDER 681
WESTERN SPADEFOOT TOAD 682
FOOTHILL YELLOW-LEGGED FROG 683
MOUNT LYELL SALAMANDER 685
SOUTHWESTERN POND TURTLE 686
3.3.3 Birds 688
TRICOLORED BLACKBIRD 688
WHITE-FACED IBIS 689
MOUNTAIN PLOVER 690
WESTERN SNOWY PLOVER 691
3.3.4 Mammals 693
PACIFIC WESTERN BIG-EARED BAT 693
GREATER WESTERN MASTIFF-BAT 694
NELSON'S ANTELOPE GROUND SQUIRREL 694
SPOTTED BAT 696
SHORT-NOSED KANGAROO RAT 697
3.3.5 Invertebrates 698
CIERVO AEGIALIAN SCARAB BEETLE 698
SAN JOAQUIN TIGER BEETLE 699
DOYEN'S TRIGONOSCUTA DUNE WEEVIL 700
3.3.6 Plants 701
HEARTSCALE 701
BRITTLESCALE 702
LESSER SALTSCALE 702
LOST HILLS SALTBUSH 703
KAWEAH BRODIAEA 704

SLOUGH THISTLE 705
RECURVED LARKSPUR 706
SPINY-SEPALED COYOTE-THISTLE 707

3.4 Other Species of Concern 708
3.4.1 State-Listed Species 708
SWAINSON'S HAWK 708

4.0 Additional Listed and Proposed Species 710
4.1 Federally Listed Species 710
4.1.1 Fish 710
4.1.2 Birds 710
ALEUTIAN CANADA GOOSE 710
AMERICAN PEREGRINE FALCON 712
4.1.3 Mammals 713
GIANT KANGAROO RAT 713
FRESNO KANGAROO RAT 714
4.1.4 Plants 715
SAN BENITO EVENING-PRIMROSE 715
PALMATE-BRACTED BIRD'S-BEAK 716
HOOVER'S WOOLY-STAR 717
SAN JOAQUIN WOOLY-THREADS 718
4.2 Federally Proposed Species 719
4.2.1 Plants 719
MARIPOSA PUSSY-PAWS 719
HARTWEG'S GOLDEN SUNBURST 720
CARPENTERIA 721
FLESHY OWL'S CLOVER 722

5.0 Summary and Recommendations 723
5.1 Overview 723
5.2 Impacts of Alternatives 723
5.2.1 Alternative 1 (No-Action) 723
5.2.2 Alternative 2 (NED Plan) 723
5.2.3 Alternative 3 (Locally Preferred Plan) 724
5.3 Recommendations 725

6.0 Coordination 725

7.0 List of Preparers 726

8.0 Literature Cited 727

Tables

1. Summary of Endangered Species Potentially Occurring in the Project Area . 647

Figure

1. Study Area and Vicinity 638

Appendixes

A. Correspondence With U.S. Fish And Wildlife Service 746
B. Survey Report 764
C. Valley Elderberry Longhorn Beetle Mitigation Guidelines 787

Biological Data Report
Kaweah River Basin Investigation
Tulare, California

1.0 Introduction

1.1 Purpose and Need

This Biological Data Report was prepared for the Kaweah River Basin Investigation, California, project in compliance with Section 7(c) of the Endangered Species Act of 1973. This report describes the species of concern occurring in the general vicinity of those parts of the Kaweah reservoir system which are downstream of Terminus Dam along the Kaweah River, St. John's River, Cross Creek, and the Tulare lakebed. The project alternatives include modifications of the spillway at Terminus Dam at Lake Kaweah, Horse Creek bridge, and the existing bridge over the spillway, in order to provide flood protection and water supply.

The U.S. Fish and Wildlife Service (FWS) provided two lists dated January 30 and September 27, 1995, of Federally recognized species of concern which may occur within the proposed project area (Appendix A). The original January 30, 1995, letter listed 52 Federally recognized species. Of the total, nine are Federally listed species: threatened delta smelt, endangered blunt-nosed leopard lizard, threatened giant garter snake, endangered bald eagle, endangered San Joaquin kit fox, endangered Tipton kangaroo rat, threatened valley elderberry longhorn beetle, threatened vernal pool fairy shrimp, and endangered California jewelflower. Four species have been proposed for listing as endangered: California red-legged frog, San Joaquin Valley Orcutt grass, San Joaquin adobe sunburst, and Greene's tuctoria. Three species, Sacramento splittail, Hoover's spurge, and Springville clarkia, are proposed for listing as threatened.

The September 27 letter listed 16 additional Federally listed species: giant kangaroo rat, Fresno kangaroo rat, Aleutian Canada goose, American peregrine falcon, Paiute cutthroat trout, San Benito evening-primrose, palmate-bracted bird's-beak, Hoover's wooly-star, San Joaquin wooly-threads, and little Kern golden trout. Two species have been proposed for listing as endangered: Mariposa pussy-paws and Hartweg's golden sunburst. Two species, carpenteria and fleshy owl's clover, are proposed for listing as threatened.

The FWS's January letter also identified 36 Federally listed candidate species, and the September letter identified an additional 73 candidate species. Federal candidate species are assigned to one of two categories depending on the

current state of knowledge of the species and their biological appropriateness for listing. Federal category 1 candidate species include taxa for which substantial information has been compiled to support the appropriateness of proposing that the taxa be listed as endangered or threatened. Federal category 2 candidates include taxa for which sufficient information is available to indicate possible listings, but for which additional data are required on vulnerability and threats. Candidate species have no protection under the Endangered Species Act, but are included for consideration because it is possible that one or more of these candidates could be proposed and listed before the project is completed.

This biological data report includes the following information regarding the Federal and State species of concern: current legal status, distribution, habitat requirements, status of the populations in the proposed project area, possible reasons for endangerment, and analysis of the potential impact of the project alternatives on these species. This information is necessary to determine what mitigation measures might be required to avoid, minimize, or compensate for impacts to any of these listed species. Data on some of the candidate species are not yet generally available; therefore, information of these species is presented in less detail.

1.2 Project Area

The Kaweah River Basin project area is located in the southeast portion of the San Joaquin Valley, occupying portions of Tulare and Kings Counties, California (Figure 1). The Basin and supporting watershed stretch from an elevation of 12,500 feet, mean sea level (m.s.l.), in the Sierra Nevada, down the west slope of the Sierra foothills to the floor of the San Joaquin Valley, and ultimately into the Tulare lakebed. Bordered on the north and south by the Kings River and Tule River Basins, respectively, the Kaweah River Basin below Terminus Dam and exclusive of the Tulare lakebed covers an area of approximately 531 square miles. The region has a semi-arid Mediterranean climate of hot, dry summers and cool, wet winters. The Kaweah River is fed by rain and snow runoff with average annual runoff near Three Rivers of 406,100 acre-feet. The project area is divided into three reaches for descriptive and analytical purposes: the reservoir area which includes Terminus Dam and Lake Kaweah, the downstream area, and the Tulare lakebed. A general description of each area is provided below.

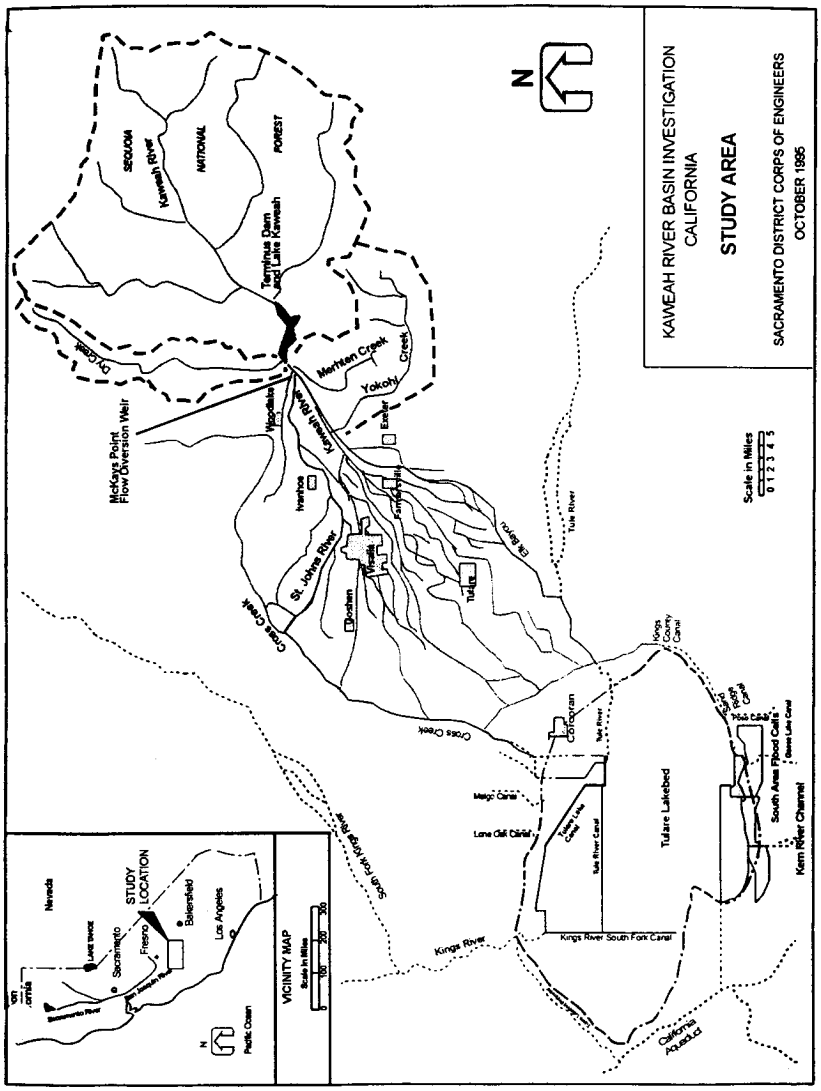

KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
STUDY AREA
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995
N
SEQUOIA
NATIONAL
FOREST
Kaweah River
Terminus Dam and Lake Kaweah
Dry Creek
Merhten Creek
Yokohl Creek
McKays Point Flow Diversion Weir
Woodlake
Exeter
Ivanhoe
Farmersville
Visalia
Tulare
St. Johns River
Cross Creek
Goshen
Elk Bayou
Tule River
Kings County Canal
Corcoran
Tule River
Tulare Lakebed
Kings River South Fork Canal
Kings River
South Fork Kings River
California Aqueduct
South Area Flood Cells
Kern River Channel
Scale in Miles
0 1 2 3 4 5
VICINITY MAP
Scale in Miles
0 100 200 300
STUDY LOCATION
Nevada
Sacramento
Fresno
Bakersfield
Los Angeles
Pacific Ocean

Figure 1

Terminus Dam and Lake Kaweah

Lake Kaweah is located on the main branch of the Kaweah River about 20 miles east of Visalia. Terminus Dam, built in 1962 by the U.S. Army Corps of Engineers, provides flood protection and irrigation water to downstream interests. The earthfill dam is 250 feet high and has a gross pool elevation of 694 feet, m.s.l., providing 143,000 acre-feet of storage capacity. Lake Kaweah inundates approximately 1,945 acres at maximum pool, floods nearly 5 miles of river, and varies from 700 to 9,000 feet wide.

Downstream Area

Downstream of Terminus Dam, the St. John's River divides from the Kaweah River at McKays Point. There are many other major and minor distributaries that divide south of McKays Point. The Kaweah River ceases to be an identifiable stream south of Highway 245, and the river branches into Mill Creek and other streams. The St. John's River turns into Cross Creek near Southern Pacific Railroad tracks north of Goshen. A few tributaries, such as Dry Creek and Yokohl Creek, enter the system and are tributary to the Kaweah and St. John's Rivers. As this system extends to the San Joaquin Valley floor, many more distributaries branch from the main river creating the effect of a delta. Some of the distributaries eventually reach the Tulare lakebed, and some do not.

The Tulare Lakebed

The Tulare lakebed is located in the southern part of the Central Valley about equally distant from the cities of Fresno and Bakersfield. Historically, the Tulare lakebed received all of the runoff from the Kaweah, Kern, Kings, and Tule Rivers. Because the lakebed lacked an outlet to the sea, in most years it acted as a sink, and at one time it was the largest body of water west of the Mississippi River.

1.3 Project Description

1.3.1 Background. The Kaweah River Basin Project, comprising Terminus Dam and Reservoir, was authorized by the Flood Control Act of 1944 (Public Law No. 534, 78th Congress, 2d Session). Construction was completed, and the reservoir began filling in 1962. The purposes of the project alternatives were flood control and water supply, primarily for agricultural irrigation.

The general authority for this investigation comes from the 1964 Congressional Resolution of the House Committee on Public Works. The presently proposed project's purposes are to increase flood protection and agricultural water supply storage.

1.3.2 Construction Alternatives

Alternative 1 (No Action). If Terminus Dam remains at its present size and no additional flood control projects are built in the area, the flood threat would continue to the city of Visalia and surrounding community and to the agricultural areas including the Tulare lakebed. Potential adverse effects would include loss of valuable agricultural production and damages to homes, businesses, and public facilities.

Alternative 2 (NED (National Economic Development) Plan). The Corps and the non-Federal sponsors are currently evaluating ways to enhance flood control below Terminus Dam at Lake Kaweah and provide additional water storage. The Kaweah River Basin Investigation, California, study evaluates flooding problems downstream of Terminus Dam along the Kaweah River, St. John's River, Cross Creek, and Tulare lakebed and includes the city of Visalia.

Alternative 2, the NED plan, would include raising and widening the spillway at Terminus Dam. The elevation of the spillway would be raised by 21 feet from 694 feet, m.s.l., to 715 feet, m.s.l. This would raise the gross pool by 21 feet and add 42,600 acre-feet of storage space in Lake Kaweah. As a result, the total flood storage capacity in the lake would increase from 143,000 acre-feet to 185,600 acre-feet.

The spillway would be widened from the existing 307 feet to 455 feet. An ungated concrete ogee section would be placed over the existing concrete broadcrested sill. Rock excavation would be required at the right and left abutments, with most of the excavation taking place on the left abutment. The excess material would be placed on the downstream face of the dam.

No new access roads would be required, and no existing access roads would be relocated. The existing bridge over the spillway would be lengthened by 140 feet to accommodate the widening of the spillway. This lengthening would involve adding two 70-foot concrete spans to the bridge.

To accommodate the rise in gross pool elevation, the existing State Highway 198 bridge over Horse Creek would be relocated immediately upstream of the existing bridge. Currently, the lowest elevation on the bridge is 711.5 feet, m.s.l. This bridge would be reconstructed at a new height of 718.5 feet, m.s.l. This is an increase of about 7 feet. The highway leading into and out of the bridge would also be raised, and the highway would be reconstructed for about 1,500 feet on each side. The structural design would be the same as the existing highway. The location of the bridge and highway would be slightly offset. During construction,

the existing bridge would be kept open and then demolished when the new bridge is complete and open to traffic.

The total land required for construction of the NED plan would be 618 acres. There are 243 acres in the reservoir area between 694 feet, m.s.l., and 715 feet, m.s.l., this area would not be cleared of vegetation before inundation. There are several structures that would need to be relocated due to the project. These structures would be entitled to relocation assistance benefits. The relocations include one motel and 6 dwellings.

Alternative 3 (Locally Preferred Plan). Alternative 3, the locally preferred plan, consists of raising and widening the spillway at Terminus Dam as described for Alternative 2. The structural components of the two alternatives are the same. However, Alternative 3 also changes the water control diagram and basin wetness parameter for Lake Kaweah.

The water control diagram shows the seasonal distribution of flood space and conservation space within the reservoir and describes the operational or release guidelines for the reservoir. Flood space is the space allotted within the reservoir for flood control to the downstream area while conservation space is the space allotted to irrigation water supply.

The basin wetness parameter is used as an index of soil moisture. The parameter is computed based on accumulated rainfall and associated soil conditions in the watershed. Soil moisture determines how much space is needed in the reservoir to store runoff.

Currently, the entire reservoir is used for flood control space during the flood season (mid-November to the end of the snowmelt season). The season is made up of two operation scenarios: rainflood operation and snowmelt operation. Rainflood operation begins in mid-November and extends to the end of April while the snowmelt operation begins on February 1 and ends at various times depending on yearly snowmelt conditions. During the rainflood season, the flood control space contains conditional space that can store carryover water based on the basin wetness parameter. Currently, the conditional rainflood space is 7,000 acre-feet, which means that based on the wetness parameter, up to 7,000 acre-feet can be stored in the reservoir during rainflood operation season. During the snowmelt season, the Corps coordinates with the watermaster to determine reservoir storage based on snowmelt forecasting for each season. When conditions warrant it, however, the entire reservoir may be emptied for flood control purposes at any time.

During the reservoir modeling for Alternative 3, the 30-year average storage in the reservoir during the rainflood season was determined to be 12,000 acre-feet. As a result, Alternative 3 was formulated to modify the current water control diagram and basin wetness parameter to store up to 12,000 acre-feet during the rainflood season. If necessary, the diagram would be modified in the future to allow for an inflow of sediment into the reservoir, but the revised wetness parameter would be a permanent addition to the diagram and would not be modified. When conditions warrant it, however, the entire reservoir would continue to be emptied for flood control purposed at any time.

2.0 Methodology

2.1 Identification of Species of Special Concern

In accordance with the Endangered Species Act, the Corps requested that the FWS identify endangered, threatened, proposed, and candidate species that might occur in the project area. As a result, the FWS provided the Corps with two lists dated January 30 and September 27, 1995, of endangered, threatened, and candidate species and species proposed for listing that may occur in the area of the Kaweah River Basin Investigation (Appendix A). The Corps also requested that FWS review three previous lists dated January 1, 1990, February 26, 1993, and November 3, 1993, to ensure consistency with the current list. The Corps is assuming that the January and September lists include all of the species that the Corps needs to evaluate for this study.

The FWS and California Department of Fish and Game (DFG) were contacted to obtain descriptions of habitat requirements for the special status species and to determine their presence or absence in the project area. The California Department of Water Resources (DWR) was also contacted to discuss the presence or absence of species in the project area.

2.2 Literature Search

Additional information for this report was obtained from several sources. First, the files of the Corps' Environmental Resources Branch contain information compiled from a variety of sources including books, journals, and various government publications. Files were obtained from FWS, DFG's Natural Heritage Division, and DFG's Wildlife Management Division, and a search of the Natural Diversity Data Base (NDDB) was done on June 23, 1995. Literature was also obtained from the library at the University of California, Davis.

2.3 Surveys for Selected Species

The original species listed in the January letter from FWS were used as the basis for the endangered species analysis and were considered in the selection of surveyed species. However, discussions of the additional listed and proposed species identified in the updated September letter are included in the BDR, but no additional surveys have been done. If analysis of potential effects on these additional species indicates that surveys are necessary, they would be done before project construction begins.

2.3.1 Need and Purpose of Surveys

The purpose of the field surveys is to evaluate the potential for adverse effects to any of the species from the modification of Terminus Dam and subsequent increased inundation associated with the modification of the dam.

2.3.2 Selection of Species to Be Surveyed

The Corps determined that it was not feasible to survey for all of the listed, proposed, and candidate species on FWS's list. As a result, the Corps developed specific selection criteria and evaluated the species to determine which species would be surveyed. These criteria included:

(1) whether suitable habitat exists in the project area
(2) historical and recent occurrence in the project area
(3) the potential for direct construction impact by the project alternatives
(4) current Federal and State status of species

Suitable habitat for each species was determined by reviewing available literature, historical records, historical and recent occurrences in the project area (NDDB), and conversations with local people with knowledge of the habitats and species in the project area. If no suitable habitat existed in the project area and there were no historical occurrences of a species in or near the project area, the species was not included in the survey list. If suitable habitat existed in the project area, there were no known occurrences of the species in or near the project area, and the current Federal status was proposed or listed, the species was included in the survey. The FWS was also consulted regarding the usefulness of previous surveys for the San Joaquin kit fox, blunt-nosed leopard lizard, tipton kangaroo rat, San Joaquin antelope squirrel (also known as Nelson's antelope ground squirrel), and the bald eagle. The FWS advised that additional surveys for these five species be conducted so they were included in the survey list.

Although suitable habitat may exist in the project area, direct effects from project alternatives are expected only at Terminus Dam, Horse Creek bridge, and around the reservoir. Species occurring downstream of the reservoir between Terminus Dam and the Tulare lakebed would not be directly affected by project alternatives.

The current Federal and State status of each species were also considered as part of the survey criteria. Federally listed and proposed species are protected under the Endangered Species Act. Candidate species have no protection under the Endangered Species Act, but are included since it is possible that one or more of these candidates could be proposed and listed before the project is completed. Endangered, threatened, and rare plants and animals have legal protection under the California Endangered Species Act of 1984 (section 2072.7) of the State of California Department of Fish and Game Code.

2.3.3 List of Species to Be Surveyed

Based on the selection criteria, the Corps determined that the following species needed to be surveyed to determine the presence or absence of the species and its habitat in the project area.

Listed Species

Blunt-nosed leopard lizard (*Gambelia silus*)
San Joaquin kit fox (*Vulpes macrotis mutica*)
Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*)
Valley elderberry longhorn beetle (*Desmocerus cliafornicus dimorphus*)
California jewelflower (*Caulanthus californicus*)

Proposed Species

Springville clarkia (*Clarkia springvillensis*)

Candidate Species

Southwestern pond turtle (*Clemmys marmorta pallida*)
Tricolored blackbird (*Agelaius tricolor*)
Heartscale (*Atriplex cordulata*)
Lost Hills saltbush (*Atriplex vallicola*)
Kaweah brodiaea (*Brodiaea insignis*)
Spiny-sepaled coyote-thistle (*Eryngium spinosepalum*)

2.3.4 Field Surveys

Initially, a literature search was done to determine the likelihood of these species occurring in the project area. In addition, local experts provided crucial information not available in the literature.

Based on the literature search and consultation with local experts, each species listed above was evaluated for its potential to occur in the project area and its likelihood of being adversely affected by project alternatives. When there was insufficient information to make these determinations, field surveys were performed. The following species required field surveys:

Valley elderberry longhorn beetle
Spiny-sepaled coyote-thistle
Kaweah brodiaea

Local experts were consulted, and known populations of both plant species were surveyed to familiarize surveyors with plant characteristics. Transects were then performed in portions of the project area where topographic and edaphic factors warranted, and the previously identified population was relocated and characterized. The shoreline of Lake Kaweah was surveyed by boat to located all potentially affected elderberry bushes. A telescoping survey rod was used to determine the relative location of the bushes to the existing high-water mark. Bushes that had the potential to be inundated were then characterized and investigated for valley elderberry longhorn beetle use. In addition, Horse Creek Bridge and the spillway and bridge on Terminus Dam were investigated by DWR for signs of use by bats, but none were found.

2.4 Results and Uses of Surveys

Based on the surveys and evaluation of occurrence and effects, only two listed species and five candidate species are likely to be affected by the project. A discussion of findings for each species and an analysis of the project's potential to affect each species are included in the survey report issued by DWR (Appendix B).

2.5 Overview of Federally Listed Species

The Corps asked the FWS to identify endangered, threatened, proposed, and candidate species that might occur in the Kaweah River project area. An overview of the species listed in the January letter is shown in Table 1. Proposed and candidate species are not provided the same level of protection under the Endangered Species Act as listed species, but the presence and possible impacts

to the proposed and candidate species were evaluated in case they are listed before the project is completed.

The FWS's original January letter identified nine listed species and seven proposed species that may be present in the project area. Of the nine listed species, five are listed endangered, and four are listed threatened. Of the seven species proposed for listing, four are proposed endangered, and three are proposed threatened.

Of the 36 candidate species, 12 are being surveyed. The 12 surveyed candidate species or their potential habitat may occur in the project area. The other candidate species were considered outside the project area, or there were no known occurrences in the project area. Ten candidate plant species are not included in this BDR because all known habitat and occurrences are in or near Sequoia National Park, which is outside the project area. These 10 species are Ramshaw sand-verbena, Bodie Hills rock-cress, Shirley Meadows mariposa, slough thistle, Pierpoint Springs liveforever, Kern River daisy, mouse buckwheat, Hockett Meadows lupine, DeDecker's lupine, and Sequoia gooseberry. However, if the status of any of these candidate species should change to proposed during construction, additional assessments would be prepared.

2.6 Overview of State Species of Special Concern

A search of the NDDB revealed that four State-listed species which are also Federally listed may occur in the project area. Three species are listed as endangered, and one is listed as threatened by the State. These species are the Tipton kangaroo rat, San Joaquin kit fox, blunt-nosed leopard lizard, and the plant Kaweah brodiaea. Another species listed as threatened by the State is the Swainson's hawk.

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area*

Common and Scientific Name	Federal/State Status*	Habitat Requirements	Distribution	Occurrence in the Study Area
MAMMALS				
San Joaquin kit fox *Vulpes macrotis mutica*	E/T	Annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub	San Joaquin Valley and portions of the Interior Coast Range	No documented occurrences; possible habitat within the study area
Tipton kangaroo rat *Dipodomys nitratoides nitratoides*	E/E	Alkaline sink communities with shrub vegetation and saltbush shrublands	Tulare Basin portion of San Joaquin Valley floor	The Tulare lakebed is the only portion of the study area that lies within the known range of the rat and could contain the required habitat characteristics
Pacific western big-eared bat *Plecotus townsendii townsendii*	C2/CSC	Caves, mine tunnels, and buildings for roosts	Throughout California	No documented occurrences in the project area
Greater western mastiff-bat *Eumops perotis californicus*	C2/--	Occurs in various 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 in the project area
Nelson's antelope ground squirrel *Ammospermophilus nelsoni*	C1/T	Scattered shrubs, annual forbs and grasses distributed over broken terrain with small gullies and washes	Western San Joaquin Valley including portions of eastern San Luis Obispo County	No documented occurrences; possible habitat may occur near Kaweah reservoir
Spotted bat *Euderma maculatum*	C2/--	Arid deserts and grasslands to mixed conifer forests and cliffs	Southern California, Nevada, New Mexico, Arizona	No documented occurrences in or near the project area

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
Short-nosed kangaroo rat *Dipodomys nitratoides brevinasus*	C1/--	Grassland and desert-shrub associations on friable soils.	Western side of San Joaquin Valley	No documented occurrences; possible habitat in study area around reservoir area
BIRDS				
bald eagle *Haliaeetus leucocephalus*	E/E	Coniferous forests within 1 mile of lakes, reservoirs, rivers, or creeks (nesting and roosting)	Nesting primarily in Lassen, Shasta, and Plumas Counties; winters in Klamath Basin, Sacramento and San Joaquin Valleys, and along some foothill streams	Surveys reveal this species is known to winter in the project area primarily around Lake Kaweah
tricolored blackbird *Agelaius tricolor*	C2/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	Surveys reveal this species is known to occur in the Tulare lakebed when habitat conditions are favorable
white-faced ibis *Plegadis chihi*	C2/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	Surveys reveal this species is known to occur in the Tulare lakebed and nest there when habitat conditions are favorable
mountain plover *Charadrius montanus*	C2/--	Grasslands and level fields with low, sparse vegetation	Winters along west side of Central Valley of California; southern Arizona, Texas to Central Mexico	Surveys reveal this species is known to winter in the San Joaquin Valley on the west side

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
Western snowy plover, interior population *Charadrius alexandrinus nivosus*	C2/CSC	Sandy marine and estuarine shores.	Beaches along coast. Inland nesting areas include Salton Sea, Mono Lake and other isolated shores or alkali lakes in northeastern CA, Central Valley and southeastern deserts	No documented occurrences in the project area; surveys reveal this small shore bird is an obligate salt water species known to use evaporation ponds in the vicinity of the Tulare lakebed
REPTILES				
Blunt-nosed leopard lizard *Gambelia silus*	E/E	Sparsely vegetated plains, alkali flats, low foothills, grasslands, canyon floors, large washes, and arroyos.	San Joaquin Valley and adjacent foothills southward and into eastern San Luis Obispo County	No documented occurrences in the project area; the nearest occurrence to Lake Kaweah is more that 60 miles away. The Tulare lakebed is the only portion of the project area that lies within the range of this species
Giant garter snake *Thamnophis gigas*	T/T	Marshy areas permanent fresh water; temporary water such as slough, irrigation canals, drainage ditches and flooded rice fields with tule, cattail, blackberry, mustard, thistles	Fresno, Merced, San Joaquin, Sacramento, Yolo, Butte, Sutter, and Solano Counties	No documented occurrences in or near the project area; possible habitat exists in project area downstream from Terminus Dam and along distributaries that reach the Tulare lakebed

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Names	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
AMPHIBIANS				
California red-legged frog *Rana aurora draytonii*	PE/CSC	Streamsides, grasslands, woodlands, and humid forests.	Northern California south into Baja California and west of the Cascade-Sierra crest.	No documented occurrences; Although once common in the San Joaquin Valley, this species has been eliminated from the majority of its range and is unlikely to occur in the project area
California tiger salamander *Ambystoma californiense*	C1/CSC	Inhabits underground burrows of other rodents and slow water environments	Central Valley north to Butte County and south to Kern County	No documented occurrences of this species in or near the project area
Western spadefoot toad *Scaphiopus hammondi*	C2	Underground burrows, ponds, dry mud cracks, grasslands with shallow temporary pools	Central Valley and adjacent foothills	No documented occurrences; possible habitat in the project area
Foothill yellow-legged frog *Rana boylii*	C2/CSC	Rocky streams in valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral and wet meadows	Coast Ranges from Oregon border south to Transverse Mts. Isolated population in Central Valley	This species historically occurred in the project area where Lake Kaweah now lies. This species is currently found only at high elevations in Sequoia National Park
Mount Lyell salamander *Hydromantes platycephalus*	C2/--	Rock areas in mixed conifer, red fir, lodgepole pine and subalpine habitats	Occurs only in the Sierra Nevada from Sierra County south to Tulare County	No documented occurrences of this species in or near the project area; possible habitat high in foothills above the Kaweah reservoir

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
Southwestern pond turtle *Clemmys marmorata pallida*	C2/--	Quiet water of ponds, lakes, streams, marshes, reservoirs. Hibernate in underwater bottom mud	Suitable aquatic habitat throughout California west of Sierra Cascade crest. Isolated populations along Mojave River and its tributaries	This species was not found in the project area. However, due to occurrence records in the vicinity and the opinion of local experts, it is likely that turtles occur in the lake and/or its tributaries near the lake
FISH				
Delta smelt *Hypomesus transpacificus*	T/T	Estuarine areas with salinities below 2 grams per liter; spawns in fresh water	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 records of occurrences in or near the project area
Sacramento splittail *Pogonichthys macrolepidotus*	PT	Inhabits slow-moving stretches of the Sacramento River and Delta and in small shallow sloughs and marshes.	Confined to lower delta region and in the main channel of the Sacramento River	No documented record of occurrences; possible habitat available downstream in Kaweah River
Longfin smelt *Spirinchus thaleichtys*	C2/--	Estuaries; spawns on rocks or aquatic plants	Pacific coast of North America from Prince William Sound south to the San Francisco Bay-Delta Estuary	No documented record of occurrences of this species in or near the project area

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
Kern brook lamprey *Lampetra hubbsi*	C2/-	Silty backwaters of large rivers in foothill regions, Larvae favor sand/mud substrate.	Lower reaches of Merced River, Kaweah River, Kings River, and San Joaquin River. Larvae found in Siphons of Friant-Kern Canal.	No documented record of occurrences of this species in or near the project area
INVERTEBRATES				
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	Surveys revealed that this species was not found in the project area, however, 5 elderberry shrubs exist in the area; two elderberry shrubs were located around Lake Kaweah with exit holes indicating use by beetles; three elderberry shrubs were located at the Horse Creek Bridge area of the project area
Vernal pool fairy shrimp *Branchinecta lynchi*	E/--	Ephemeral freshwater habitats including vernal pools and swales with clear to tea-colored water.	Grasslands of Central Valley Central Coast Mountains and South Coast Mountains	No documented record of occurrences of this species in or near the project area
Ciervo aegialian scarab beetle *Aegialia concinna*	C1/--	Usually found on sandy substrates and feeds on detritus. Specific habitat requirements and life history information unknown	Found in California at various locations including Contra Costa, Antioch, and Fresno Counties. Isolated occurrences at Monocline Ridge in San Benito Co. and Mendota in Fresno Co.	No documented record of occurrences of this species in or near the project area
San Joaquin tiger beetle *Cicindella tranquebarica*	C2/--	There is little information available at this time	No information available at this time	No documented record of occurrences of this species in or near the project area

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
Doyen's trigonoscuta dune weevil *Trigonoscuta doyeni*	C2/--	Sand inhabiting weevil in sand dunes	Kettleman City sand dunes in Kings County, California	No documented record of occurrences of this species in or near the project area
PLANTS				
California jewelflower *Caulanthus californicus*	E/E	Grassland and mixed grassland-scrub habitats on sandy soils	Santa Barbara County, San Luis Obispo County and Kern County	No documented occurrences of this species in or near the project area; this species is highly unlikely to occur in the project area since suitable habitat consists of sandy, grassland soils on the valley floor
Hoover's spurge *Chamaesyce hooveri*	PT/--	Occurs in large, deep vernal pools among the rolling hills, remnant alluvial fans and depositional stream terraces at the base of the Sierra Nevada Foothills.	Tehama, Butte, Glenn, Stanislaus, and Tulare Counties	No documented recorded occurrences of this species in or near the project area
Springville clarkia *Clarkia springvillensis*	PT	Chaparral, deciduous evergreen wood habitat types including granitic soils in openings in blue oak woodlands	Tulare County	Springville clarkia has no documented occurrences in the project area
San Joaquin Valley Orcutt grass *Orcuttia inaequalis*	PE/--	Vernal pools	Fresno, Madera and Merced Counties	No recorded occurrences of this species in the project area

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
San Joaquin adobe sunburst *Pseudobahia peirsonii*	PE/E	Heavy adobe clay soils where water retention properties are high. Non-native grassland and grassland-blue oak woodland ecotone	Southern Sacramento Valley and San Joaquin Valley of California	This species requires heavy adobe soils and is unlikely to occur in the project area based on consultation of Natural Resources Conservation Service soil survey maps that indicate no suitable habitat exists in the project area; a record search shows no known sightings near the project area
Greene's tuctoria *Tuctoria greenei*	PE/--	Vernal pools, valley and foothill grassland	Shasta, Tehama, Butte, Stanislaus, and Merced Counties	No recorded occurrences of this species in or near the project area
Heartscale *Atriplex cordulata*	C2/--	Grassland communities with hard, trampled, somewhat alkaline or saline soils	Central Valley of California	This species is an annual herb found in alkaline habitat on the valley floor. Survey reveal suitable habitat for this species potentially exists in the Tulare lakebed portion of the project area; there are no recorded occurrences for this species in the lakebed, but it does occur in the vicinity
Brittlescale *Atriplex depressa*	C2R/--	Alkaline or clay soils. Limited information available	Central Valley of California	Surveys revealed plant is not present; there are no recorded occurrences of this species in the lakebed, but it does occur in the vicinity
Lesser saltscale *Atriplex minuscula*	C2R/--	Alkaline plays	Fresno and Kern Counties	No documented occurrences; surveys revealed this plant not present

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area
Lost Hills Saltbush *Atriplex vallicola*	C2/--	Dried pools and in alkaline soils	Fresno, King, Kern, and San Luis Obispo Counties	No documented occurrences; surveys revealed this plant not present in the project area
Kaweah brodiaea *Brodiaea insignis*	C2/E	Foothill oak woodland, blue oak savannah and valley grassland plant communities. Heavy clay soil over granite on west-facing slopes	Kaweah and Tule River drainages of Tulare County, California	John Stebbins, botanical consultant, did not find this species when this site was previously surveyed. A new population of this species was discovered in May 1995 during surveys to relocate the spiny-sepaled coyote-thistle (Eryngium) population. Approximately five individual plants were located directly adjacent to the Eryngium population.
Recurved larkspur *Delphinium recurvatum*	C2/--	Poorly drained, fine, alkaline soils in grasslands	Glenn and Butte Counties from Contral Costa County south to Kern County	The survey revealed that the only portion of the project area with potentially suitable habitat is the Tulare lakebed; there are no documented records of this species in the project area, although there are numerous records in the vicinity

Table 1. Summary of Endangered Species Potentially Occurring in the Project Area Continued

Common and Scientific Name	Federal/State Status[1]	Habitat Requirements	Distribution	Occurrence in the Study Area[2]
Spiny-sepaled coyote-thistle *Eryngium spinosepalum*	C2/--	Vernal pools and valley grassland	Fresno, Stanislaus, and Tulare Counties	This species was identified at one location in the current project area during vegetation surveys performed by John Stabbins for the Department of Water Resources. Ground surveys in May 1995, relocated this population and showed that it was smaller, with approximately 50 plants versus 300 in 1989

[1] Species from list dated January 30, 1995

Federal:

E = Endangered
T = Threatened
PE = Proposed Endangered
PT = Proposed Threatened
C1 = Category 1: taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened
C2 = Category 2: taxa for which existing information may warrant listing, but for which substantial biological information to support a proposed rule is lacking
r = recommended for a particular status

State:

E = Endangered
T = Threatened
R = Rare
CSC = California Species of Concern

-- = no listing

Sources: Hickman 1993; Moyle and Herbold 1990; Moyle *et. al.* 1989; Moyle 1976; and FWS 1995

3.0 Species Accounts for Original Species

3.1 Federally Listed Species

3.1.1 Fish

DELTA SMELT (*Hypomesus transpacificus*)
Family: Osmeridae

Status: The Delta smelt is listed as a threatened species under the Endangered Species Act. In addition, it is a State candidate for threatened status.

Description: The delta smelt was described as follows by Moyle, et al. (1989): A slender-bodied fish typically 60 - 70 mm in standard length (SL), although a few may attain 120 mm SL. Live fish are nearly translucent and have a steely-blue sheen to their sides. Occasionally there may be one chromatophore between the mandibles, but usually none is present. Its mouth is small, with a maxilla that does not extend past the mid-point of the eye. The eyes are relatively large; the orbit width is contained about 3.5 - 4 times in the head length. Small pointed teeth are present in the upper and lower jaws. The first gill arch has 27 - 33 gill rakers and there are 7 branchiostegal rays. There are 9 - 10 dorsal fin rays, 8 pelvic fin rays, 10 - 12 pectoral fin rays, and 15 - 17 anal fin rays. The lateral line is incomplete and has 53 - 60 scales along it. There are 4 - 5 pyloric caeca.

Habitat: The Delta smelt spends most of its life in the shallow waters of the estuarian mixing zone where salinities range from 0 to 2 grams per thousand. However, the species spawns in fresh water at temperatures from about 7-15 degrees Celsius (°C). Most spawning occurs in the dead-end sloughs and shallow edge-waters of channels. Hard substrates such as rocks, gravel, tree roots, and submerged branches are necessary for eggs to attach to. Once hatched, the pelagic larvae return to the estuarian mixing zone where they feed on copepods, cladocerans, and amphipods (FWS, 1993).

Distribution: The delta smelt is endemic to the upper Sacramento-San Joaquin estuary in central California. Historically, it occurred from Suisun Bay upstream to the city of Sacramento on the Sacramento River and Mossdale on the San Joaquin River. Now, however, delta smelt are rare in Suisun Bay and more or less absent from Suisun Marsh where they once were common. Due to hydrology modifications (the shifting of the mixing zone), the delta smelt are now found mostly in the inferior habitat of the Sacramento River channel, upstream of Suisun Bay (Moyle, et al., 1992 in FWS, 1993).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences in or near the project area. The project area is significantly upstream of any likely area that the delta smelt would inhabit so it is unlikely that delta smelt would be present in the river near construction.

Project Impacts: No adverse impacts of Alternative 1 and 2 of the project are anticipated since the delta smelt would most likely occur downstream from any proposed work sites along the Kaweah River.

Endangerment: The decline of the Delta smelt has been attributed to modifications of Delta hydrology wrought by water diversions and flood control projects, coupled with competition from introduced nonindigenous aquatic species, and reduction in the abundance of important food organisms (FWS, 1993).

3.1.2 Reptiles

BLUNT-NOSED LEOPARD LIZARD (*Gambelia silus*)
Family: Iguanidae

Status: The blunt-nosed leopard lizard is Federally listed as endangered. The State also lists this species as endangered.

Description: This species is a large lizard with a long, round tail. Color above is grey or brown, with whitish crossbars on the back and tail. Dark blotches on the back and tail and a short, blunt snout give this species its common name. Breeding females have orange or reddish spots on the sides. Lengths from snout to vent in adults is 3 to 5 inches.

Habitat: It inhabits sparsely vegetated plains, alkali flats, low foothills, grasslands, canyon floors, large washes, and arroyos.

Distribution: The species was originally found throughout the San Joaquin Valley and adjacent foothills from about San Joaquin County southward and into eastern San Luis Obispo County.

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the blunt-nosed leopard lizard in the project area. This lizard inhabits sparsely vegetated plains, lower canyon slopes, valley floors, and washes. Vegetation may include types of grasses such as saltbush (*Atriplex* spp.), iodine bush (*Allenrolfea occidentalis*), and seepweed (*Suaeda fruticosa*). Suitable habitat for the blunt-nosed leopard lizard may exist in the upland areas around the Kaweah Reservoir although there are no historical sightings of the lizard at the reservoir. Suitable

habitat for this species may also exist downstream of the dam in upland areas throughout the Kaweah River system.

Because the lizard is a Federally listed endangered species, surveys were conducted by DWR to determine the presence or absence of the lizard and its habitat in the project area. The surveys revealed that the nearest known sighting of this species was in 1973 near the town of Ivanhoe, which is approximately 15 miles from Lake Kaweah.

Project Impacts: The Tulare lakebed is the only portion of the project area that would be in the range of the blunt-nosed leopard lizard. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of the project alternatives would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated. Since the locally preferred plan provides the same level of flood protection to the lakebed as the NED plan, no adverse effects to this species are anticipated.

Endangerment: Although there has been some progress towards recovery, primarily in the form of habitat protection, the trend of blunt-nosed leopard lizard populations is unknown. Urbanization and agricultural development have eliminated nearly all leopard lizard habitat in the San Joaquin Valley. Of the wildlife habitat remaining in the San Joaquin Valley in 1976, 228,000 acres were identified as leopard lizard habitat. By April 1980, this habitat had been reduced to 158,000 acres. The blunt-nosed leopard lizard now occurs in scattered locations in the valley and in the eastern portions of the coast ranges, including the Antelope and Carrizo Plains and Cuyama Valley.

GIANT GARTER SNAKE (*Thamnophis gigas*)
Family: Thamnophis

Status: The giant garter snake (GGS) is a currently listed as threatened by both the Federal and State governments.

Description: *T. gigas* is one of the largest garter snakes, reaching up to 4.5 ft in length. It is dull brown in color with a checkered pattern of well separated black spots on the back. It has a dull yellow dorsal stripe and lateral stripes that are not developed. Its head is elongated with a pointed muzzle (DFG, 1980).

Habitat: *T. gigas* generally inhabit marshy areas near permanent fresh water but will also inhabit marsh areas with temporary water such as sloughs, irrigation canals, drainage ditches, and flooded rice fields. Garter snake habitats usually

contain tule, cattail, blackberry, mustard, various thistles and annual and perennial grasses (NDDB, 1995). This vegetation, along with the burrows of rodents and crayfish, provides shelter from predation (Hansen, 1986).

T. gigas is an aquatic feeder that specializes in ambushing fish underwater. It generally feeds on small fish such as carp (*Cyprinus carpio*), bullhead (*Ictalurus* sp.), mosquitofish (*Gambusia affinis*), and minnows. It will also feed on the larvae and young of the Bullfrog (*Rana catesbeiana*) (Hansen, 1986).

During the active season from March to June, the giant garter snake must bask in sunny expanses of emergent or streamside vegetation in order to raise its body temperature. In the dormant season accessible upland retreats with suitable shelter are necessary during periods of flooding or runoff (Hansen, 1986).

Distribution: Historically, the range of the giant garter snake was the Central Valley from the vicinity of Sacramento and Antioch southward to Buena Vista Lake near Bakersfield in Kern County (Hansen and Brode, 1980).

The reclamation of wetlands for agriculture has destroyed much of the original habitat. *T. gigas* currently inhabits marshlands around sloughs, irrigation and drainage ditches, canals, streams, and lakes in Fresno, Merced, San Joaquin, Sacramento, Yolo, Butte, Sutter and Solano Counties (Hansen, 1986).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the giant garter snake in or near the project area. However, the giant garter snake may be present but undetected in irrigation canals, drainage ditches, or temporary pools downstream from Terminus Dam, and along distributaries that eventually reach the Tulare lakebed.

Project Impacts: Although potential habitat exists in the project area, it is likely to occur downstream of the reservoir between Terminus Dam and the Tulare lakebed. Construction and inundation impacts are limited to Kaweah reservoir, Terminus Dam and Horse Creek areas and the Tulare lakebed. No significant adverse effects due to the project alternatives are expected between Terminus Dam and Tulare lakebed. Therefore, no adverse effects to the giant garter snake are expected to occur from project alternatives.

Endangerment: *T. gigas* faces endangerment from three factors: urbanization, agriculture, and the introduction of predator and competitive species. Urban development has dramatically changed its habitat through pollution, destruction of its food sources, and conversion to green grass landscapes. Wetlands have been drained and streams have been rerouted through pipes or concrete channels to create sites for urban development and agriculture. *T. gigas* have been lost during

the operation of farming equipment. Livestock grazing has deleted protective plant cover and compacted the soil resulting in the destruction of underground retreats. The effects of DDT and other pest control chemicals are currently unknown. Large predatory fish species introduced into many permanent waterways compete with *T. gigas* for smaller forage fish (Hansen, 1986).

3.1.3 Birds

BALD EAGLE (*Haliaeetus leucocephalus*)
Family: Accipitridae

Status: The bald eagle has been listed as endangered by both the State and Federal governments. In February 1990 the FWS announced it would undertake a comprehensive study of bald eagle populations to determine if the species would warrant reclassification from endangered to the less critical threatened category. The Fish and Wildlife Service reclassified under the Endangered Species Act of 1973 (Act), as amended, the bald eagle from endangered to threatened effective August 11, 1995 (FWS, 1995).

Description: Adults eagles are brownish-black with white head, neck, and tail. The females are larger than the males as is common in most raptors. The wingspan ranges from about 6.5 - 8.0 ft. and weights range from 8.0 - 14.0 lbs. The plumage of young birds is mostly brown and blotched irregularly with white or buff colors. As the birds approach maturity, 4 or 5 years of age, the head, neck, and tail become progressively whiter over several annual molts (DFG, 1985).

Habitat: Historically, bald eagles used a wide variety of habitat types and nesting materials. These include: coastal cliffs, and pinnacles, mountain pinnacles and caves, coastal deciduous and evergreen trees, interior riparian trees, costal redwoods, and interior coniferous trees (see Detrich (1986) for a list of tree species). 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 500m from the nearest water body on average. Often times they will build alternate nests in the same territory and very use between them in different years (FWS, 1986).

At least three important factors are thought to influence bald eagle selection of wintering habitat. These include: (1) the presence of productive forage areas near by , (2) seclusion from human disturbance, (3) the presence of dense stands of timber for diurnal perching and nocturnal roosting (Paruk, 1987).

Distribution: Historically, the bald eagle inhabitated 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, the Pacific Northwest states, the 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 (FWS, 1986).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the bald eagle in or near the project area. However, potential roosting habitat is present, and bald eagles may occasionally occur within or near the project area. Two bald eagles were sited from November 1994 to February 1995 downstream from Terminus Dam. An immature bald eagle was also sighted downstream from the dam during the months of January or February 1995. An adult bird was sighted in December 1994 near the dam area (Parker pers comm, 1995).

Project Impacts: Observations have shown infrequent and transient visits by bald eagles. Removal of mature trees and snags can constitute loss of roosting and perching habitat for eagles. However, the project alternatives would not involve the removal of trees and snags. Also, any construction activities and noise would likely not adversely affect any eagles because they are highly mobile winter transients. Currently, about 1,000 acre-feet of sediment storage space remains in the reservoir. This space is expected to fill in by the year 2000 without the project alternatives. In the past, water has remained in the reservoir during the rainflood season because of sediment storage space and precipitation parameters which can be used in dry years to keep winter carryover water in the reservoir. With alternative 2, which uses the current precipitation parameters, little space would remain for winter water during the rainflood season. Alternative 3 would use new precipitation parameters which would allow up to 12,000 acre-feet of winter water storage during the rainflood season. This revised precipitation parameter would be a permanent addition to the water control diagram. With Alternative 2, effects to the bald eagle would likely include a reduction in winter foraging habitat at the reservoir. Under Alternative 3, winter foraging habitat for the bald eagle would likely benefit as compared to without project conditions Alternative 2.

Endangerment: Bald eagle populations have declined throughout their range since the beginning of the Anglo-American settlement. The decline accelerated with the beginning of widespread pesticide use in the 1940's. Other major factors contributing to eagle population declines and decreases in distribution were and continue to be habitat loss, illegal shooting, and electrocution from transmission lines (FWS, 1986).

3.1.4 Mammals

SAN JOAQUIN KIT FOX (*Vulpes macrotis mutica*)
Family: Canidae

Status: The San Joaquin kit fox is listed as endangered by the Federal government, and as threatened by the State.

Description: The San Joaquin kit fox is the largest of the four or five recognized subspecies in North America. The San Joaquin kit fox has an average body length of 20 inches, an average tail length of 12 inches, and stand about 9 to 12 inches at the shoulder. The slender-built animals are characterized by relatively long legs and large, conspicuous ears. Adult males weigh about 5 pounds, and adult females weigh about 4.6 pounds. Pelage color differs with season, being tan to buffy gray dorsally in summer and silver gray dorsally in winter. Ventral coloration is white year-round. The long bushy tail is black-tipped, and the insides of the ears are covered with white hairs. Kit foxes attain adult size and pelage at about 5 months of age.

Habitat: The San Joaquin kit fox is a permanent resident of arid regions of the southern half of California (DFG, 1990:288). The kit fox lives in annual grasslands or grassy open stages of vegetation dominated by scattered brush, shrubs, and scrub (DFG, 1990:288).

Distribution: Historic range of the San Joaquin kit fox included most of the San Joaquin Valley from the vicinity of Tracy in San Joaquin County southward to southern Kern County (DFG, 1991:32-33). By 1930 this range may have already been reduced by 50 percent, and kit foxes that formerly occupied portions of their northern, northeastern, and eastern range were restricted to the southern and western parts of the valley. Kit foxes occur in the remaining native vegetation associates of the valley floor and surrounding foothills from southern Kern County north to Los Banos in Merced County. Depending on extent of agricultural development, distribution is spotty within this broad range. In addition, smaller, less dense populations may be found further north and in the narrow corridor between Interstate 5 and the Interior Coast Range from Los Banos to Contra Costa County. Portions of Monterey, Santa Clara, San Benito, and Santa Barbara Counties are also included in the range of the San Joaquin kit fox.

Project Area Occurrence: According to the NDDB (1995), the San Joaquin kit fox has no recorded occurrences within the project area. However, U.S. Fish and Wildlife Service range maps show that suitable habitat is available for the San Joaquin kit fox in the Tulare lakebed portion of the project area. Suitable habitat

that the San Joaquin kit fox prefers is open grassland areas of scattered brush, shrubs, and scrub. Since potential habitat exists in the project area and the fox is a Federally listed endangered species, surveys were conducted by DWR to determine the presence or absence of the fox and its habitat in the project area. Local experts believe that the San Joaquin kit fox if not likely to use the area around Lake Kaweah as habitat (Hansen and Presley pers comm, 1995). Further, surveys by ECOS, Inc., in 1989 in much of the survey area below Terminus Dam found no conclusive evidence of the kit fox presence.

Project Impacts: The Tulare lakebed is the only portion of the project area that would be in the range of the kit fox. However, the fox would only inhabit areas in the lakebed that are not flooded. Since the effect of the project alternatives, NED plan and locally preferred plan, would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Endangerment: Loss of habitat due to urban expansion onto surrounding agricultural land, expansion of intensive agriculture, and extensive petroleum exploration operations (DFG, 1991:33). Residential developments and public works projects such as reservoirs decrease suitable habitat. The San Joaquin kit fox is also subject to disease, predation, roadkill, shooting, trapping, and rodenticide mortality.

TIPTON KANGAROO RAT (*Dipodomys nitratoides*)
Family: Heteromyidae

Status: The Tipton kangaroo rat is listed as endangered by the Federal and State Governments.

Description: The Tipton kangaroo rat is one of three recognized subspecies of the San Joaquin kangaroo rat (*Dipodomys nitratoides*). The Tipton kangaroo rat is a small species of the genus Dipodomys, approximately 8 inches to 9 inches in total length. Overall appearance is that of a compact rodent, with a flattened head with small ears, short neck, and cylindrical body. The hind legs are elongated, and serve as the principal means of locomotion. A long tufted tail, comprising about one-half of the total length of the animal, provides balance. Coloration is brownish above, changing to whitish ventrally. The underside of the tail is also white in coloration. The presence of four toes on the feet of this taxon distinguish it from other kangaroo rat species with which it is symptomatic (Williams, 1979).

Habitat: Preferred habitats consist of alkaline sink communities, with shrub vegetation as saltbush (*Atriplex* spp.), iodine bush (*Allenrolfea occidentalis*), and seepweed (*Suaeda fruticosa*) (Williams, 1985). Habitats also include saltbush

shrublands characterized by several species, such as *Atriplex polycarpa*, *A. spinifera*, *A. lentiformis*, and *A. phyllostegia* (Williams, 1985).

Shallow burrows are excavated from which animals forage at night for seeds that are cached. Fur-lined cheek pouches are used by these animals to hold seeds while foraging. Williams (1985) notes that burrows are often placed on slightly elevated ground to reduce the likelihood of seasonal flooding; such sites include "the berms of roads (where placed above ground level), canal embankments, railroad beds, and the bases of shrubs and fences where wind-blown soils accumulate above the level of surrounding terrain."

Distribution: The original historic range of the Tipton kangaroo rat extended over the Tulare Basin portion of the San Joaquin Valley floor; from Lemoore and Hanford in the north, south to the northern edge of Bakersfield. The range extended as far east as the vicinity of Delano, and to the west to Kettleman City (Williams, 1985).

Little information is available on the population densities of the Tipton kangaroo rat, Williams (1985), when assessing the status of the Tipton kangaroo rat for the FWS, relied heavily on prior population studies conducted on the closely related Fresno kangaroo rat (*Dipodomys notroides exilis*). However, Fresno kangaroo rat densities appear to be higher than Tipton kangaroo rat densities in the Tulare basin area. Fresno kangaroo rat population densities range from approximately 7 to 10 individuals per acre. Population turnover is rapid; very few individual animals probably survive more than one year. Density estimates for the Tipton kangaroo rat have been estimated to be between 0.65 and 1.95 per acre west of Buttonwillow, and between 0.60 and 3.06 per acre on the Paine Wildflower Preserve, Kern County.

Project Area Occurrence: Suitable habitat for the Tipton kangaroo rat may exist downstream of the dam in the Tulare lakebed portion of the project area. Because the rat is a Federally listed endangered species, surveys were conducted by DWR to determine the presence or absence of the rat and its habitat in the project area.

Project Impacts: If the Tipton kangaroo rat or its habitat (shrub vegetation or suitable burrow sites) exists in the project area, it would likely occur downstream of the reservoir at the Tulare lakebed. The survey report concluded that the incremental reduction of flooded acreage in the lakebed would not likely affect this species habitat so no adverse effects on the kangaroo rat are anticipated.

Endangerment: Habitat loss as a result of agricultural production is a chief reason for Federal and State listing of this rodent. Williams (1985) estimated that the original geographical range of the Tipton kangaroo rat encompassed 1,716,000

acres. As of July 1985, only 63,4000 acres (3.7 percent) remained undeveloped. Extant habitats typically are composed of widely scattered small parcels separated by agricultural fields. A detailed listing of individual parcel locations is available from Williams (1985).

Additional factors contributing to endangerment of the Tipton kangaroo rat include habitat modification associated with urbanization and possibly pesticide use (Williams, 1985). A total of four historical records for the rat were found during a search of the NDDB (1995). One of these sites, encompassing about 800 acres of habitat centered by Section 11 of Township 20 South, Range 21 East, includes a single 229-acre parcel of land inventoried during a range-wide inventory conducted for the FWS prior to Federal listing (Williams, 1985). No other parcels within the project area contained habitat favored by the Tipton kangaroo rat.

3.1.5 Invertebrates

VALLEY ELDERBERRY LONGHORN BEETLE (*Desmocerus californicus dimorphus*)
Family: Cerambycidae

Status: This species is Federally listed as threatened. It has no State listing.

Description: In general, longhorn beetles are characterized by somewhat elongate and cylindrical bodies with long antennae, often in excess of 2/3 of the body length. In contrast, males of Valley Elderberry Longhorn Beetle (VELB) are stout-bodied and their elytra (thickened, hardened forewings) are coarsely punctured with a metallic-green pattern of 4 oblong maculations, surrounded by a bright red-orange border. The border eventually fades to yellow on museum specimens. The maculations are fused on some males, more closely resembling the nominate subspecies. Antennae are about as long as the body or slightly shorter. Body length is approximately 0.51 - 0.83 " (USACE, 1990).

Females are more robust, elytra are subparallel, and the dark pattern is not reduced. Antennae reach about the middle of the elytra and body length is approximately 0.71 - 0.98. Both sexes of VELB are readily identified due to their distinctive appearance (USACE, 1990).

Habitat: The beetle is host specific, maturing in and feeding as adults on elderberry (*Sambucus* spp.). The VELB prefers to inhabit trees with a girth of 5.91 - 25.6 " (USACE, 1985).

Distribution: VELB 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 VELB 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 VELB for comparison with current population levels.

Project Area Occurrence: There are no records of VELB occurrence at, or adjacent to, the project site (NDDB, 1995). The VELB inhabits moist valley oak woodlands along the margins of rivers and streams. Suitable habitat for the VELB may exist in the upland areas around the Kaweah reservoir although there are no historical sightings of the VELB at the reservoir. Because the VELB is a Federally listed threatened species, surveys were conducted by DWR to determine the presence or absence of the VELB in the project area.

Project Impacts: The survey report indicated that VELB are known to occur both above and below Lake Kaweah. Every potentially affected elderberry bush around the lake was surveyed for VELB or signs of its presence. No VELB were seen during the surveys; however, VELB exit holes were identified in two potentially affected elderberry shrubs at the east end of the lake. A total of three elderberry bushes would be inundated by the project alternatives. Additionally, two elderberry bushes would be affected during the construction of Horse Creek bridge.

Mitigation: Preliminary informal consultation with FWS was initiated for the five elderberry shrubs affected by the project. Mitigation for the VELB was analyzed using the "General Compensation Guidelines for the Valley Elderberry Longhorn Beetle" from the FWS dated February 26, 1993. Although FWS usually prefers transplanting imperiled shrubs, the three shrubs in danger of inundation should be left where they are due to the difficulty of moving them successfully. The two shrubs at Horse Creek would be transplanted prior to construction. The 5 elderberry shrubs have a total of 92 stems over 1 inch, which at a mitigation ratio of 3:1 means that 276 seedlings/cuttings would have to be planted. As stated in the guidelines for the VELB, elderberry plantings should have an 80 percent survival ratio after 10 years. The seedlings/cuttings would be planted on 2.1 acres of Corps property in the Horse Creek area. The mitigation plantings would be planted in areas of existing riparian vegetation. The mitigation and monitoring would likely be done by lake personnel. Mitigation measures would be implemented using the FWS's VELB mitigation guidelines.

Endangerment: Due to the limited knowledge of VELB's life history and its ecological requirements, precise threats to its survival are difficult to enumerate. Clearly the primary threat to survival of the VELB has been and continues to be the loss and alteration of habitat by agricultural conversion, grazing, levee

construction, stream and river channelization, removal of riparian vegetation, rip-rapping of shoreline, plus recreational, industrial, and urban development. During the past 150 years over 90 percent of the riparian habitat in California has been destroyed by such practices. Insecticide and herbicide use in agricultural areas may be factors limiting the beetle's distribution. The age and quality of individual elderberry shrubs/trees and stands as a foodplant for VELB may also be a factor in the beetle's limited distribution (USACE, 1990).

Riparian habitat is still being degraded by urban development and levee repair work along the rivers. There has been some successful elderberry transplantings in specific areas along the rivers. This has increased the viable habitat for the beetle (USACE, 1990).

VERNAL POOL FAIRY SHRIMP (*Branchinecta lynchi*)
Family: Branchinectidae

Status: The vernal pool fairy shrimp is a Federally proposed endangered species. It has no State listing.

Description: Vernal pool fairy shrimp have delicate elongated bodies, large stalked compound eyes, no carapace and 11 pairs of swimming legs. They move gracefully by beating their legs that pass in a wave-like anterior to posterior direction. The shrimp ranges in size from 10.9 to 25 mm in length. In males, the basal segment outgrowth below and posterior to the pulvillus is ridgelike. Females carry eggs in a pyriform ventral brood pouch (FWS, 1992).

Habitat: The vernal pool fairy shrimp lives in ephemeral freshwater habitats, such as vernal pools and swales with clear to tea-colored water. None are known to occur in running or marine waters or other permanent bodies of water. This species is most commonly observed in grass or mud-bottomed swales, earth sump or basalt flow depression pools in unplowed grasslands. The vernal pool fairy shrimp has been collected from early December to early May (FWS, 1992; Eng et al., 1990).

Distribution: This California endemic occupies the grasslands of the Central Valley, Central Coast Mountains and South Coast Mountains. Its 29 known vernal pool sites range from the Bina Plains of Tehama County in the northern Central Valley, through most of the length of the Central Valley and eastern margin of the Central Coast Mountains Region, to the mountain grasslands north of Santa Barbara, a total of 615 km. Several disjunct populations are located 285 km. farther south on the Santa Rosa Plateau and in Skunk Hollow in Riverside County. The species was collected at elevations from 10 to 1,159 meters (FWS, 1992; Eng et al., 1990).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the vernal pool fairy shrimp in or near the project area. Since there seems to be no suitable habitat (vernal pools) for this shrimp in the area, this species is not expected to occur there.

Project Impacts: No adverse impacts to the vernal pool fairy shrimp are anticipated since its habitat is not present in or near the proposed construction sites.

Endangerment: Vernal pools and the other ephemeral bodies of water that form the habitat for this shrimp are imperiled by a variety of human-caused activities such as urban development, water supply/flood control activities and conversion of land to agricultural use (FWS, 1992; Eng et al., 1990).

3.1.6 Plants

CALIFORNIA JEWELFLOWER (*Caulanthus californicus*)
Family: Brassicaceae

Status: The California jewelflower is currently listed as endangered by the Federal and State governments.

Description: The California jewelflower is an annual herb of the mustard family (Brassicaceae). Its stems are erect, up to about 1 foot tall, and produce several flowering branches. The leaves are wavy-margined and most are in a basal rosette. The flowers are translucent white with purple to green tips. Fruit, stem, and foliar hair characteristics distinguish this species from other jewelflowers (FWS, 1995).

Habitat: The California jewelflower occurs in grassland and mixed grassland-scrub habitats, often on sandy soils. All of the previously known and recently discovered populations occur in remnants of mixed native/non-native grassland habitat (FWS, 1995).

Habitat loss resulting from agricultural land conversion, increased livestock grazing and trampling associated with the development of summer water sources, oil and gas development, other human activities, competition with aggressive non-native annual grasses probably eliminated California jewelflower from Fresno, Kings, and Tulare Counties and reduced its range in Kern and Santa Barbara Counties. These factors continue to threaten many of the remaining populations (FWS, 1995).

Distribution: California jewelflower is endemic to the southern San Joaquin Valley region. It originally occurred throughout much of the Tulare Basin form Coalinga

and Fresno in Fresno County to the Cuyama Valley in Santa Barbara County and Bakersfield in Kern County. Historical collections document its occurrence at 47 sites and an early collector described the plant as "abundant on the plains of the San Joaquin from Tulare southward" (FWS, 1995).

In 1990, California jewelflower was known to occur at only 10 populations, primarily in three areas: the mouth of Santa Barbara Canyon in Santa Barbara County, the southern portion of the Carrizo Plain in San Luis Obispo County, and at The Nature Concervancy's Paul Paine Preserve in Kern County (a small colony of introduced plants). Since 1990, several more populations have been discovered following wet winters (FWS, 1995).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the California jewelflower in or near the project area. However, due to the listed status of this species, surveys were conducted by DWR to determine its presence or absence of this plant and its habitat in the project area.

Project Impacts: The survey report indicated that this species is unlikely to occur in the project area. Therefore, no adverse effects to the California jewelflower are expected to occur with the project alternatives.

Endangerment: Project-induced flood reduction or development of any lands where this species is present may further jeopardize the continued existence of this species in the southern San Joaquin Valley.

3.2 Federally Proposed Species

3.2.1 Fish

SACRAMENTO SPLITTAIL (*Pogonichthys macrolepidotus*)
Family: Cyprinidae

Status: The Sacramento splittail is a Federally proposed threatened species.

Description: The Sacramento splittail can grow up to 40 cm in length and is easily recognized by the enlarged upper lobe of the tail, small head, and barbels at the corner of its mouth. Its sides are a dull silvery gold, which gets duller with age. Its back is dusky olive grey. During the breeding season the paired and caudal fins are tinged with red-orange, and the males become darker and develop small white tubercles on the head (Moyle, 1976).

Habitat: *P. marrolepidotus* lives mostly in slow-moving stretches of the Sacramento River and Delta and in small shallow sloughs and marshes. They are extremely tolerant of brackish water, unlike other members of the minnow family (Moyle, 1976). Their habitat is usually lined with emergent vegetation that offers protection from larger fish and provides abundant sources of food. They are generally bottom feeders and will prey on a variety of organisms depending on the environment. Detritus is a major part of their diet along with arthropods, aquatic insect larvae, and earthworms in flooded areas (Daniels and Moyle, 1983).

P. macrolepidotus is an annual spawner and produces a large number of eggs per year. They are mature by their second winter and live a relatively long life. Spawning occurs between early March and mid-May and is usually associated with an increase in day length and temperature. It is probable that splittail spawn on vegetation (Daniels and Moyle, 1983).

Distribution: Historically, *P. macrolepidotus* inhabited a wide range of lakes and rivers in the Central Valley, but today seem to be confined to the lower delta region and the main channel of the Sacramento River. They are, however, the most abundant species of minnow in this area (Daniels and Moyle, 1983).

Project Area Occurrence: The NDDB (1995) contained no records for the splittail in the project area, but it is possible that this fish occurs in some parts of the project area. Suitable habitat is available for the Sacramento splittail downstream in the Kaweah River.

Project Impacts: Aquatic resources are not likely to be affected by project activities. Therefore, it is unlikely that the splittail would be adversely affected.

Endangerment: The Sacramento splittail, although abundant within its habitat, occurs in a limited area. With environmental changes from introduced species and upstream water projects such as the increased use of water as coolant in powerplants, the splittail's abundance may decline rapidly (Daniels and Moyle, 1983).

3.2.2 Amphibians

CALIFORNIA RED-LEGGED FROG (*Rana aurora draytonii*)
Family: Ranidae

Status: The California red-legged frog has been proposed for Federal listing as endangered and is a Species of Special Concern to the California Department of Fish and Game.

Description: *R. a. draytonii* is 1.75 to 5.25 inches long with long back legs. Its lower abdomen and underside of its legs are red overlying a yellow background. Its head is usually dark with a white strip on the jaw. Its back is dotted with small black flecks and large dark blotches with light centers on a background of brown, grey, olive, or reddish brown (Stebbins, 1985).

Habitat: *R. a. draytonii* is a pond frog that inhabits streamsides, grasslands, woodlands, and humid forests. It favors areas where cattails and other plants provide a good cover. It is most common in lowlands and foothills and usually near a permanent source of water. It may, however, appear far from water in damp woods or meadows after a rainfall (Stebbins, 1985).

The breeding period is in the rainy months of January through April and only lasts 1 to 2 weeks (Stebbins, 1985). Egg masses are laid in a water source on emergent vegetation so that the surface of the egg mass will just break the surface of the water (Hayes and Miyamoto, 1984). When not breeding, *R. a. draytonii* can be found in the damp woods.

Distribution: Historically, *R. a. draytonii* have ranged from northern California south into Baja California and west of the Cascade-Sierra crest. Its habitat once included parts of the Central Valley, but it currently appears to be absent from that region. It inhabits elevation from near sea level to 8,000 feet (Stebbins, 1985).

Current records site *R. a. draytonii* in many southern California counties: Ventura, Orange, Santa Barbara, Riverside, San Diego, San Luis Obispo, Los Angeles, and Monterey (NDDB, 1985).

Project Area Occurrence: No sightings of the California red-legged frog have been reported in or adjacent to the project area (NDDB, 1995). Red-legged frogs are rare in the Sierra Nevada foothills, and it is unlikely that they occur on the San Joaquin Valley floor (Brode, 1995).

Project Impacts: Suitable habitat may exist downstream from the dam but not at any proposed construction sites. Therefore, it is unlikely that construction would threaten any habitat or adversely affect the California red-legged frog.

Endangerment: In the late 1800's and early 1900's *R. a. draytonii* was heavily marketed as a source of frog legs. Females of the species were preferred over the males because of the females large size. As a result, breeding activity was greatly reduced to where *R. a. draytonii* populations in the early 1900's were too minimal to record. Introduction of the bullfrog (*R. catesbeiana)* to California as an additional source of frog legs added to the decline in *R. a. draytonii* population due to the competition and predation from the bullfrog (Jennings and Hayes,

1985). Today the California red-legged frog faces endangerment because of habitat destruction such as the draining of wetlands for agriculture and urban development.

3.2.3 Plants

HOOVER'S SPURGE (*Chamaesyce hooveri*)
Family: Euphorbiaceae

Status: Hoover's spurge is a Federally proposed threatened species. It has no State listing.

Description: This annual herb of the spurge family (Euphorbiaceae) is glabrous and prostrate. The small grey-green leaves are asymmetric at the base, rounded to kidney-shaped, and have small white teeth around the leaf margins. The small white flowers occur singly in the leaf axils. This species flowers into late summer. It can be found growing in the dried cracked mud on the bottom of vernal pools.

Habitat: Hoover's spurge occurs in relatively large, deep vernal pools among the rolling hills, remnant alluvial fans, and depositional stream terraces at the base of the Sierra Nevada foothills. It tends to occur where competition from other species has been reduced by prolonged seasonal inundation or other factors (Stone, et al., 1988).

Loss of vernal pool habitat to irrigated agriculture has probably caused most of the decline in this species. Continued expansion of agricultural development threatens about one-third of the remaining populations. Moderate intensities of livestock grazing appear not to threaten the plant; however, intensive grazing and trampling of vernal pools could harm this species. All remaining populations are on privately owned lands (Stone, et al., 1988).

Distribution: Hoover's spurge is endemic to the eastern Central Valley. Its historical distribution is not well documented, but presumably it was more common than at present among the vernal pools of the eastern Sacramento and San Joaquin Valleys. Approximately 23 extant occurrences occur in three clusters: one in Tehama, Butte, and Glenn Counties; another in eastern Stanislaus County; another in northwestern Tulare County (Stone, et al., 1988).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences in or near the project area. Since the plant tends to occur in vernal pools among rolling hills, it likely exists outside the Kaweah project area and not near any project worksites.

Project Impacts: Since there is no suitable habitat (vernal pools) in or near the proposed project worksites, this species would not likely be adversely affected by the project.

Endangerment: Loss of vernal pool habitat to irrigated agriculture has probably caused most of the decline in this species. Continues expansion of agricultural development threatens about one-third of the remaining populations. Moderate intensities of livestock grazing appear not to threaten the plant; however, intensive grazing and trampling of vernal pools could harm this species. All remaining populations are on privately owned lands (Stone, et al., 1988).

SPRINGVILLE CLARKIA (*Clarkia springvillensis*)
Family: Onagraceae

Status: Springville clarkia is a Federally proposed threatened species. It has no State listing.

Description: Springville clarkia is an erect annual herb belonging to the evening-primrose family (Onagraceae). This plant can grow to 3 feet in height. It has simple or, more usually branched stems. The bright green leaves can grow to 3 inches long and 1 inch wide. The lavender-pink flowers appear in May to July and have a characteristic purple spot at the base of the flower. Other features which separate this clarkia from other clarkias found growing with it are the absence of long hairs on the outside of the flower and the color of the outside of the flower (FWS, 1995).

Habitat: Springville clarkia is found on granitic soils in openings in the blue oak (*Quercus douglasii*) woodlands and on roadbanks. Springville clarkia occupies chaparral and deciduous evergreen wood habitat types (FWS, 1995).

Distribution: Springville clarkia can be found from an elevation between 1,200 to 3,000 feet. All populations are found in Tulare County. Eight of the total nine populations are found within a 43 square mile area. The ninth population is 16 miles to the northwest. Four populations are found on lands administered by the Sequoia National Forest, three are on private land, one on land owned by Tulare County, and part of one owned by the California Department of Fish and Game (FWS, 1995).

The largest population is found inside the Springville Clarkia Preserve that is owned by the California Department of Fish and Game. That population was impacted by the construction of a road and site leveling prior to construction of a home. The number of plants in this population is larger than the combined total of the

populations. Sphinx moth predation has been observed as a problem in one population (FWS, 1995).

Project Area Occurrence: According to the NDDB (1995), Springville clarkia has no recorded occurrences in the project area. However, suitable habitat may be available for Springville clarkia to occur in the project area. This species could exist in the valley grassland areas above the reservoir, but this species is not likely to occur at the specific project worksites.

Project Impacts: No adverse impacts to Springville clarkia are anticipated since its habitat is not present in or near the proposed construction sites. The Springville clarkia is located outside the project area.

Endangerment: Threatened by grazing, off-road vehicles and residential development. Sequoia National Forest has adopted species management guidelines (CNPS, 1988).

SAN JOAQUIN VALLEY ORCUTT GRASS (*Orcuttia inaequalis*)
Family: Poaceae

Status: San Joaquin valley orcutt grass is a Federally proposed endangered species. It has no State listing.

Description: This tufted annual grass grows 2-6 inches in height. This plant is covered with soft, straight spreading hairs and is grayish-green looking. Its foliage and flowering stems are covered with a sticky, aromatic, bitter-tasting secretion that is characteristic of the tribe containing *Neostaphia*, *Tuctoria,* and *Orcuttia*. The end of the flowering stalk consists of 7-15 small flowers that are congested in the upper 1/4 to 1/8 of the flower stalk. The tip of the lower bracts enclosing individual flowers have 5 teeth with the middle tooth being the longest. Individual flowers are arranged on opposite sides of the flower stalk. Flowering time is May to June.

Habitat: San Joaquin valley orcutt grass occupies primarily vernal pools. This grass grows on the bottom of dried vernal pools and is often found with spike rush (*Eleocharis* spp.) and coyote thistle (*Eryngium* spp.). Other associated species include hairy Orcutt grass (*Orcuttua pilosa*) and Colusa grass (*Neosapfia colusana*). This plant, as all vernal pool species, is sensitive to patterns of rainfall, temperature, length of pool inundation, and any changes to vernal pool hydrology.

Distribution: Historically, this vernal pool grass was common in vernal pools from Waterford, Stanislaus County to areas near Visalia in Tulare County. Many

populations have been extirpated by agricultural conversion on vernal pool habitat. As a result, this species is now extinct from Stanislaus County. The 12 remaining populations are found in scattered vernal pools in Fresno, Madera, and Merced Counties. This vernal pool grass is usually found from 100-500 feet in elevation. One population is found on lands managed by the Bureau of Land Management. The remaining 11 populations are on private lands.

Project Area Occurrence: According to the NDDB (1995), San Joaquin valley orcutt grass has no recorded occurrences in the project area. Since this grass is endemic to vernal pool habitat and the project project area lacks vernal pools, the San Joaquin valley orcutt grass is not likely to occur in the project project area.

Project Impacts: Since there is no suitable habitat (vernal pools) in or near the proposed project worksite, this species would not likely be adversely affected by project alternatives.

Endangerment: The San Joaquin valley orcutt grass is seriously threatened by agriculture (CNPS, 1988).

SAN JOAQUIN ADOBE SUNBURST (*Pseudobahia peirsonii*)
Family: Asteraceae

Status: The San Joaquin adobe sunburst has been proposed for Federal listing as endangered and is listed as endangered by the State of California.

Description: The San Joaquin adobe sunburst is an erect annual herb about 1-6 decimeters (4-18 inches) tall loosely covered with white, wooly hairs. Its alternate leaves are twice divided into smaller divisions (bipinnatifid), triangular in outline, and 2-6 cm (1-3 inches) in length. Flower heads, which appear in March or April, are solitary at the ends of the branches. The ray flowers are bright yellow and equal in number to the sub-floral bracts (phyllaries) and about 3mm (0.1 inches) long; the disk flowers are numerous and there is no pappus (Stebbins, 1991).

Habitat: Pseudobahia peirsonii prefers heavy adobe clay soils where the water retention properties are high. These soils are mainly distributed in the valleys and flats near the foothills of the southeastern San Joaquin Valley (Stebbins, 1991).

Distribution: Pseudobahia peirsonii is endemic to nonnative grassland and grassland-blue oak woodland community ecotone of the southern Sacramento Valley and San Joaquin Valley of California (Brown, 1982).

Project Area Occurrence: A search of the NDDB (1995) revealed the last recorded sighting in the vicinity was in 1936. However, because the San Joaquin adobe sunburst is a Federally proposed endangered species, surveys were conducted by DWR to determine the presence or absence of the San Joaquin adobe sunburst and its habitat in the project area.

Project Impacts: The survey report states that consultation with the Natural Resource Conservation Service soil survey maps indicates that no suitable habitat exists in the project area. Therefore, no adverse effects to the San Joaquin adobe sunburst are expected to occur due to project alternatives.

Endangerment: The primary threat facing Pseudobahia peirsonii is the ongoing and threatened destruction, and the adverse modification of their habitat. The habitat of the plant is being threatened or eliminated by one or more of the following: Ag-land development, urbanization, overgrazing, competition from alien plants, water projects, mining, highway projects, recreational activities, transmission line maintenance, and other anthropogenic actions.

GREENE'S TUCTORIA (*Tuctoria greenei*)
Family: Poaceae

Status: Greene's tuctoria is a Federally proposed endangered species.

Description: Greene's tuctoria is a tufted, somewhat hairy annual grass that grows 2-6 inches tall. This plant produces several to many erect stems. The outermost stems are usually bent over and give the appearance of a spreading growth form. Little distinction exists between the sheath and the blade. Each stem ends in a spike-like flower cluster that is partially enveloped by the uppermost leaf. The individual flowers are arranged in a spiral around the end of the stem and are congested and enlarged toward the end of the stem. The lemmas are entire or are finely toothed. This plant does not produce large amounts of the sticky secretion as do the rest of the members of this grass tribe. Flowering time is usually May through July (FWS, 1995).

Habitat: Greene's tuctoria inhabits vernal pools, valley and foothill grassland. This unusual member of the grass family (Poaceae) grows in the dried bottoms of vernal pools in open grasslands of the Central Valley (DFG, 1992).

Distribution: Green's Orcutt grass is found in small vernal pools in the Central Valley of California. Historically, this plant was found in Fresno, Madera, and Tulare Counties, but no populations exist in those counties anymore. Currently, the range of this species includes Shasta, Tehama, Butte, Stanislaus, and Merced

Counties, and is believed to be extirpated from Fresno, Madera, San Joaquin, Stanislaus, and Tulare counties (DFG, 1992).

Project Area Occurrence: The NDDB (1995) revealed no occurrences of Greene's Orcutt grass in or near the project area. Since there are no vernal pools in the project area, the Greene's Orcutt grass probably does not occur in the Kaweah project area.

Project Impacts: No adverse impacts to the Greene's Orcutt grass are anticipated since its habitat (vernal pools) is not present in or near the proposed construction sites.

Endangerment: Green's Orcutt grass is threatened by agriculture and urbanization (CNPS, 1988). Over half of the nearly forty known Greene's Orcutt grass occurrences have been extirpated by conversion of habitat to irrigated agriculture or by intensive cattle grazing. Greene's orcutt grass continues to be threatened by destruction of vernal pools for agriculture and residential development in the Central Valley (DFG, 1992).

3.3 Federal Candidate Species

3.3.1 Fish

LONGFIN SMELT (*Spirinchus thaleichthys*)
Family: Osmeridae

Status: Longfin smelt is a Category 2 candidate for Federally listing. It has no State listing.

Description: The longfin smelt is a small, thin, silvery fish with a large mouth (McGinnis, 1984). The sides of the fish appear translucent silver and the back has an olive to iridescent pinkish green hue. This smelt has 8 to 10 dorsal fins, 18 to 21 anal rays, 10 to 12 pelvic rays, 38 to 47 gill rakers, and 4 to 6 pyloric ceca. It differs from other California smelts by their long pectoral fins, incomplete lateral line, weak or absent striations on the opercular bones, low number of scales in the later series (55 to 62), and long maxillary bones which extend just short of the posterior margin of the eye (Moyle, 1976).

Habitat: Longfin smelt inhabit moderately saline waters in estuaries. They seem to prefer the middle or bottom of the water column on areas where the salinities are normally greater than 10 ppt. The primary food of this smelt is the opossum shrimp. The longfin smelt probably spawns from December through February in

the lower reaches of rivers that feed the estuaries. It probably deposits its adhesive eggs either on rocks or aquatic plants, much like the delta smelt (McGinnis 1984, Moyle 1976).

Distribution: The longfin smelt is found in all major bays and estuaries from San Francisco Bay northward to Prince William Sound, Alaska. In north-central California, smelt spend the early summer in San Pablo and San Francisco Bays, then move into Suisun Bay in August. During winter, they spawn in the lower reaches of the Sacramento River.

Project Area Occurrence: The NDDB (1995) revealed no occurrences of the longfin smelt in or near the project area. The longfin smelt is not likely to occur in the Kaweah River project area because it is not within the smelt's historical range. Furthermore, the project area does not have suitable aquatic habitat for the longfin smelt.

Project Impacts: Since there is no suitable aquatic habitat in or near the project area or at the proposed construction sites, the longfin smelt would not be adversely affected by project alternatives.

Endangerment: Just as the Delta smelt, the decline of the longfin smelt is probably related to modifications of Delta hydrology wrought by water diversions and flood control projects, coupled with competition from introduced nonindigenous aquatic species (threadfin shad and inland silverside), and reduction in the abundance of important food organisms.

KERN BROOK LAMPREY (*Lampetra hubbsi*)
Family: Petromyzontidae

Status: The Kern Brook lamprey is a Federal Category 2 candidate species. It has no State listing.

Description: The Kern brook lamprey is a non-parasitic lamprey endemic to the San Joaquin drainage. Its morphology is like that of other lampreys: eel-like body, no paired fins, and a sucking disc instead of jaws. Larvae, known as ammocoetes, are similar to adults in shape but lack eyes and a well-developed oral disc. The Kern brook lamprey is much smaller than the parasitic anadromous lampreys; adults range from 91 to 139 mm in length and ammocoetes from 117 to 142 mm in length. Ammocoetes are typically larger than adults because non-parasitic lampreys shrink following metamorphosis. The number of trunk myomeres ("blocks" of muscle mass along the body) ranges from 51 to 57 in ammocoetes. In adults, the supra-oral lamina (tooth) typically has 2 cusps, with 4 inner lateral

teeth on each side of the disc. The sides and dorsum are a grey-brown, and the ventral area is white. Dorsal fins are unpigmented, but there is some black pigmentation restricted to the area around the notochord in the caudal fin (Moyle *et al.* 1994).

Habitat: Principal habitats of Kern brook lamprey are silty backwaters of large rivers in the foothill regions. In summer, ammocoetes are usually found in shallow pools along edges of run areas with slight flow at depths of 30-110 cm where water temperatures rarely exceed 25 degrees Celcius. Common substrates occupied are sand, gravel, and rubble. Ammocoetes seem to favor sand/mud substrate where they remain buried with the head protruding above the substrate and feed by filtering diatoms and other micro-organisms from the water. This type of habitat is apparently present in the siphons of the Friant Kern Canal. Adults likely require the coarser gravel-rubble substrate for spawning (Moyle et al. 1994)

Distribution: *Lampetra hubbsi* was first discovered in the Friant-Kern Canal, but it has since been found in the lower reaches of the Merced River, Kaweah River, Kings River, and San Joaquin River. In 1988, ammocoetes and adult lampreys were found in several siphons of the Friant-Kern Canal, when they were poisoned during an effort to rid the canal of white bass.

Project Area Occurrence: The NDDB (1995) revealed no occurrences of the Kern brook lamprey in or near the project area. The Kern brook lamprey probably occurs in the Friant-Kern Canal or the lower reaches of the Kaweah River which is outside the Kaweah project area, downstream from the dam site. The Kern brook lamprey probably does not occur in or near the proposed project area or near the specific worksites.

Project Impacts: Since there is no suitable habitat in the project area and no project area occurrences (NDDB, 1995), the project alternatives would not adversely affect the Kern brook lamprey.

Endangerment: Populations of this species are thinly scattered throughout the San Joaquin drainage and isolated from one another. Such a fragmented distribution makes local extirpations likely, without hope of recolonization, followed by eventual extinction of the species. The probability of local extirpation is increased by the fact that all known populations are located below dams, where stream flows are regulated without regard to the needs of the lampreys. Fluctuations or sudden drops in flow may isolate or dry up ammocoetes. Gravel needed for spawning may be eliminated or compacted, so it cannot be used by adults. Ammocoetes may also be carried to "dead-end" habitats such as the Friant-Kern siphons. Clearly, management of flows in the lower reaches of rivers of the San

Joaquin drainage will need to consider the needs of this lamprey in order for the species to persist.

3.3.2 Amphibians

CALIFORNIA TIGER SALAMANDER (*Ambystoma californiense*)
Family: Ambystomatidae

Status: The California tiger salamander is a Federal Category 2 Candidate and a State Species of Special Concern.

Description: A. californiense is a large stocky salamander which is 6 - 16 cm long. It has small eyes, a broad, rounded snout and tubercles on the underside of its feet. This salamander has large pale yellow spots on a black background that are scarce or absent along the middle of the back. Individuals from southern coastal California populations have a few spots and a prominent cream band on the lower sides (Stebbins, 1985).

Habitat: The adult California tiger salamander inhabits underground burrows of ground squirrels, badgers, and gophers. This salamander frequents quiet water ponds, reservoirs, lakes, and temperate pools and streams from arid sage brush plains and rolling grasslands to mountain meadows and forests. Adults emerge only for brief periods during nightfall to breed, usually during or shortly after rainfall. Breeding takes place in temporary rain pools, vernal pools, and permanent waters of grassland and open woodland of low hills and valleys (Stebbins, 1985).

The breeding period is from December to February, and the larvae require approximately 4 months to reach metamorphosis. The larvae diet consists mostly of tadpoles and to a lesser extent snails. The larvae swim very little and feed on whatever passes directly in front of them. Most feeding is done on the bottom, but larger larvae may swim toward the surface to capture prey (Anderson, 1968).

Distribution: Historically, the tiger salamander was distributed throughout the Central Valley. However, this species has been extirpated from much of its former range due to agricultural and urban development (Stebbins, 1985). Its current range is between the Sierra Nevada and the Coastal Ranges, extending north to Butte County and south to Kern and Tulare Counties. This species of salamander has been recorded at sites in the following counties: Tulare, Stanislaus, San Joaquin, Marin, Madera, Lake, Kern, Fresno, Contra Costa, Calaveras, Alameda, Sacramento, Butte, and Yolo (Hayes, n.d.).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the California tiger salamander in or near the project area. Suitable habitat for this species may be present in the project area. However, this species has been considered to be eliminated from much of its range due to agricultural and urban development.

Project Impacts: Although potential habitat exists in the project area, it is likely to occur downstream of the reservoir between Terminus Dam and the Tulare lakebed. Construction and inundation impacts are limited to Kaweah reservoir, Terminus Dam and Horse Creek areas and the Tulare lakebed. No significant adverse effects due to project alternatives are expected between Terminus Dam and the Tulare lakebed. Therefore, no adverse effects to the California tiger salamander are expected to occur with project alternatives.

Endangerment: The California tiger salamander is threatened by the continued loss and fragmentation of habitat due to agricultural and urban development. Most existing vernal pools have been altered allowing drainage or connection with semi-permanent canals. This results in contact with introduced species that prey upon the salamander larvae (centrarchid fish and bullfrogs). Heavy rains can also cause overflowing in the pool creating waterways of sufficient depth for fishes to invade the pools and consume nearly all the defenseless larvae (Hayes, n.d.).

WESTERN SPADEFOOT TOAD (*Scaphiopus hammondi*)
Family: Pelobatidae

Status: Federal category 2 candidate.

Description: Adult western spadefoot toads are 4 to 6 cm in length. The eyes are large and protuberant with a vertically elliptical pupil. The tip of the snout is turned upward, giving a pug-dog profile; no bony lumps are between the eyes. They have a single prominent, rounded, sharp edged black spade on the foot. The skin is usually smooth and relatively thin, but sometime, small, round, tubercles tipped with orange or red appear. The color above is dusky green, gray or brown with scattered spots and darker blotches with irregularly outlined, creamy or whitish longitudinal stripes, one on each side of the midline, extending from the upper eyelids; and sometimes a similar stripe on each side extending backward from the ear region. Stripes are sometimes broken (Stebbins, 1954).

Habitat: These nocturnal animals spend most of their time in underground burrows up to 36 inches deep (Stebbins, 1972) which they construct themselves. Some individuals also use mammal burrows. Recently metamorphosed juveniles seek refuge in the immediate vicinities of breeding ponds for up to several days after

transformation. They hide in drying mud cracks, under boards and in other surface objects including decomposing cow dung. Grasslands with shallow temporary pools are optimal habitats for the western spadefoot.

Breeding and egg laying occur almost exclusively in shallow, temporary pools formed by heavy winter rains. Egg masses are attached to plant material or the upper surfaces of small submerged rocks. Breeding and egg laying normally occur from late winter to the end of March. Eggs hatch quickly, usually within two weeks (Stebbins, 1951).

Distribution: The western spadefoot toad ranges throughout the Central Valley and adjacent foothills and is usually quite common where it occurs. In the Coast Ranges it is found from Point Conception south to the Mexican border at elevations from sea level to 4,500 feet in the southern Sierra foothills. This species occurs primarily in grassland areas, but occasional populations also occur in valley-foothill hardwood woodlands. Some populations persist for a few years in orchard-vineyard habitats.

Project Area Occurrence: No occurrences of the western spadefoot toad have been recorded in the project area (NDDB, 1995). Suitable habitat for the western spadefoot toad may exist downstream of the dam throughout the Kaweah River system.

Project Impacts: The toad's habitat consists primarily of vernal pools and similar seasonally wet ponds. Vernal pools may not exist in the project area; however, seasonally wet ponds may exist downstream of the reservoir between Terminus Dam and the Tulare lakebed. Construction and inundation impacts are limited to Kaweah reservoir, Terminus Dam and Horse Creek areas and the Tulare lakebed. No significant adverse effects due to project alternatives are expected between Terminus Dam and the Tulare lakebed. Therefore, no adverse effects to the toad are expected to occur under the project alternatives.

Endangerment: *S. hammondi* is common where it occurs. As California's increasing population continues to encroach on the spadefoot's habitat, its populations are likely to decrease.

FOOTHILL YELLOW-LEGGED FROG (*Rana boylii*)
Family: Ranidae

Status: The foothill yellow-legged frog is a category 2 candidate for Federal listing. The foothill yellow-legged frog has no State listing. The Department of Fish and

Game has recognized the foothill yellow-legged frog as a species of special concern.

Description: The foothill yellow-legged frog is gray, brown, reddish, or olive, usually flecked and mottled. General coloration resembles color of stream bottom with which the frog blends. The underside of hind limbs and lower belly are yellow. There is a triangular light-colored patch on snout. The dorsolateral folds are indistinct and the toe tips usually not dusky (Stebbins, 1972).

Habitat: The foothill-yellow legged frog is found in or near rocky streams in a variety of habitats, including valley-foothill hardwood, valley-foothill hardwood-conifer, valley-foothill riparian, ponderosa pine, mixed conifer, coastal scrub, mixed chaparral, and wet meadow types (DFG, 1990).

Adults often bask on exposed rock surfaces near streams. When disturbed, they dive into the water and take refuge under submerged rocks or sediments. During periods of inactivity, especially during cold weather, individuals seek cover under rocks in the streams or on shore within a few meters of water (DFG, 1990).

Adults eat both aquatic and terrestrial invertebrates. Adults insects appear to be favored, but snails, and pieces of molted skin have also been found in stomach samples. Tadpoles probably graze on algae and diatoms along rocky stream bottoms (DFG, 1990).

Unlike most other ranid frogs in California, this species is rarely encountered (even on rainy nights) far from permanent water. Tadpoles require water for at least three or four months while completing their aquatic development (DFG, 1990).

Distribution: The foothill yellow-legged frog is found mostly in small permanent foothill streams higher than 200 meter elevation. The foothill yellow legged frog occurs in the Coast Ranges from the Oregon border south to the Transverse Mts. in Los Angeles Co., in most of northern California west of the Cascade crest, and along the western flank of the Sierra south to Kern Co. Livezey reported an isolated population in San Joaquin Co. on the floor of the Central Valley. Isolated populations are also known from the mountains of Los Angeles Co. Its elevation range extends from sea level to 1830 m (6,000 ft) in the Sierra (DFG, 1990).

Project Area Occurrence: Several occurrences of the foothill yellow-legged frog have been recorded near the project area (NDDB, 1995). However, the foothill yellow-legged frog is found mostly in small permanent foothills streams and historically occurred in the area where Lake Kaweah now lies. Surveys were conducted by DWR to determine the presence or absence of the frog and its habitat in the project area.

Project Impacts: According to the survey report, extensive surveys have been done in the Kaweah watershed, and this species is currently found at high elevations in the Sequoia National Park. Therefore, no adverse effects to the foothill yellow-legged frog are expected to occur with the project alternatives.

Endangerment: The foothill yellow-legged frog coexists with the Cascades frog and the red-legged frog at some localities, but different microhabitat preferences probably diminish competition. Moyle implicated the bullfrog in the observed reduction of foothill yellow-legged frog populations in the Sierra. Centrachid fishes readily eat *Rana* eggs, and where introduced into foothill streams, may also contribute to the elimination of *R. boylei* (DFG, 1990).

MOUNT LYELL SALAMANDER (*Hydromantes platycephalus*)
Family: Plethodontidae

Status: The Mount Lyell salamander is a Category 2 candidate species for Federal listing. It has no State listing.

Description: The adult salamander is slightly over 4 inches and the head and body is flattened. It has a blunt snout and its tongue is pedicelled. The eyes are relatively small. This salamander has blunt-tipped toes that are partly webbed. The color of the Mt. Lyell salamander is above dark chocolate to blackish, marked with mottlings of pale gray to pinkish buff composed of numerous whitish flecks sometimes largely obscuring dark ground color. The dorsal coloration resembles granitic rocks common in habitat of this salamander (Stebbins, 1951).

Habitat: This species occurs in massive rock areas in mixed conifer, red fir, lodgepole pine, and subalpine habitats. Such areas must include a water source. North and east slopes, often at the base of cliffs or rockpiles, appear to be favored. Preferred rocky areas are often over decomposed granite soils, which are moistened by seeps or melting snow (FWS, 1995).

Water requirements during the period of surface activity are met by snowmelt, seepages, and spray from waterfalls. During the remainder of the year moisture is provided by seepages within rock fissures or other subsurface refugia (FWS, 1995).

Cover is provided during the period of surface activity primarily by flat granite rocks. Winter hibernation probably occurs within deep rock fissures or under slabs of exfoliating granite soil (FWS, 1995).

Little is known about specific microhabitat requirements for breeding and egg laying. Eggs are probably deposited beneath granite rocks or slabs covering moist granite soil (FWS, 1995).

Distribution: The Mount Lyell salamander occurs only in the Sierra Nevada from Sierra Co. south to Tulare Co. Populations are discontinuously distributed in isolated patches of suitable habitat. Usually common where they occur, individuals are active on the surface only when free water in the form of seeps, drips, or spray is available. This species occurs at an elevation of 4,000 feet to 11,600 feet (FWS, 1995).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the Mount Lyell salamander in or near the project area. The Mt. Lyell salamander is usually found on wet bare earth or rock, in high country snowpack, seldom actually in water. This species may occur high in the foothills above the Kaweah Reservoir in rocky places bordering mountain meadows (Stebbins, 1951). This species probably does not occur at or near the construction sites.

Project Impacts: No adverse impacts to this species are anticipated due to the lack of suitable habitat at or near the construction sites.

Endangerment: Very little information on endangerment is available at this time. Because of their secretive habits and the relative absence of potential predators in the habitats where they normally occur, this species is probably not taken in large numbers as prey by any vertebrate species.

SOUTHWESTERN POND TURTLE (*Clemmys marmorata pallida*)
Family: Emydidae

Status: This species is Federally listed as a category 2 candidate species. It has no State listing.

Description: Adults are commonly 5 to 6 inches in carapace length, and occasionally longer. *Clemmys marmorata pallida* is distinguished by small or absent inguinal plates and neck markings which contrast with light ground color. The carapace is low, without median keel, and smooth in old adults; shields have concentric ridges in younger individuals and concentric and radiating ridges in immature. The plastron have six pairs of shields and broad bridge. The forelimbs have prominent scales, hind limbs less conspicuous ones; toes are webbed with prominent, slender nails (when unworn); the tail is usually less than one-third the carapace length. The carapace is olive with dark brown to blackish, with each

shield marked with a network of spots, lines or dashes of brown or black which tend to radiate from growth centers (Stebbins, 1954).

Habitat: Turtles seem to prefer the quiet water of ponds, small lakes, and sluggish streams, but are found also in rivers, clear streams, marshes and reservoirs. When in streams with considerable current, the turtle usually selects the quieter pools. It has occasionally been observed in brackish and even seawater. Food consists of aquatic plants such as pond lily pads, insects such as beetles, and carrion. Pond turtles bask on partially submerged logs, rocks, mats of floating vegetation, open mud banks, and other such sites. Turtles slip from basking sites to underwater retreats at the approach of humans or potential predators. Hibernation in colder areas is passed underwater in bottom mud. (Zeiner, et al., 1988; Stebbins, 1954).

Females lay 3 to 11 eggs from March to August. Two distinct habitats may be used for oviposition. Along large slow-moving streams, eggs are deposited in nests constructed in sandy banks. Along foothill streams, females may climb hillsides, sometimes moving considerable distances to find a suitable nest site. Nests have been observed in a variety of different soil types, from sandy to very hard. Soil must be at least 4 inches deep for nesting (Stebbins, 1954).

Distribution: The pond turtle is common to uncommon in suitable aquatic habitat throughout California, west of the Sierra Cascade crest. It is absent from desert regions except along the Mojave River and its tributaries (Zeiner, et al., 1988).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the southwestern pond turtle in or near the project area. Turtles prefer ponds, small lakes, and streams. Suitable habitat for the southwestern pond turtle may be present downstream from the Kaweah Reservoir. Since potential habitat is present, the turtle may occur in or near the project area.

Project Impacts: If the turtle or its habitat exists in the project area, it would likely occur downstream of the reservoir between Terminus Dam and the Tulare lakebed. Project construction and inundation effects are limited to Kaweah reservoir, Terminus Dam and Horse Creek areas and the Tulare lakebed. No significant adverse effects due to the project are expected between Terminus Dam and the Tulare lakebed. Therefore, no adverse effects to the turtle are expected to occur with the project alternatives.

Endangerment: Hatchlings and juveniles are preyed upon by a variety of vertebrate predators, including certain fishes, bullfrogs, garter snakes, wading birds, and some mammals (Zeiner, et al., 1988).

3.3.3 Birds

TRICOLORED BLACKBIRD (*Agelaius tricolor*)
Family: Emberizidae

Status: The tricolored blackbird is a species of special concern in California and is a category 2 candidate for Federal listing.

Description: The tricolored blackbird is 7 to 9-1/2 inches long. The male looks like the red-winged blackbird except that it has a much darker red shoulder patch than the redwing, and the shoulder patch is bordered by white instead of yellow. The female tricolored blackbird looks like the female redwing but is darker. The lower part of the breast and the lower back are sooty colored, and the streaking on the underparts is obscured (Terres, 1980).

Habitat: 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 blackbird produces two broods each year, laying eggs between April and June. Eggs hatch in about 11 days, and the young leave the nest about 13 days after hatching (Terres, 1980).

Invertebrates make up about 80 percent of the tricolored blackbird's diet. In the summer this mainly includes beetles, caterpillars, and spiders. During the fall and winter, weed seeds and grain are an important part of the bird's diet (Terres, 1980).

Distribution: 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.

Project Area Occurrence: A search of the NDDB (1995) revealed no recorded sightings of the blackbirds around Lake Kaweah, but there may be suitable foraging habitat in the Tulare lakebed. Because the tricolored blackbird and its habitat may

exist in the project area, surveys were conducted by DWR to determine the presence or absence of the bird and its habitat in the project area.

Project Impacts: The survey report concluded that this species is known to occur in the Tulare lakebed when flooded areas promote cattail growth. Water management decisions in the lakebed probably have a greater influence on this species than the amount of flooded acreage. Therefore, a reduction in flooded acreage due to the project alternatives may not have a direct effect on the species. The wetland mitigation plan for the project may indirectly provide suitable habitat for this species.

Endangerment: Tricolors have been proposed for state and federal listing as endangered because their overall population has declined by more than 90% since the 1930's. The population is declining, at least in part, because of drainage of marshes (Terres, 1980).

WHITE-FACED IBIS (*Plegadis chihi*)
Family: Threskiornithidae

Status: The white-faced ibis is a category 2 candidate for Federal listing.

Description: The white-faced ibis is a dark, chestnut-colored bird with a long down-curved bill. This species is very similar to the glossy ibis of the eastern United States. The two can only be differentiated during the breeding season. During this time the white-faced ibis is characterized by white feathers bordering the bare facial skin, from the top of the bill around the eyes and under the chin. The glossy ibis has blue feathers bordering the bare facial skin (Terres, 1980).

Habitat: The white-faced ibis seems to prefer freshwater marshes and rice fields where it eats insects, newts, leeches, earthworms, some snails, crustaceans, and fishes. Nesting occurs in colonies typically associated with wetlands; at times small groups may be found in heron rookeries. Nests are usually built in large beds of bulrushes or reeds (Terres, 1980).

Distribution: This species primarily occurs in central North America, east of the Sierra Nevada and west of the Mississippi River. Small breeding populations do occur in the Central Valley of California. Small numbers have been known to winter in southern central California (Terres, 1980).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the white-faced ibis in or near the project area. The white-faced ibis seems to prefer freshwater marshes and rice fields. The white-face ibis may forage in this

habitat type at the Tulare lakebed. Because the white-faced ibis and its habitat may exist in the project area, surveys were conducted by DWR to determine the presence or absence of the bird and its habitat in the project area.

Project Impacts: This species occurs and nests in the Tulare lakebed when habitat conditions are favorable. As a result, a reduction in floodwater to the lakebed under Alternatives 2 and 3 is expected to have an incremental effect on this species. To compensate for this potential loss, the wetlands mitigation plan for the project alternatives would provide suitable habitat for this species.

Endangerment: Endangerment stems from loss of habitat and eggshell thinning due to pesticide ingestion by the breeding birds.

MOUNTAIN PLOVER (*Charadrius mountanus*)
Family: Charadriidae

Status: The mountain plover is a Federal category 2 candidate.

Description: The mountain plover's field marks are similar to a small Killdeer, but without breast-rings. In breeding plumage, it has a white forehead and white line over it's eye, contrasting with a black crown in non-breeding season. Unbanded white underparts separate this plover from all other brown-backed plovers in breeding season. A buffy tinge on its breast is more extensive in winter plumage. It may be confused with winter Lesser Golden-Plover but the mountain plover has paler unspotted upperparts and paler legs, light wing-stripe, and dark tailband (Peterson, 1961). Its eggs (usually in threes) are olive and spotted.

Habitat: The mountain plover's habitat consists of semiarid grassland, plains, and plateaus. This bird forages in dry upland sites and nests in scraped areas on the ground. The mountain plover feeds on small marine life, insects, and some vegetable matter.

Distribution: The mountain plover breeds from northern Montana, North Dakota through Wyoming, western Nebraska, western Kansas, Colorado, New Mexico into western Texas. The mountain plover winters from central California, southern Arizona, southern Texas to central Mexico. Several records of the mountain plover have also been noted in northwestern California, Nevada, Utah, southeastern Alberta, and southern Saskatchewan (Peterson, 1961). The mountain plover is fairly common October - March, with some stragglers in July, on very short grassland or mostly barren fields of the Central Valley of California (chiefly San Joaquin Valley, Carrizo Plain, and Imperial Valley). Stragglers are also recorded on

coastal grasslands of central and southern California August - February (Cogswell, 1977).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the mountain plover in or near the project area. However, its habitat requirements and known distribution suggest that it may be present. Therefore, surveys were conducted by DWR to determine the presence or absence of the bird and its habitat in the project area.

Project Impacts: The survey report indicated that the mountain plover is known to winter in the San Joaquin Valley on the west side. Since this species only has the potential to winter in the project area, no adverse effects to this species are anticipated.

Endangerment: Endangerment steam from urban expansion and agricultural conversion.

WESTERN SNOWY PLOVER (*Charadrius alexandrinus nivosus*)
Family: Charadriidae

Status: The western snowy plover, interior population, is a Category 2 candidate species for Federal listing. The western snowy plover is one of two subspecies of the snowy plover which occur in the United States. The western snowy plover is considered to consist of two distinct subpopulations--the costal and the interior populations as determined through extensive banding studies (Buford pers comm, 1995). The snowy plover is noted by the State of California as a Species of Special Concern.

Description: Little information is available on the interior population of the western snowy plover, a subspecies of the snowy plover. Generally, the snowy plover is very pale in color, and very pale in color in the Gulf coast birds. It has a thin dark bill, dark or grayish legs, a partial breast band, and a dark ear patch. Females and juveniles resemble the piping plover (National Geographic Society, 1987).

Habitat: While the coastal population of the western snowy plover typically inhabits coastal areas, such as beaches, sandy flats, estuaries, and salt ponds (Zeiner et al., 1990), as a year-round resident, the interior population migrates inland to breed in areas including agricultural waste water evaporation ponds and the perimeters of alkaline lakes (Buford pers comm, 1995). The snowy plover requires a sandy, gravelly or friable soil substrate for nesting. Nests are shallow depressions in the sand or soil, sometimes lined with small pebbles, glass

fragments, or gravel. Frequently locates nest near or under objects such as driftwood, rocks, or defoliated bushes (Zeiner et al., 1990).

The snowy plover gleans insects and amphipods from the dry sand of upper beaches along the coast. Occasionally forages in wet sand for young sand crabs. At salt ponds and alkali lakes, feeds primarily on brine flies. May stand in water for cooling at some of the hotter inland nesting areas (Zeiner et al., 1990).

Distribution: In general, western snowy plovers are distributed throughout the western United States from southern Washington through Baja California. Some populations winter in Baja California and Mexico, and the interior population breeds inland in the western United States from Oregon and Nevada to California. In California, breeding birds of the interior population occur in the Central Valley and along the western edge of the Sierra Nevada. Nests, feeds, and takes cover on sandy or gravelly beaches along the coast. Inland nesting areas occur at the Salton Sea, Mono Lake, and isolated sites on the shores of alkali lakes in northeastern California, the Central Valley, and southeastern deserts (Zeiner et al., 1990). Migration activities begin in July and August from northwest Oregon to Baja California. Remains on wintering grounds from September through March. Smaller numbers remain year-round at the Salton Sea and at the salt ponds on San Francisco Bay (Zeiner et al., 1990).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the western snowy plover in or near the project area. The western snowy plover may forage in small ponds in the Tulare lakebed area. Since the western snowy plover and its habitat may exist in the project area, surveys were conducted by DWR to determine the bird's presence or absence in the project area.

Project Impacts: The survey report noted that the western snowy plover is an obligate saltwater species that is known to use evaporation ponds near the Tulare lakebed. Since this species is an obligate saltwater species, there is no suitable habitat in the project area, and no adverse effects are anticipated.

Endangerment: Gulls, ravens, coyotes, and skunks are important predators of adults, eggs, and young at Mono Lake. The historical nesting area for the snowy plovers, sandy marine beaches, has brought them into constant contact with humans using these populations at salt ponds and other inland areas is opportunistic and compensates somewhat for increased human disturbance at the coastal nesting sites (Zeiner, et al., 1990).

3.3.4 Mammals

PACIFIC WESTERN BIG-EARED BAT (*Plecotus townsendii*)
Family: Vespertilionidae

Status: The Pacific western big-eared bat is a category 2 candidate for Federal listing. The State lists it as a Species of Special Concern.

Description: The Pacific western big-eared bats typically weigh 9 - 11 grams. Their forearms are 41 - 46 mm long and they have extremely large ears, over 25 mm high and joined at across the forehead. On the nose in front of the eyes are two prominent lumps. Generally, this bat is clove-brown, with the bases of ventral hairs being grey or brown and the tips brown or buffy. The tail membrane is naked and the skull has 32 teeth (Burt and Grossenheider, 1980).

Habitat: The Pacific western big-eared bat requires caves, mines, tunnels, buildings, or other human-made structures for roosting. It may use separate sites for night, day, hibernation, or maternity roosts. Hibernation sites are cold but not below freezing. Maternity roosts are warm. Roosting sites are the most important limiting resource for this species. This bat prefers mesic sites. It captures beetles and a variety of soft-bodied insects in flight, or gleans them from brush or trees or feeds along habitat edges (Harris, 1990).

Distribution: *P. t. townsendii* is found throughout California.

Project Area Occurrence: According to the NDDB (1995), the Pacific western big-eared bat has no recorded occurrences in the project area. Since there is no potential roosting habitat in or near the project area or at specific worksites, it is unlikely that this bat would be present in the Kaweah project area.

Project Impacts: Since there is no suitable roosting habitat in or near the proposed project worksites, this species would not be adversely affected by the project alternatives.

Endangerment: The primary threat to *P. t. townsendii* is habitat loss. This species is extremely sensitive to disturbance of roosting sites. All known nursery colonies in limestone caves in California have been abandoned. In addition, the species is especially sensitive to wing banding (Harris, 1990).

GREATER WESTERN MASTIFF-BAT (*Eumops perotis californicus*)
Family: Molossidae

Status: The greater western mastiff-bat is a category 2 candidate for Federal listing. It has no State listing.

Description: The western mastiff bat is the largest native bat in the United States. Its wings are distinctively long and narrow. This allows rapid sustained flight, but limits maneuverability (Zeiner, 1990).

Habitat: These bats live in arid and semi-arid lowlands. They roost on or in crevices, cliffs, trees, tunnels and buildings, usually in colonies but sometimes singly (Ingles, 1965). They use riparian habitat for forage (Zezulak, 1992). Suitable habitat for the bat consists of extensive open areas with abundant roost locations provided by crevices in rock outcroppings and buildings (Zeiner, 1992).

Distribution: This species occurs in the lower Sonoran Desert, along the Colorado River and the California coast from San Diego to Santa Barbara and then in a narrow belt inland up to Alameda. They occur west of the confluence of the San Joaquin and Sacramento Rivers (Ingles, 1965).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the greater western mastiff-bat in the project area. Since there is no potential roosting habitat in or near the project area or at specific worksites, it is unlikely that this bat would be present in the Kaweah project area.

Project Impacts: Since there is no suitable roosting habitat in or near the proposed project worksites, this species would not be adversely affected by the project alternatives.

Endangerment: The loss of riparian habitat is a major endangerment to this species.

NELSON'S ANTELOPE GROUND SQUIRREL (*Ammospermophilus nelsoni*)
Family: Sciuridae

Status: The Nelson's antelope ground squirrel is also known as the San Joaquin antelope squirrel. This species is classified as a Category 1 candidate species for Federal listing. This species is designated a threatened mammal species in California (DFG, 1980).

Description: The Nelson's antelope ground squirrel, like other ground squirrels, is a diurnal mammal active during daylight hours. the animal is about 9 inches long, grayish brown with one white stripe on each side and no dark colored body stripes (Schlorff, 1987). The tail is about 2 3/4 inches long and typically held closely over the back while running exposing a white underside. The Nelson's antelope ground squirrel employs a combination of thermoregulation adaptations that allow it to thrive in its arid environment. The animals' thermoneutral zone is higher than any other nonsweating mammal (90-107 degrees F) (Schlorff, 1987).

The Nelson's antelope ground squirrel and all other ground squirrels are fossorial, making tunnels and burrows underground. All ground squirrels have inside cheek pouches which are used to store and transport foods such as seeds and fruits. The antelope ground squirrel has a diet consisting primarily of seeds, nuts, and fruits. Insects and carrion are taken when available (Schlorff, 1987).

This species inhabits arid sparsely-vegetated plains and lower mountain slopes. Females produce one (usually) to two litters of 5-11 young annually. Gestation is about 30-35 days. Average life span in the wild is often less than one year but a maximum of four years is possible for captive individuals (Schlorff, 1987).

Habitat: The Nelson's antelope ground squirrel exists among dry, sparsely vegetated, loam soils. Suitable habitat for this mammal is scattered shrubs, annual forbs and grasses, and is distributed over broken terrain with small gullies and washes (Zeiner et al., 1990).

The Nelson's antelope squirrels feed primarily on insects, green vegetation, seeds, and occasionally on small vertebrates. Insects were the predominant food items consumed from mid-May to mid-December, and green vegetation (annual grasses and forbs) made up the majority of the diet from mid-December through mid-May. Small vertebrates and seeds of perennial shrubs, annual grasses, and forbs, were eaten throughout the year, accounting for 5-20 percent of the diet (Zeiner et al., 1990).

These squirrels dig burrows, or use kangaroo rat burrows. They also use cover provided by rocks and other topographic features. These squirrels frequent areas with sandy loam soils, widely spaced alkali scrub vegetation, and dry washes (Zeiner et al., 1990).

Distribution: The Nelson's antelope squirrel is a permanent resident of the western San Joaquin Valley from 200-1,200 feet in elevation on dry, sparsely vegetated loam soils. Found from southern Merced Co., south to Kern, Kings, and Tulare counties. These squirrels also occur in portions of eastern San Luis Obispo

County. In 1979, only about 20 percent of the original range was occupied (Zeiner et al., 1990).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the Nelson's antelope squirrel in or near the project area. Since this species inhabits sparsely vegetated arid plains and lower mountain slopes with minimally disturbed natural grass and shrub communities, it may occur in the foothills around the Kaweah Reservoir. The squirrel probably would not be near construction sites at the dam because of the potential high water levels.

Project Impacts: No adverse impacts to the San Joaquin antelope squirrel are anticipated since there is no suitable habitat at or near the proposed construction sites.

Endangerment: Loss of habitat to cultivation and the effects of rodenticide have contributed to the decline of this species (Zeiner et al. 1990). The population trend is considered to be declining due to loss, degradation, and fragmentation of habitat to urban, agricultural, and other human development; overgrazing by livestock; and highway construction (DFG, 1992).

SPOTTED BAT (*Euderma maculatum*)
Family: Vespertilionidae

Status: The spotted bat is a Federal Category 2 candidate. It has no State listing.

Description: *E. maculatum* is dark sepia, has huge ears, and has a white spot on its rump and another on each shoulder. Its forearm is approximately 51 mm long, and its skull has 34 teeth (Burt and Grossenheider, 1980).

Habitat: Habitats occupied by the spotted bat range from arid deserts and grasslands to mixed conifer forests. Cliffs provide optimal roosting habitat for this bat. Generally, it prefers to roost in rock crevices. Occasionally, it roosts in caves and buildings. Moths are the principle food for the spotted bat (Harris, 1990).

Distribution: The spotted bat is limited to southern California, Nevada, New Mexico, Arizona, and portions of a few other western states.

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the spotted bat in or near the project area. The spotted bat prefers sites with adequate roosting habitat such as cliffs. Since there is no potential roosting habitat in or near the project area or at specific worksites, it is unlikely that the spotted bat would be present in the Kaweah project area.

Project Impacts: Since there is no suitable roosting habitat in or near the proposed project worksites, this bat would not be adversely affected by project alternatives. If cliffs are present, the species would most likely be located in the foothills which are outside of the project area.

Endangerment: The spotted bat may be threatened by human disturbance and the loss of habitat.

SHORT-NOSED KANGAROO RAT (*Dipodomys nitratoides brevinasus*)
Family: Heteromyidae

Status: The short-nosed kangaroo rat is a subspecies of the San Joaquin kangaroo rat (*Dipodomys nitratoides*) and is closely related to the Fresno and Tipton kangaroo rats, which are both subspecies of the San Joaquin kangaroo rat. The short-nosed kangaroo rat is a Category 1 Candidate species for Federal listing.

Description: Since there is little information available on the short-nosed kangaroo rat, and it is closely related to the Fresno kangaroo rat (*Dipodomys nitratoides exilis)*, the Fresno kangaroo rat will be described here. The short-nosed kangaroo rat does not differ substantially from the other subspecies of *D. nitratoides* or the general form and appearance of other species of kangaroo rats (Schlorff, 1995). As with other kangaroo rats it is adapted for bipedal locomotion, having greatly enlarged hind limbs, a long tail, and a short neck. The head is large and dorsal-ventrally flattened and with dorsal-laterally placed ears and eyes. Dorsal and lateral surfaces are colored dark yellowish-buff; the underparts are white. Dark whisker patches are connected by a dark band of fur across the nose. The tail has a crest of longer hairs distally, terminating in a tuft. *D. n. exilis* is distinguished from *D. n. nitratoides* and *D. n. brevinasus* by its smaller size. The skull is shorter, with relatively less inflated mastoid bullae and shorter rostrum and nasal bones than other populations. *D. n. exilis* is darker in color than typical *D. n. brevinasus*, but is about the same shade as some *D. n. nitratoides* (Schlorff, 1990).

Habitat: *Dipodomys nitratoides brevinasus* occupies grassland and desert-shrub associations on friable soils. They inhabit highly alkaline soils around Soda Lake, on the Carrizo Plains, and less saline soils elsewhere. On the valley floor, around Los Banos, Merced County, small populations live on dikes secure from winter flooding, then move into seasonally flooded iodine bush shrublands during the summer months, where at least some individuals reproduce. The short-nosed kangaroo rat was reported to occur in the Panoche Valley, San Benito County, on gentle slopes and rolling, low hill-tops where some shrubs were present. Light to moderate grazing by livestock probably enhances habitat for short-nosed kangaroo rats (Williams, 1986).

Distribution: Short-nosed kangaroo rats are found on the western side of the San Joaquin Valley, from near Los Banos, Merced County, southward west of the San Joaquin River and a line approximately coincident with the Kettleman Hills, Lost Hills, and Elk Hills to the southern end of the valley. They also occur in the Panoche Valley, San Benito County, the Sunflower Valley, Kings County, the Antelope Plain in Kern County, the Carrizo Plain in San Luis Obispo County, the Cuyama Valley in San Luis Obispo and Santa Barbara counties, and at the edge of the valley floor around the south end of the San Joaquin Valley from the vicinity of Maricopa on the West to east of Bakersfield on the east. Within this area, they are found mostly on flat and gently sloping terrain and on hill tops in desert-shrub associations, primarily Atriplex (Williams, 1986).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the short-nosed kangaroo rat in or near the project area. Since there is suitable habitat (alkaline grasslands and shrubs) for this species in the project area, it is possible that the short-nosed kangaroo rat could occur. This species could exist around the reservoir in areas above the flood levels in the valley grassland, but most likely not at the construction sites.

Project Impacts: No adverse impacts to the short-nosed kangaroo rat are anticipated since its habitat is not likely to be present near the construction sites.

Endangerment: Rapid urbanization, and agricultural developments associated with the State Water Project have extirpated this species from much of its historical range (Zeiner, et al., 1990).

3.3.5 Invertebrates

CIERVO AEGIALIAN SCARAB BEETLE (*Aegialia concinna*)
Family: Scarabaeidae

Status: The Ciervo aegialian scarab beetle is a Category 1 species for Federal listing. It has no State listing.

Description: The Ciervo aegialian scarab beetle is a small beetle of the family Scarabaeidae. Aegialia concinna is a pale brownish yellow color, with its ventral surface mostly paler than dorsum. The head is mostly granulate with some close, coarse punctures, and the vertex smooth. Its functional wings are absent. The length ranges from 3.33 to 3.52 mm, and the width ranges from 1.75 to 1.80 mm. The small size, pale color, and slender, smooth hind tibiae distinguish *concinna*. No close relationship with any species of *Aegialia* is apparent, and the lack of males makes genitalic comparisons impossible. When it was described by

Gordon and Cartwright in 1977, only four specimens, all females, were available. Since then, many more specimens have been collected (Cartwright and Gordon, 1988).

Habitat: There is little information available at this time. This beetle is a flightless dune-obligate species, usually found on sandy substrates and probably feeds on detritus. Specific habitat requirements and life history information are unknown.

Distribution: Records have shown *A. concinna* to be found in California at various locations such as Contra Costa County, Antioch; Fresno Co., Monocline Ridge; San Benito Co., Panoche Road. It has also been found near Mendota in Fresno County (Cartwright and Gordon, 1988).

Project Area Occurrence: The NDDB (1995) contained no records for this species. Since this is a dune-obligate species and there are no sand dunes in the project area, the Ciervo aegialian scarab beetle probably does not occur there (Andrews, 1995).

Project Impacts: No adverse impacts to *A. concinna* are anticipated since its habitat is not present in or near the proposed construction sites.

Endangerment: *A. concinna* is threatened by the loss of habitat and habitat degradation (FWS, 1995).

SAN JOAQUIN TIGER BEETLE (*Cicindella tranquebarica*)
Family: Cicindelidae

Status: The San Joaquin tiger beetle is a Federal category 2 candidate for Federal listing. It has no State listing.

Description: There is little information available at this time. However, studies on behavioral control of body temperature among tiger beetles has received substantial attention. The genus *Cicindela* is cosmopolitan in distribution. Adults are diurnal predators which actively search the ground surface for prey. Adult C. *tranquebarica* are 13-16 mm long and weigh about 0.1 gram. Their dorsal body surface is bronze colored with white markings on the elytra (Morgan, 1984).

Habitat: No information is available at this time.

Distribution: Little information is available at this time. This species is found from Maine to Arizona.

Project Area Occurrence: A search of the NDDB (1995) revealed no records for this species. Since there is no description of habitat for this species, it is not known whether the San Joaquin tiger beetle would occur in the project area.

Project Impacts: Since it is not known whether suitable habitat exists in or near the project area for this species, impacts to the tiger beetle are unknown at this time.

Endangerment: The San Joaquin tiger beetle is probably threatened by the loss of habitat and habitat degradation.

DOYEN'S TRIGONOSCUTA DUNE WEEVIL (*Trigonoscuta doyeni*)
Family: Curculionidae

Status: Doyen's trigonoscuta dune weevil is a Category 2 species for Federal listing. It has no State listing.

Description: There is no information is available at this time.

Habitat: *Trigonoscuta doyeni*, a member of the family curculionidae, is a sand inhabiting weevil in the Kettleman City sand dunes in Kings County, California. The last observations on the beetle were obtained in 1980 on a very small patch of sand a few square yards wide. The life history, distribution, and habits are unknown (FWS, 1995).

Distribution: There is only one area that this dune weevil is known to occur, and this is west of Interstate 5 and north of Highway 41, 1 mile west of Kettleman City in Kings County (Andrews, 1995).

Project Area Occurrences: The NDDB (1995) contained no records for this species. Since there are no sand dunes in the project area, the Doyen's trignoscuta dune weevil probably does not occur there (Andrews, 1995).

Project Impacts: No adverse impacts to the Doyen's dune weevil are anticipated since its habitat (sand dunes) is not present in or near the proposed construction sites.

Endangerment: This beetle is seriously threatened by destruction of the sand dunes and industrial development. Habitat degradation is occurring rapidly (FWS, 1995). The beetle is found on public lands owned by the Bureau of Land Management and is threatened by off-road vehicle use in the sand dunes

(Andrews, 1995). This beetle may have already been extirpated from its type locality.

3.3.6 Plants

HEARTSCALE (*Atriplex cordulata*)
Family: Chenopodiaceae

Status: Heartscale is a category 2 candidate for Federal listing. It has no State listing.

Description: Heartscale is an annual which reaches about 15-35 cm. high. The branches are stout, spreading or ascending, covered with barqan-like scales and straw-colored. Leaves are numerous, sessile, broadly cordate-ovate, 5-10 cm. long acute or obtuse at the apex, clasping at the base, entire, white-furtivaceous and firm. The staminate and pistillate flowers are mixed in small axillary clusters. Fruiting bracts are sessile or subsessile, ovate-orbicular, 3mm. long, compressed, acute at apex, united to the middle, deeply and acutely dentate, the sides slightly tuberculate or smooth. Flowers from May to October (Munz and Keck, 1973:68).

Habitat: Heartscale prefers hard, trampled, somewhat alkaline or saline soils. It is found in valley grassland communities (Munz and Keck, 1973:68).

Distribution: Heartscale occurs at an elevation range from sea level to 600 feet in the central Valley of California. It is known to occur in the Sacramento and San Joaquin valleys. Approximately 25 populations are known from as far south as Tulare County to as far north as Glenn County.

Project Area Occurrence: A search of the NDDB (1995) does not contain any record of this species although habitat may occur in the Tulare lakebed area. Therefore, surveys were undertaken by DWR to determine the current status of this species in the project area.

Project Impacts: The Tulare lakebed is the only portion of the project area that would be in the range of this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of the project alternatives would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Endangerment: No information on endangerment is available at this time.

BRITTLESCALE (*Atriplex depressa*)
Family: Chenopodiaceae

Status: Brittlescale has been recommended for Category 2 status by the FWS. It has no State listing.

Description: Very little information is available at this time. The stems of the brittlescale are prostate to decumbent, glabrous to scaly, white, and generally brittle. The leaves are sometimes opposite, with 4-8 mm size blades, that are cordate to ovate, entire, and generally white-scaly, with acute tips that are sessile (Hickman, 1993).

Habitat: Very little information is available at this time. Brittlescale prefers alkaline or clay soils (Hickman, 1993).

Distribution: Brittlescale is known to occur near Mendota in Fresno County and Merced to Kern Counties. Its range is from the Sacramento Valley to the San Joaquin Valley.

Project Area Occurrence: A search of the NDDB (1995) does not contain any record of this species although habitat may occur in the Tulare lakebed area. Therefore, surveys were undertaken by DWR to determine the current status of this species in the project area.

Project Impacts: The Tulare lakebed is the only portion of the project area that would be in the range of this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of the NED plan and locally preferred plan would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Endangerment: No information on endangerment is available at this time.

LESSER SALTSCALE (*Atriplex minuscula*)
Family: Chenopodiaceae

Status: Lesser saltscale has been recommended for Category 2 candidate status by the FWS (January 1995). It has no State listing. Very little information is found at this time on this species.

Description: Very little information is available at this time.

Habitat: This species is found along alkaline playas.

Distribution: The range for this species is from Fresno and Kern Counties.

Project Area Occurrence: A search of the NDDB (1995) does not contain any record of this species although habitat may occur in the Tulare lakebed area. Therefore, surveys were undertaken by DWR to determine the current status of this species in the project area.

Project Impacts: The Tulare lakebed is the only portion of the project area that would be in the range of this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of the project alternatives would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Endangerment: No information on endangerment is available at this time.

LOST HILLS SALTBUSH (*Atriplex vallicola*)
Family: Chenopodiaceae

Status: Lost Hills saltbush is a Category 2 candidate species for Federal listing. It has no State listing.

Description: Lost Hills saltbush is another annual within the same genus and family as heartscale, *Atriplex cordulata*. This plant grows to less than 8 inches but has the same kind of erect stems as the heartscale, *Atriplex cordulata*. The leaves and flowers are different between these two species. Very little information is available on this species at this time.

Habitat: This species is found in dried pools and in alkaline soils. This plant occurs at elevations less than 600 feet in the San Joaquin Valley. Lost Hills saltbush integrates with *Atriplex cordulata*.

Distribution: Historical collections of this plant are only found in Fresno, King, Kern, and San Luis Obispo Counties (CNPS, 1988).

Project Area Occurrence: A search of the NDDB (1995) does not contain any record of this species although habitat may occur in the Tulare lakebed area. Therefore surveys were undertaken by DWR to determine the current status of this species in the project area.

Project Impacts: The Tulare lakebed is the only portion of the project area that would be in the range of this species. However, the species would only inhabit areas in the lakebed that are not flooded. Since the effect of the NED plan and

locally preferred plan would be an incremental loss of flooded area in the lakebed, no adverse effects to this species are anticipated.

Endangerment: Lost Hills saltbush is threatened by grazing and agriculture conversion (CNPS, 1988).

KAWEAH BRODIAEA (*Brodiaea insignis*)
Family: Amaryllidaceae

Status: Kaweah brodiaea is a Federal category 2 candidate species. The State has classified it as an endangered species.

Description: Kaweah brodiaea is a showy, herbaceous perennial 10-30 cm tall. It grows from a dark-brown, fibrous-coated corm found 5-15 cm below ground level. It bears several long, linear-basal leaves and the stems are leafless. Leaves are rose-purple to pink flowers on thin pedicels 2-9 cm long. Flowers have short, unconstricted, tubular perianth tube, 6-9 mm long. Three sepals, petal-like, together with petals total six. Due to their similar appearance, the six are termed "tepals". They measure 1-1.5 cm in length and spread at right angles in a wheel-like appearance from the tube. Staminodia three, notched, prominent, erect, strongly involute, and white. Anthers 3 and attached by the base. Stigma three-winged. Seeds black and with a longitudinally striated surface.

Closely related genera are *Dichelostemma* and *Triteleia*; both lack staminodia. Sympatric *Brodiaea* include *B. coronaria* and *B. elegans*. Both differ from *B. insignis* in having flowers 2.4-3.8 cm in length. The former has rose-purple flowers. The latter has a funnel-like perianth tube, flat staminodia and purple-violet flowers.

Habitat: Heavy clay soil over granite on west-facing slopes, foothill oak woodland, at 240-460m. This attractive wildflower forms small, pink carpets of color within the blue oak savannah and valley grassland plant communities. It grows on granitic substrates preferring deep, clayey soils and south/southwest-facing slopes.

Distribution: Kaweah brodiaea is endemic to the Kaweah and Tule River drainages of Tulare County, California. Kaweah brodiaea was found to grow with the rare spiny-sepaled coyote-thistle (*Eryngium spinosepalum*), in moist swales in a valley grassland plant community. Elevation: 500-4500 feet.

Project Area Occurrence: Several occurrences of the Kaweah brodiaea have been recorded near but not in the project area (NDDB, 1995). These records were substantiated by a vegetation survey conducted in 1991 (DWR, 1991).

Therefore, surveys were conducted by DWR to determine the presence or absence of the plant and its habitat in the project area.

Project Impacts: During surveys for this study in May 1995, DWR discovered a new population of this species at the east end of the reservoir. The elevation of this population was estimated to be 720 feet. This elevation is very close to the new proposed inundation level of 715 feet. About five plants were located at this site. A topographic survey would be needed to determine if this population would be inundated by the project alternatives. Since this species is a candidate species, no mitigation is required by Federal law but if inundated, relocation of the population to an appropriate location could be done by lake personnel at no added cost to the project. During the pre-construction and engineering phase of the project, plans would be made to relocate this population. Additionally, this site should be protected from human disturbances by building firebreaks with exclusionary fencing.

Endangerment: Previously thought to be one of the rarest plants in the southern Sierra Nevada, Kaweah brodiaea has recently been found at several sites on private grazing land, though it is still restricted in range. Historic localities in the Tule River Canyon appeared to have been extirpated. A recent reintroduction program in that watershed has reestablished the plant on National Forest lands within its historic range. Kaweah livestock grazing, road widening and maintenance, including roadside herbicide spraying and mowing.

SLOUGH THISTLE (*Cirsium crassicauleii*)
Family: Asteraceae

Status: The slough thistle is a Federal category 2 candidate species. The CNPS inventories the species on list 1B with a R-E-D code of 3-3-3: (a) occurrence confined to several populations, or present in such small numbers that it is seldom reported, (b) endangered in a portion of its range, and (c) endemic to California (CNPS, 1988).

Description: The slough thistle comprises thistle-like plants with white, pink, or purplish flowers, more than one flower per head, nonfleshy receptacles, and plumose pappus-bristles. *Cirsium* is an annual or biennial herb, 1 to 3 m tall, sometimes spreading by new rosettes from the base; stem leaves pinnately parted with clasping bases that form spiny ear-shaped lobes, upper surface becoming smooth and even with age, lower surface lightly pubescent; flower heads pinkish purple (sometimes white), each head 2 to 3 cm wide and tall; outer phyllaries with single, long, stiff, terminal spine and often a few shorter lateral spines arising near the apex.

Habitat: The slough thistle is usually found on banks of streams, marshes, sloughs, or canals and sometimes in moist to wet places.

Distribution: The slough thistle is listed as historically occurring in Kings, Kern, and San Joaquin Counties (CNPS, 1988).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of slough thistle in or near the project area. Since slough thistle is found on banks of streams, sloughs, or canals, it may occur downstream from Terminus Dam and along distributaries that eventually reach the Tulare lakebed.

Project Impacts: If the plant or its habitat exists in the project area, it is most to occur downstream of the reservoir between Terminus Dam and the Tulare lakebed. Project construction and inundation effects are limited to Kaweah reservoir, Terminus Dam and Horse Creek areas and the Tulare lakebed. No significant adverse effects due to the project are expected between Terminus Dam and the Tulare lakebed. Therefore, no adverse effects to the plant are expected to occur with the project.

Endangerment: Healthy populations of slough thistle may exist one year and be completely gone the next. Slough thistle sometimes grows in disturbed areas (CNPS, 1979).

RECURVED LARKSPUR (*Delphinium recurvatum*)
Family: Ranunculaceae

Status: The recurved larkspur is a category 2 candidate for Federal listing. The State has no special classification for this species. The CNPS places this species on their 1B list with a R-E-D code of 1-2-3; rare, but found in sufficient numbers and distributed widely enough that the potential for extinction is low at this time; endangered in a portion of its range; endemic to California (CNPS, 1988).

Description: *D. recurvatum* is a perennial with 18 - 85 cm stems. The stem base is often narrower than root but firmly attached to root and the stems are more or less glabrous. Leaves are 3 - 11 lobed and more or less glabrous. Basal leaves are generally much larger than cauline leaves. Pedicles are 10 - 56 mm, 7 - 25 mm apart, and more or less glabrous. Sepals are generally light blue and reflexed. Laterals are 11 - 16 mm and the spur is 10 - 18 mm. The lower petals are white. The fruit is 8 - 21 mm, generally less than 3X longer than wide. Seeds are winged and coat cell margins are wavy (Hickman, 1993). Flowering time is March to May (Munz, 1968).

Habitat: Recurved larkspur inhabits poorly drained, fine, alkaline soils in grasslands and *Atriplex* scrub from 30 - 600 m in elevation (Hickman, 1993).

Distribution: D. recurvatum is found in Glenn and Butte Counties and from Contra Costa County south to Kern County.

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the recurved larkspur in or near the project area. Recurved larkspur inhabits alkaline soils in grasslands and *Atriplex* scrub, which may be present downstream in the Tulare lakebed area. Because of the available habitat, it is possible that the recurved larkspur may exist in the project area. Therefore, surveys were conducted by DWR to determine the presence or absence of the plant and its habitat in the project area.

Project Impacts: This species favors poorly drained, fine alkaline grassland soils. The only portion of the project area with potential habitat would be the non-flooded areas of the Tulare lakebed. The survey report stated that an NDDB search did not show any records for the lakebed area. Since the project alternatives would reduce flooded acreage in the lakebed, no adverse effects to this species are anticipated.

Endangerment: Threats to this species stem from the continued loss of habitat due to the development of agricultural lands. Some populations are threatened by a proposed reservoir (CNPS, 1988).

SPINY-SEPALED COYOTE-THISTLE (*Eryngium spinosepalum*)
Family: Apiaceae

Status: The spiny-sepaled coyote-thistle is a category 2 candidate for Federal listing. It has no State listing.

Description: The spiny-sepaled coyote-thistle is an erect plant of the carrot family (Apiaceae) with branching stems that may grow up to 30 inches in height. The leaves are oblong to oblanceolate, and sharply serrate to pinnately sharply lobed. The sepals of the flowers are 3.5-4.5 mm, lanceolate, and pinnately sharply lobed or sharply toothed. The petals are white and oblong (Hickman, 1993).

Habitat: The spiny-sepaled coyote-thistly inhabits vernal pools and depressions found in grasslands from 300 to 600 feet (Hickman, 1993).

Distribution: Known to occur in Fresno, Stanislaus, and Tulare Counties (CNPS, 1988).

Project Area Occurrence: A search of the NDDB (1995) revealed several recorded sightings of the spiny-sepaled coyote-thistle within and near the project area. One recorded sighting substantiated during a 1991 vegetation survey by DWR, is located just above the high water mark at the east end of Lake Kaweah. Therefore, surveys were undertaken to determine the current status of this species in the project area.

Project Impacts: This species was discovered at the east end of Lake Kaweah during surveys in 1991. Surveys in May 1995 relocated this population but with a smaller number of plants. In 1991, the population was 300 plants, and now the population is about 50 plants. This population is located directly adjacent to the Kaweah brodiaea population. Since this species is a candidate species, no mitigation is required by Federal law but if inundated, relocation of the population to an appropriate location could be done by lake personnel at no added cost to the project. During the pre-construction and engineering phase of the project, plans would be made to relocate this population. Additionally, this site should be protected from human disturbances by building firebreaks with exclusionary fencing.

Endangerment: Recreational use, home construction, ranching activities threaten the spiny-sepaled coyote-thistle. Site would be inundated if lake is raised by 6 feet (NDDB, 1995).

3.4 Other Species of Concern

3.4.1 State-Listed Species

SWAINSON'S HAWK (*Buteo swainsoni*)
Family: Accipitridae

Status: The Swainson's hawk is listed as threatened by the State.

Description: The wing span of the Swainson's hawk is 4 to 4.75 feet. The wings are slightly pointed and, when gliding, are held in a somewhat above horizontal position. Both sexes of this hawk are similar in appearance. Typical adults can be identified by the dark breastband. From overhead, buffy wing-linings contrast with the dark flight feathers, and the tail is gray above, often shading to white ar the base (Peterson, 1961).

Habitat: The Swainson's hawk is primarily found in riparian habitats. Cottonwoods, oaks, sycamores, and large willow trees form the dominant overstory vegetation in the zones most important to Swainson's hawks.

Historically, and to a lesser extent today, a native grassland community, including oat, bromegrass, ryegrass, and barley provided foraging habitat for Swainson's hawks beyond the valley oak component of the riparian system.

Nests are built at the top of cottonwoods and oaks that provide shade for the nest and also afford a good view of the surrounding terrain. Nests are generally 3 to 4 feet across and up to 100 feet above the ground. The same nest is often repaired and used again and again.

Food consist almost entirely of rodents (including ground squirrels) and insects (including locusts and crickets). Suitable foraging habitats include native grasslands or lightly grazed pastures, alfalfa, other hay crops, and certain grain and row crops (Terres, 1980). Unsuitable foraging habitat includes rice field, orchards, and cotton crops.

Distribution: Historically, the range of the Swainson's hawk included most of California except the Sierra Nevada and the wet northwest portion of the state. This hawk was once found throughout lowland Canada but is now restricted to portions of the central Valley and portions of the extreme northeastern part of the State and the Great Basin regions (DFG, 1979). Most reports of birds in the northeastern part of the state refer to migrants.

This is species is a scarce breeding bird in California, having suffered the most severe decline of any bird in the State except for the Bell's Vireo. Only a few pairs remain in the San Joaquin Valley, and most of these are from Merced County and northward. The largest known remaining population is located in the Davis, Woodland-Sacramento area of the Sacramento Valley. In the portions of Yolo county outside the Yolo Basin area, over 100 known active nests were counted. Also, the lower Sacramento River has one of the highest breeding densities of Swainson's hawk within Sacramento County, with 31 known active nests in 1990 located from River Miles 47-79.

Project area Occurrence: The NDDB (1995) contains no recorded sightings of the Swainson's hawk within the project area. The project area lies at the southern end of the Central Valley breeding range, where Swainson's hawk nests are few and scattered. The NDDB (1995) lists occurrences of the Swainson's hawk outside the project area.

Project Impacts: The project area is at the southern portion of the hawk's range. Known nests in the vicinity are few and scattered. The project alternatives would not adversely affect areas where suitable habitat may exist, downstream of Terminus Dam. Therefore, no adverse effects are anticipated.

Endangerment: The statewide population has experienced a steep decline from its estimated historic population of 17,000 breeding pairs to approximately 550 pairs in 1990 (Corps, 1991). Endangerment stems from loss of habitat due to urban expansion into existing agricultural and grassland areas and from the trend toward planting more and more crops that are unsuitable for Swainson's hawks (vineyards, orchards, rice, corn, and cotton).

4.0 Additional Listed and Proposed Species

4.1 Federally Listed Species

4.1.1 Fish

Two fish species, Paiute cutthroat trout (*Onchorhynchus clarki seleniris*) Little Kern golden trout (*Oncorhynchus mykiss whitei*), are Federally listed as threatened. These two species are native to areas outside the project area. The Paiute cutthroat trout is native to Silver King Creek and tributaries in the East Fork Carson River drainage in Alpine County. Populations have also been introduced into Stairway Creek in Madera County, Delaney Creek in Tuolumne County, and the outflow of Sharktooth Lake in Fresno County. The Little Kern golden trout is endemic to the Little Kern River drainage in Sequoia National Forest. Since no populations exist in the project area, they were eliminated from further detailed analysis.

4.1.2 Birds

ALEUTIAN CANADA GOOSE (*Branta canadensis leucopareia*)
Family: Anatidae

Status: The Aleutian Canada goose was Federally listed as an endangered species in 1967. In December 1990 it was reclassified as threatened. The Aleutian Canada goose has no State listing.

Description: A small race of Canada goose averaging 1,700 to 2,000 grams. Typical coloring is black head and neck, white cheek patches, dark back and wings, white rump, and black tail feathers, legs, and feet. B. c. leucopareia is distinguished by a conspicuous white neck ring at the base of the neck (usually greater than 10 mm wide), subtended by a ring of darker feathers. Cheek patches are usually separated by a black line under the throat. The similar appearing cackling Canada goose is smaller in size and has a darker breast color, whereas Traverner's Canada goose is larger and has a lighter breast color. Both these

subspecies sometimes have white neck rings, but they are usually narrow or indistinct (FWS, 1982).

Habitat: The Aleutian Canada goose uses a wide variety of habitats, including pasturelands 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).

Distribution: 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).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences of the Aleutian Canada goose in or near the project area. Potential habitat for this species exists in the intermittently flooded areas in the Tulare Lakebed. However, these areas are located significantly south of the nearest known wintering area (Los Banos) for this species.

Project Impacts: The project alternatives would result in an incremental reduction in flooding in the Tulare Lakebed area. These flooded areas may serve as roosting and foraging habitat for the Aleutian Canada goose. However, since the project area is significantly south of the known distribution of the Aleutian Canada goose, this species would not likely be adversely affected.

Endangerment: Several factors may have contributed to the initial decline of the Aleutian Canada goose. The most important of these factors was probably the introduction of the Arctic fox to the Aleutian breeding grounds of the geese. Foxes were first released on the islands in 1836 for fur-farming purposes. It is thought that the foxes fed on the geese, over time decimating their numbers and bringing them close to extinction. Buldir was one of the few islands that escaped the Arctic fox introduction. Other factors that may have hastened the goose's decline include over hunting and loss of habitat at the California wintering grounds (FWS, 1982).

AMERICAN PEREGRINE FALCON (*Falco peregrinus anatum*)
Family: Falconidae

Status: The American peregrine falcon is currently listed as endangered with the Federal and State governments. Studies are being conducted to determine if the falcon should be downgraded to the less critical threatened category.

Description: Adult peregrine falcons are outwardly similar, but the female is larger. This falcon is 15-20 in long and has a wingspread of 43-46 in. The wings are long and pointed. Adults are characterized by a slatey back and pale underparts, with spots and bars. Young birds are dark brown above and heavily striped below. The peregrine's flight pattern resembles that of the domestic pigeon (Terres, 1980).

Habitat: Peregrine falcon habitat basically consists of nesting, perching, roosting, and foraging areas in relatively open country. Some winter movement may occur, particularly in the northern part of the range (FWS, 1982).

The American peregrine falcon nests almost exclusively on cliffs, usually near water. Tree nesting is virtually unknown in this population, and nesting on man-made structures is rare. There are records of nests on dunes or other low mounds, but these are infrequent, and no recent records exist. Characteristics of nesting cliffs appear to be sheer cliffs of 150 ft or more in height and a small cave or overhung ledge large enough to contain three or four full-grown nestlings. Suitability of the cliff is enhanced by several holes or ledges that can be used in alternate years as nests (FWS, 1982).

Common foraging grounds for the bird generally include wooded areas, open grasslands, coastal strands, and bodies of water. Wooded areas near water attract a diverse avifauna, and bodies of water provide open areas where prey cannot easily escape attack. Marshes, savannas, and shorelines are also common foraging areas (FWS, 1982).

Distribution: Historically, the peregrine falcon was one of the most widely distributed of all bird species. Peregrines were recorded in most every major land mass of the earth except Antarctica and were found breeding over most of the range. Three subspecies were known in North America. The American peregrine falcon has historically nested throughout North America from the boreal forest south into Mexico wherever suitable nesting and foraging habitat occurred (FWS, 1982).

Currently, the peregrine is distributed throughout California. Productivity enhancement by State and Federal agencies has contributed to the rise of the peregrine populations. Captive breeding and hatching are successful forms of

enhancement. Of 211 peregrines hatched into the wild between 1974 and 1979, 71 percent reached the age of independence (FWS, 1982).

Project Area Occurrence: A search of the NDDB (1995) revealed no occurrences in or near the project area. There is no appropriate nesting habitat in the project area so it is unlikely that the peregrine falcon nests there. However, this species may forage in portions of the project area where waterfowl and/or songbirds congregate, such as riparian and wetland habitat around Lake Kaweah and flooded areas in the Tulare lakebed. If this species does use these areas, it is probably a highly mobile winter transient.

Project Impacts: No known or potential nesting habitat for this species would be affected by the project alternatives. However, the project alternatives may result in the loss of riparian habitat at the reservoir and an incremental reduction in flooding in the Tulare lakebed area. Both the riparian habitat and the flooded areas may serve as foraging habitat for the falcon because they provide habitat for the falcons prey (songbirds and waterfowl). As a result of this potential loss of habitat, the American peregrin falcon may be adversely affected. To compensate for this potential loss, the wetlands and riparian mitigation plan would provide suitable replacement foraging habitat.

Endangerment: Previous endangerment was due to the use of pesticides such as DDT and DDE. Egg shell thinning and behavioral differences caused by the pesticides increased mortality and decreased reproduction habits. Once the breeding population was reduced, natural mortality factors became significant contributors to the further decline of this species (FWS, 1982).

4.1.3 Mammals

GIANT KANGAROO RAT (*Dipodomys ingens*)
Family: Heteromyidae

Status: The giant kangaroo rat is Federally and State-listed as endangered.

Description: The giant kangaroo rat is the largest of the kangaroo rats. It has a large head on a short neck, relatively large eyes, and a white hip stripe. Its fur is mostly buff colored, with darker flanks and a white belly. Its head and body average 14.5 cm long. Its tail, which is a few inches longer than its body, ends in a large tuft. The average body weight for adults is between 130 and 180 grams (Thelander and Crabtree, 1994).

Habitat: This species inhabits fine sandy loam soils supporting sparse annual grass/forb vegetation. To a lesser extent, this species is also found in low-density alkali desert scrub. Optimal cover consists of areas with virtually no shrub overstory and homogeneous terrain. Seeds of peppergrass and filaree are the primary foods of the giant kangaroo rat (Ahlborn, 1982).

Distribution: Historically, the giant kangaroo rat ranged from northeastern Santa Barbara County and western Kern County, and from the base of the Techachapi Mountains northward to an area near Los Banos in Merced County. Currently, this species occurs in scattered colonies along the western side of the San Joaquin Valley (e.g. Carrizo Plain and Panoche Valley) (Ahlborn, 1982). The giant kangaroo rat is generally found only west of Interstate 5 (Hovik, 1995).

Project Area Occurrence: The NDDB (1995) reports no sightings of this species in the project area. Although marginal habitat for this species is present in the flood detention areas in the Tulare lakebed, this area is outside the known distribution of this species. Therefore, it probably does not occur there.

Project Impacts: The giant kangaroo rat most likely does not occur in the project area. Even if this species does occur in the project area (Tulare lakebed), it would not likely be adversely affected by any incremental reduction in flooding from the project (Hovik, 1995). Therefore, no adverse impacts on this species are anticipated.

Endangerment: This species is threatened by loss and degradation of habitat due to agricultural development and trampling by cattle. Use of rodenticides has also reduced population numbers (Ahlborn, 1982).

FRESNO KANGAROO RAT (*Dipodomys nitratoides exilis*)
Family: Heteromyidae

Status: The Fresno kangaroo rat is Federally and State-listed as endangered.

Description: The Fresno kangaroo rat has a large head on a short neck, relatively large eyes, a white hip stripe, and a relatively dark patch across its nose. The fur on its body is predominately buff colored with white on the belly. Its head and body together measure about 10 cm, and its tail measures 12.2 - 15.2 cm. The Fresno kangaroo rat uses its strong legs and large tail to bound from place to place, much like the kangaroo (Thelander and Crabtree, 1994).

Habitat: This species inhabits alkali desert scrub and herbaceous habitats on sandy loam soils. Seeds of annual forbs and grasses are the primary foods of the giant kangaroo rat. To a lesser extent, they also eat green vegetation (Ahlborn, 1982).

Distribution: Historically, the Fresno kangaroo rat ranged from north-central Merced County south through southwestern Madera and Central Fresno Counties. Today, this species is restricted to less than 6,500 acres of fragmented, isolated habitat in Fresno County (Thelander and Crabtree, 1994).

Project Area Occurrence: The NDDB (1995) reports no sightings of this species in the project area. Although marginal habitat for this species is present in the flood detention areas in the Tulare lakebed, this area is outside the known distribution of this species. Therefore, it probably does not occur there.

Project Impacts: The Fresno kangaroo rat most likely does not occur in the project area. Even if this species does occur in the project area (Tulare lakebed), it would not likely be adversely affected by any incremental reduction in flooding resulting from the project (Hovik, 1995). Therefore, no adverse impacts on this species are anticipated.

Endangerment: This species is threatened by loss and degradation of habitat due to agricultural development and trampling by cattle. Use of rodenticides has also reduced population numbers (Ahlborn, 1982).

4.1.4 Plants

SAN BENITO EVENING PRIMROSE (*Camissonia benitensis*)
Family: Onagraceae

Status: The San Benito evening primrose is Federally listed as threatened. This species has no special status with the State. The CNPS categorizes this plant on their 1B list with a R-E-D code of 3-3-3: occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported; endangered throughout its range; and endemic to California (Skinner and Pavlik, 1994).

Description: The San Benito evening primrose is a small, hairy, annual with bright yellow flowers. Its stems are erect or decumbent, 3 - 20 cm. Branches are wiry and widely spreading. Leaves are 7 - 20 mm, very narrowly elliptic, and minutely serrate (FWS, 1985; Hickman, 1993). Flowering time for this species is May to June (Skinner and Pavlik, 1994).

Habitat: This species inhabits clayey or gravelly alluvial terraces of serpentine origin in chaparral or cismontane woodlands. The plant is found at elevations ranging from 2,500 to 4,600 feet (FWS, 1985).

Distribution: The San Benito evening primrose is known only from a small number of colonies in parts of the Clear Creek and San Carlos Creek drainages in San Benito County (FWS, 1985).

Project Area Occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. No habitat for this species (gravelly alluvial terraces of serpentine origin) is present in the project area. Furthermore, the project area is significantly outside the known range of this species.

Project Impacts: San Benito evening primrose does not likely occur in the project area. Therefore, this species would not likely be adversely affected by the project alternatives.

Endangerment: The San Benito evening primrose is threatened by off-road vehicle use and gravel mining.

PALMATE-BRACTED BIRD'S BEAK (*Cordylanthus palmatus*)
Family: Scrophulariaceae

Status: Palmate-bracted bird's beak is State- and Federally listed as endangered. The CNPS categorizes this plant on their 1B list with a R-E-D code of 3-3-3: occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported; endangered throughout its range; and endemic to California (Skinner and Pavlik, 1994).

Description: Palmate-bracted bird's beak is a hemiparasitic annual herb. These plants are from 4 to 12 inches tall with several to many ascending-spreading branches from near or above the base of the stem. The stems range from sparsely to densely hairy and occasionally have short, glandular hairs. The leaves and stems are grayish green and are sometimes covered with salt crystals. The small, pale, whitish flowers, 1/2 - 1 inch long, are arranged in dense spikes. Each flower is surrounded by a small, palmately-lobed floral bract (FWS, 1986; Hickman, 1993). This species flowers between May and October (Skinner and Pavlik, 1994).

Habitat: This species of birds's-beak is found in seasonally flooded, saline-alkali (black-alkali) soils called pescadero clay of lowland flats and plains (CNPS, 1977). It is commonly associated with iodine bush (*Allenrolfea occidentalis*), alkali heath

(*Frankenia grandifolia* var. *campestris*), salt grass (*Distichlis spicata*), and pickleweed (*Salicornia* spp.) (CNPS, 1989; Skinner and Pavlik, 1994). The elevation range for this species is 0 - 60 m (Hickman, 1993).

Distribution: Historically, palmate-bracted bird's beak was collected from eight scattered locations in Fresno, Madera, San Joaquin, Yolo, and Colusa Counties, and more recently, Alameda County. Some of these populations have been eliminated, and others have been greatly reduced in size (FWS, 1986). Currently, there are approximately six extant occurrences of this species (Skinner and Pavlik, 1994).

Project Area Occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. No potential habitat or known population of palmate-bracted bird's beak is present in the project area.

Project Impacts: Palmate-bracted bird's beak does not likely occur in the project area. Therefore, this species would not likely be adversely affected by the project alternatives.

Endangerment: This species is threatened by habitat modifications caused by urban and agricultural development and off-road vehicle use. Small population size may also threaten this plant through genetic depletion and reduced reproductive potential (FWS, 1986).

HOOVER'S WOOLY-STAR (*Eriastrum hooveri*)
Family: Polemoniaceae

Status: Hoover's wooly-star is Federally listed as threatened. This species has no special status with the State. The CNPS places this species on their 1B list with a R-E-D code of 1-2-3: rare, but found in sufficient numbers and distributed widely enough that the potential for extinction is low at this time; endangered in a portion of its range; and endemic to California (CNPS, 1994).

Description: Hoover's wooly-star is an annual herb with many wire-like branches and small (approximately 0.25 inch across), white flowers. With branched greyish, fuzzy stems, this species stands about 2 - 3 inches tall. It differs from other *Eriastrum* in its flower size and the ratio of the corolla tube length to the length of the petal lobes (FWS, 1990; Hickman,1993). Flowering time for this species is April through July (Skinner and Pavlik, 1994).

Habitat: This species is endemic to the valley saltbush scrub, valley sink scrub, and grasslands of central California at elevations less than 170 meters.

Distribution: Hoover's wooly star was historically distributed in the Temblor Range (Kern and San Louis Obispo Counties), Cuyama Valley (San Louis Obispo and Santa Barbara Counties), and discontinuously within the valley saltbush scrub and valley sink scrub from Fresno County south in the San Joaquin Valley. Apparently, this species never grew around the borders of the historic Tulare Lake (Kings County). Twelve of the historical populations of this species have been eliminated (FWS, 1990).

Project Area Occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. Potential habitat for Hoover's wooly star is present in the Tulare lakebed area. However, this species has never been documented there.

Project Impacts: No currently or historically occupied habitat for this species would be affected by the project alternatives. Therefore, the project alternatives would not likely adversely affect Hoover's wooly star.

Endangerment: Agricultural land conversion, urbanization, conversion of habitat for ground-water recharge basins or disposal of nutrient-agricultural effluent, and oil and gas development threaten 92 percent of the remaining populations of this species (FWS, 1990).

SAN JOAQUIN WOOLY-THREADS (*Lembertia congdonii*)
Family: Asteraceae

Status: San Joaquin wooly-threads is Federally listed as endangered. This species has no special status with the State. The CNPS categorizes the plant on their 1B list with a R-E-D code of 3-2-3: occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported; endangered in a portion of its range; and endemic to California (Skinner and Pavlik, 1994).

Description: San Joaquin wooly-threads is an annual herb with frequently-branching white-wooly stems. These stems are approximately 10 inches in length and frequently trail on the ground. The disk flowers are yellow, 4-lobed, and bell shaped. The ray flowers are 3-lobed and yellow. This species is distinguished from its closest relative, *Eatonella nivea,* from the Great Basin, by the presence of dimorphic achenes (disk achenes are 3-angled, ray achenes are 2-angled) (Hickman, 1993; FWS, 1990). Flowering time for this species is March through May (Skinner and Pavlik, 1994).

Habitat: This species inhabits sandy grasslands and alkali sinks at elevations between 90 and 700 meters (Hickman, 1993).

Distribution: Approximately 30 populations of San Joaquin wooly-threads remain in the San Joaquin Valley and adjoining foothills from the vicinity of Panoche Pass (San Benito County) southeast to Caliente Creek, east of Bakersfield, and to the southwest in Cuyama Valley (San Luis Obispo and Santa Barbara Counties) and Carrizo Plain (San Luis Obispo County) (FWS 1990; CNPS 1994).

Project Area Occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. No suitable habitat for this species is present in the project area. Furthermore, the project area is outside the known range of this species. Therefore, this species is not expected to occur there.

Project Impacts: No known populations or potential habitat for San Joaquin wooly-threads would be affected by the project alternatives. Therefore, this species would not likely be adversely affected.

Endangerment: This species is threatened by agricultural land conversion, urbanization, gravel and sand extraction, oil and gas development, continued overgrazing, and off-road vehicle use (FWS, 1990).

4.2 Federally Proposed Species

4.2.1 Plants

MARIPOSA PUSSY-PAWS (*Calyptridium pulchellum*)
Family: Portulaceae

Status: Mariposa pussy-paws has been proposed for Federal listing as endangered. This species has no special status with the State. The CNPS categorizes this plant on their 1B list with a R-E-D code of 3-3-3: occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported; endangered throughout its range; and endemic to California (Skinner and Pavlik, 1994).

Description: Mariposa pussy-paws is a small, compact, rosette-forming, annual herb. The smooth, slender, prostrate stems are 4 to 8 inches long, with smooth, spatula-shaped leaves. The four-petaled, rose-colored flowers are arranged in loose panicles. The roots are fiberous (FWS, 1994; Hickman, 1993). Flowering time for this species is between May and August (FWS, 1994).

Habitat: This species inhabits decomposed granitic sands between elevations of 460 to 1,090 meters in foothill woodlands and converted chaparral grasslands in the Sierra Nevada foothills (FWS, 1994).

Distribution: The seven extant populations of Mariposa pussy-paws occur in Fresno, Madera, and Mariposa Counties (FWS, 1994).

Project Area Occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. Though potential habitat for this species is present in the project area, it is significantly outside the known range of this species. Therefore, this species is not expected to occur there.

Project Impacts: Mariposa pussy-paws does not likely occur in the project area. Therefore, this species would not likely be adversely affected.

Endangerment: This species is threatened by urbanization and overgrazing (FWS, 1994).

HARTWEG'S GOLDEN SUNBURST (*Pseudobahia bahiifolia*)
Family: Asteraceae

Status: Hartweg's golden sunburst has been proposed for Federal listing as endangered. The State has classified it as an endangered species. The CNPS categorizes the plant on their 1B list with a R-E-D code of 2-3-3: occurrence confined to several populations or one extended population; endangered throughout its range; and endemic to California (Skinner and Pavlik, 1994).

Description: *P. bahiifolia* is a woolly annual of 5 - 20 cm. Its leaves are alternate, 8 - 25 mm, linear-oblanceolate, and entire or 3-lobed. The inflorescence heads are solitary and radiate. Peduncles are 2 - 5 cm. The involucre is 5 - 6 mm and bell-shaped or hemispheric. The 3 - 8 elliptic-lanceolate phyllaries are arranged in one series. They are equal and fused at the base, and their margins are sometimes translucent. The receptacle is conic, hemispheric, or naked. There is one ray flower per phyllary. The ligules are 5 - 10 mm, more or less ovate, and yellow, and their tips are entire or slightly toothed. Disk flowers are about 2.5 mm and yellow, with long hairy bases and glabrous lobes. The fruit is 1.5 - 2.5 mm. The flowering time is March to May (Hickman, 1993; Munz, 1959).

Habitat: The distribution of Hartweg's golden sunburst has been found to be closely correlated with the distribution of certain soil types, specifically highly acidic Amador soil. The plant occurs predominantly on the northern slopes of knolls in valley and foothill grassland plant communities, but it also can occur along shady creeks or near vernal pools. It is frequently associated with mima mound topography. All the sites are characterized by a moderate to sparse cover of annual grasses associated with numerous species of native and non-native annual

and perennial forbs. In general, this plant occupies valley and foothill grassland at altitudes between 50 to 460 feet (Stebbins 1990).

Distribution: Historically, Hartweg's golden sunburst was scattered and locally abundant in valley and foothill grasslands of the Central Valley. Currently, fewer than 20 sites are known, and several of these are classified as damaged, declining, or possibly eliminated. The known *Pseudobahia bahiifolia* occurrences are concentrated in the eastern San Joaquin Valley in Stanislaus, Madera, and Fresno Counties (Stebbins, 1990).

Project area occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. No occupied or potential habitat for this species (grasslands with mima mound topography) is present in the project area.

Project Impacts: Hartweg's golden sunburst most likely does not occur in or near the project area. Therefore, this species would not likely be adversely affected.

Endangerment: The decline of the status of the *P. bahiifolia* can generally be attributed to agriculture, overgrazing, and land development. All extant occurrences of *P. bahiifolia* except a portion of one population are located on lands under private ownership and management. As a result, existing State and Federal laws are quite limited in their ability to regulate potentially detrimental human activities (Stebbins, 1990; CNPS, 1986).

CARPENTERIA (*Carpenteria californica*)
Family: Hydrangeaceae

Status: Carpenteria has been proposed for Federal listing as threatened. The State lists this species as threatened. The CNPS categorizes the plant on their 1B list with a R-E-D code of 3-2-3: occurrence limited to one or a few highly restricted populations, or present in such small numbers that it is seldom reported; endangered in a portion of its range; and endemic to California (Skinner and Pavlik, 1994).

Description: Carpenteria is an erect to spreading evergreen shrub that grows to a height of 1 - 6.5 meters. It has glossy green, opposite leaves and pale grey bark which peels in thin, wide sheets during the fall. Its flowers are 3 - 6 cm wide, white, fragrant, and showy. The flowers are arranged terminally in a cyme or short raceme. Flowering time for this species is May through July (FWS, 1994; Hickman, 1993).

Habitat: This species inhabits drainages and mesic areas on mostly granitic soils from 460 to 1,220 meters in the chaparral and cismontane woodland communities (FWS, 1994).

Distribution: Carpenteria is endemic to a 583-square kilometer area of the Sierra Nevada foothills in eastern Fresno County. Six known populations occur in this area (FWS, 1994).

Project Area Occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. Although potential habitat for this species is present in the project area, the project area is significantly outside the known range of this species.

Project Impacts: Carpenteria does not likely occur in the project area. Therefore, this species would not likely be adversely affected.

Endangerment: This species is threatened by urbanization, fire management practices, overgrazing and trampling by cattle, and inadequate State regulatory mechanisms. In addition, logging, illegal dumping, highway construction, maintenance or roads and rights-of-way activities, and competition from native brush species have the potential to adversely affect this species (FWS, 1994).

FLESHY OWL'S CLOVER (*Castilleja campestris* ssp. *succulenta*)
Family: Scrophulariaceae

Status: Fleshy owl's clover has been proposed for Federal listing as threatened. The State lists this species as threatened. The CNPS categorizes the plant on their 1B list with a R-E-D code of 2-2-3: occurrence confined to several populations or one extended population; endangered in a portion of its range; and endemic to California (Skinner and Pavlik, 1994).

Description: Fleshy owl's clover is a glabrous, hemiparasitic annual herb which belongs to the snapdragon family. The stems are simple to branched, generally 5 to 25 cm tall, with brittle-succulent, entire, alternate leaves. The green, spike-like inflorescence has bracts which equal or exceed the bright yellow to white flowers (FWS, 1993; Hickman,1994). Flowering time for this species is April to May (Skinner and Pavlik, 1994).

Habitat: This species is endemic to vernal pools (FWS, 1993).

Distribution: Fleshy owl's clover occurs in the San Joaquin Valley over a range of 145 km extending through eastern Merced, southeastern Stanislaus, Madera, and northern Fresno Counties (FWS, 1993).

Project Area Occurrence: The NDDB (1995) reports no occurrences of this species in or near the project area. No habitat for this species (vernal pools) is present in the project area. Therefore, this species does not likely occur there.

Project Impacts: No known or potential habitat for fleshy owl's clover would be affected by the project alternatives. Therefore, this species would not likely be adversely affected.

Endangerment: This species is threatened by habitat loss and degradation due to urbanization, agricultural land conversion, livestock overgrazing, off-road vehicle use, flood control projects, highway projects, and competition from weedy nonnative plants.

5.0 Summary and Recommendations

5.1 Overview

This section summarizes the possible impacts of Alternatives 2 and 3, and no-action alternative on Federally listed and candidate species. One listed species would be affected by the project alternatives, the valley elderberry longhorn beetle. Mitigation would be provided for the beetle according to FWS guidelines. Additionally, four candidate species may also be affected by the project alternatives.

5.2 Impacts of Alternatives

5.2.1 Alternative 1 (No-Action)

The no-action alternative assumes that no Federal action would take place and the storage behind Terminus Dam would remain at its present size. Flooding would continue in the communities of Visalia, Tulare, Ivanhoe, and the Tulare lakebed, resulting in loss of agricultural production and damage to homes, businesses, and public facilities. Species of concern will continue to be adversely affected by downstream flooding resulting from the no-action alternative.

5.2.2 Alternative 2 (NED Plan)

The valley elderberry longhorn beetle, a Federally listed species, would be adversely affected by the increased gross pool at the reservoir and the replacement

of Horse Creek Bridge. Three elderberry bushes would be inundated by the NED plan, and two bushes would be affected during the construction of the Horse Creek Bridge. Also with the NED plan, which uses the current precipitation parameters, little space would remain for winter water during the rainflood season. Therefore, effects to the bald eagle would likely include a reduction in winter foraging habitat at the reservoir because there would be less water available.

Additionally, four candidate species may be affected by the NED plan. The Kaweah brodiaea and the spiny-sepaled coyote-thistle may be inundated by the increased gross pool. The white-faced ibis and the tricolored blackbird would be affected by reduced flooded habitat at the lakebed. Candidate species have no legal protection under the Federal Endangered Species Act. Mitigation for project-related effects is not required. However, if candidate species are proposed or listed before the project is completed, full consideration must be given to these species before the project can be completed. Therefore, mitigation for these species has been proposed in this document.

Detailed topographic surveys at the reservoir would be completed in the preconstruction, engineering, and design phase of the project. If the Kaweah brodiaea and spiny-sepaled coyote-thistle populations would be inundated, they would be moved to an appropriate location. Habitat to offset the loss to the tricolored blackbird and white-faced Ibis would be provided by the project wetland mitigation plan.

5.2.3 Alternative 3 (Locally Preferred Plan)

With Alternative 3, anticipated effects to the following listed and candidate species would be the same as for Alternative 2: valley elderberry longhorn beetle, Kaweah brodiaea, spiny-sepaled coyote-thistle, white-faced ibis, and the tricolored blackbird. However, habitat conditions for the bald eagle would improve with Alternative 3. Winter foraging habitat would improve due to the water control manual and precipitation parameters. Up to 12,000 acre-feet would remain in the reservoir during the winter rainflood season. This increase would provide more foraging habitat at the reservoir than with the no-action alternative or NED plan.

Candidate species have no legal protection under the Federal Endangered Species Act. Mitigation for project-related effects is not required. However, if candidate species are proposed or listed before the project is completed, full consideration must be given to these species before the project can be completed. Therefore, mitigation for these species has been proposed in this document.

Detailed topographic surveys at the reservoir would be completed in the preconstruction, engineering, and design phase of the project. If the Kaweah

brodiaea and spiny-sepaled coyote-thistle populations would be inundated, they would be moved to an appropriate location. Habitat to offset the loss to the tricolored blackbird and white-faced Ibis would be provided by the project wetland mitigation plan.

5.3 Recommendations

1. Loss of the valley elderberry longhorn beetle and its habitat would be mitigated in accordance with current FWS guidelines (Appendix C). A total of 276 elderberry seedings/cuttings would be planted on 2.1 acres of Corps property in the Horse Creek area.

2. If bald eagles are sighted, construction activities would be restricted around the Terminus Dam site. Construction activities and noise may disturb any wintering eagles between November and March when eagles may use the area.

3. If inundated, the populations of Kaweah brodiaea and spiny-seapled coyote-thistle would be moved to an appropriate location.

4. Habitat for the tricolored blackbird and white-faced ibis would be provided by the project wetland mitigation plan.

6.0 Coordination

Both informal and formal coordination with the FWS and DFG has been maintained throughout the preparation of the biological data report. The Corps retrieved a list of State-listed threatened and endangered species from the NDDB in May 1995. The Corps received lists of threatened and endangered species and other species of concern from FWS in January and September 1995. In addition, various experts from these two agencies were contacted regarding distribution of and potential impacts to special status species.

7.0 List of Preparers

Name/Expertise	Experience	Role in Preparation
Felicia Altamimi Biological Science Environmental Manager	4 years environmental planning, Corps of Engineers	Report preparation and editing
Clu Cotter Environmental Specialist III	3 years environmental planning, DWR	Biological survey
Sannie Osborn Chief, Environmental Analysis Section	13 years environmental planning, cultural resources management, Corps of Engineers	Report review and editing
Mark Pelz Ecology Environmental Manager	2 years environmental planning, Corps of Engineers	Report preparation
Jane Rinck Biological Science Environmental Manager	8 years environmental planning, Corps of Engineers	Report preparation and editing
Lynne Stevenson Technical Writer/Editor	9 years planning studies, Corps of Engineers; 10 years professional librarian	Report review and editing

8.0 Literature Cited

delta smelt

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Moyle, P.B.,J.E. Williams, and E.D. Wikramanayake. 1989. Fish Species of Special Concern of California. Final Report prepared for State of California, Department of Fish and Game, Inland Fisheries Division, Rancho Cordova, CA.

U.S. Fish and Wildlife Service (FWS). 1993. Endangered and Threatened Wildlife and Plant; Determination of Threatened Status for the Delta Smelt. Federal Register 58(42) Pgs. 12854-12863.

blunt-nosed leopard lizard

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

giant garter snake

California Department of Fish and Game (DFG). 1980. At the crossroads, a report on the status of California's endangered and rare fish and wildlife.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Hansen, G.E. 1986. Status of the giant garter snake *Thamnophis couchi gigas* (Fitch) in the southern Sacramento Valley During 1986. Prepared for the California Department of Fish and Game.

Hansen, G.E. and J.M. Brode. 1980. Status of the giant garter snake *Thamnophis couchi gigas* (Fitch). Inland Fisheries Endangered Species Program.

bald eagle

Parker L. 1995. Telephone Conversation. U.S. Army Engineer District, Sacramento Park Office, Lemoncove, CA.

California Department of Fish and Game (DFG). 1985. Information Leaflet: Bald Eagles in California.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Paruk, J.D. 1987. Habitat utilization by bald eagles wintering along the Mississippi River. Transactions of the Illinois Academy of Science 80:333-42.

U.S. Fish and Wildlife Service (FWS). 1986. Recovery Plan of the Pacific Bald Eagle.

_____. 1995. Endangered and Threatened Species; Bald Eagle Reclassification; Final Rule. Federal Register Vol. 60, No. 133.

San Joaquin kit fox

California Department of Fish and Game (DFG). 1990. California's Wildlife: Vol. III Mammals. Sacramento, CA.

_____. 1991. Department of Fish and Game's record and files. Sacramento, CA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Tipton kangaroo rat

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Williams, D.F. 1979. Distribution and population status of the San Joaquin antelope squirrel and giant kangaroo rat. Nongame Wildlife Investigations, Wildlife Management Branch, California Department of Fish and Game. Sacramento, CA.

_____. 1985. A review of the population status of the Tipton kangaroo rat, (*Dipodomys nitratoides nitratoides*). Final report. Order No. 10181-4861 (ts) '84, SE-0024-4. Sacramento Endangered Species Office, U.S. Fish and Wildlife Service. Sacramento, CA.

valley elderberry longhorn beetle

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

U.S. Army Corps of Engineers (USACE). 1990. Environmental Resources Branch Endangered Species Reference Files.

_____, 1985. Sacramento Deep Water Ship Channel Endangered Species BDR. By TRS Consultants, Inc., Harvey and Stanley Associates.

vernal pool fairy shrimp

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Eng, L.L., D. Belk and C.H. Eriksen. 1990. California Anostraca: Distribution, Habitat and Status. Journal of Crustacean Biology, 10(2)24:7-277.

U.S. Fish and Wildlife Service (FWS). 1992. Endangered and Threatened Wildlife and Plants; Proposal to Determine Endangered Status for Four Fairy Shrimp and the Vernal Pool Tadpole Shrimp in California. Federal Register, Vol. 57, No. 90.

California jewelflower

Fish and Wildlife Service (FWS). 1995. Fish and Wildlife Service species files and records. Sacramento, CA. California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Sacramento splittail

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Daniels, R.A. and P.B. Moyle, 1983. Life History of Splittail (Cyprinidae:Pogonichthys macrolepidotus) in the Sacramento-San Joaquin Estuary. Fishery Bulletin. Vol. 81, No.36:47-654.

Moyle, P.B. 1976. Inland Fishes of California, University of California Press. Berkeley, CA.

California red-legged frog

Brode, J. 1995. Telephone Conversation. California Department of Fish and Game.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Hayes, M.P. and M.M. Miyamoto. 1984. Biochemical, Behavioral and Body Size Differences Between Rana Aurora and R. A. Draytonii. Copiea. pp. 1018-1022.

Jennings, M.R. and M.P. Hayes. 1985. Pre-1900 Overharvest of California Red-Legged Frogs (*Rana Aurora Draytonii*), The Inducement for Bullfrog (*Rana Catesbeiana*) Introduction. Herpetologica. Vol.4, No.1 p.94-103.

Stebbins, R.C. 1985. Western Reptiles and Amphibians. Houghton Mifflin Company. Boston, MA.

Hoover's spurge

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Stone, R.D., et al. 1988. Status Survey of the Grass Tribe Orcuttieae and the Chamaesyce hooveri (Eurphorbiaceae) in the Central Valley of California. U.S. Fish and Wildlife Service.

Springville clarkia

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Plants of California. Sacramento, CA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Fish and Wildlife Service (FWS). 1995. Fish and Wildlife Service species files and records. Sacramento, CA.

San Joaquin Valley orcutt grass

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Plants of California. Sacramento, CA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

San Joaquin adobe sunburst

Brown, D.E. 1982. California Valley Grassland. Desert Plants 4:132-135.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Stebbins, J.C. 1991. Status survey of two endemic to the San Joaquin Valley. Unpublished report prepared for the U.S. Fish and Wildlife Service. 88pp.

Greene's tuctoria

California Department of Fish and Game (DFG). 1992. Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants. State of California, The Resources Agency, Department of Fish and Game, Sacramento, CA.

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Plants of California. Sacramento, CA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Fish and Wildlife Service (FWS). 1995. Fish and Wildlife Service species files and records. Sacramento, CA.

longfin smelt

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

McGinnis, S.M. 1984. Freshwater fishes of California. University of California Press, Berkeley, CA.

Moyle, P.B. 1976. Inland Fishes of California. University of California Press. Berkeley, CA.

Kern brook lamprey

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Moyle, P.B., R.M. Yoshiyame, E.D. Wikramanayake, and J.E. Williams. 1994. Fish Species of Special Concern for California. Prepared for the California Department of Fish and Game.

California tiger salamander

Anderson, J.D. 1968. A Comparison of the Food Habits of Ambystoma macrodactylum sigilatum, Ambystoma macrodactylum croceum, and Ambystoma tigrinum Californiense. Herpetologica 24(4).

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Hayes, M.P. (no date). A Sacramento Valley Record of the California Tiger Salamander (*ambystoma californiense*) with Comments on its Distribution and Ecology (Amphibia, Caudata, Ambystomatidate).

Stebbins, R.C. 1985. Western Reptiles and Amphibians. Houghton Mifflin Company, Boston, MA.

western spadefoot toad

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Stebbins, R.C. 1951. Amphibians of Western North America. University of California Press, Berkeley, CA.

____. 1954. Amphibians and Reptiles of Western North America. McGraw - Hill Book Company, Inc., New York, NY

_____. 1972. California Amphibians and Reptiles. University of California Press, Berkeley, CA.

foothill yellow-legged frog

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Department of Fish and Game (DFG). 1990. California's Wildlife Volume III Mammals. State of California, The Resources Agency, Department of Fish and Game, Sacramento, CA.

Stebbins, R.C. 1972. California Amphibians and Reptiles. University of California Press, Berkeley, CA.

Mount Lyell salamander

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Fish and Wildlife Service (FWS). 1995. Fish and Wildlife Service species files and records. Sacramento, CA.

Stebbins R.C. 1951. Amphibians of Western North America. University of California Press, Berkeley, CA.

southwestern pond turtle

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Stebbins, R.C. 1954. Amphibians and Reptiles of Western North America. McGraw-Hill Book Company, Inc., New York, NY.

Zeiner, D.C., A.F. Laudenslayer and K.E. Mayer. 1988. California's Wildlife, Vol. 1 Amphibians and Reptiles. California Department of Fish and Game, Sacramento, CA.

tricolored blackbird

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Terres, J.K. 1980. The Audubon Society Encyclopedia of North American Birds.

white-faced ibis

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Terres, J.K. 1980. The Audubon Society Encyclopedia of North American Birds.

mountain plover

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Cogswell, Howard L. 1977. Water Birds of California. University of California Press. Berkeley, CA.

Peterson, Roger T. 1961. A field Guide to Western Birds. Houghton Mifflin Company. Boston, MA.

western snowy plover

Buford, Dan. 1995. Personal Communication. Wildlife Biologist, U.S. Fish and Wildlife Service. Sacramento, CA.

National Geographic Society. 1987. Field Guide to the Birds of North America. Second Edition.

Zeiner, D.C., et al. 1990. California's Wildlife, Volume III-- Mammals. California Department of Fish and Game, Sacramento, CA.

Pacific western big-eared bat

Burt, W.H. and R.P. Grossenheider. 1980. A field guide to the mammals. Houghton Mifflin Company, Boston, MA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Harris, J. 1990. Townsend's Big-eared Bat. in D.C. Zeiner, W.F. Laudenslayer, K.E. Mayer, M. White, eds. California Wildlife, Volume III. Mammals. California Department of Fish and Game, Sacramento, CA.

greater western mastiff-bat

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Ingles, L.G. 1965. Mammals of California. Standford University Press, Palo Alto, CA.

Zeiner, D.C., et al. 1990. California's Wildlife, Volume III-- Mammals. California Department of Fish and Game, Sacramento, CA.

Zezulak, D. 1992. Telephone Conversation, California Department of Fish and Game.

Nelson's antelope ground squirrel

California Department of Fish and Game (DFG). 1980. At the Crossroads, a report on California's endangered and rare fish and wildlife.

_____. 1992. Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants. State of California, The Resources Agency, Department of Fish and Game, Sacramento, CA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Schlorff, R.W. 1987. Five Year Status Report. California Department of Fish and Game Wildlife Management Division, Sacramento, CA.

Zeiner, D.C., et al. 1990. California's Wildlife, Volume III-- Mammals. California Department of Fish and Game, Sacramento, CA.

spotted bat

Burt, W.H. and R.P. Grossenheider. 1980. A field guide to the mammals. Houghton Mifflin Company, Boston, MA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Harris, J. 1990. Townsend's Big-eared Bat. in D.C. Zeiner, W.F. Laudenslayer, K.E. Mayer, M. White, eds. California Wildlife, Volume III. Mammals. California Department of Fish and Game, Sacramento, CA.

short-nosed kangaroo rat

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Schlorff, R.W. 1990. Five Year Status Report. California Department of Fish and Game Wildlife Management Division, Sacramento, CA.

_____. May 1995. Telephone Conversation. California Department of Fish and Game Wildlife Management Division, Sacramento, CA.

Williams, D.F. 1986. Mammalian Species of Special Concern in California. State of California, The Resources Agency, California Department of Fish and Game. Sacramento, CA.

Zeiner, D.C., et al. 1990. California's Wildlife, Volume III--Mammals. California Department of Fish and Game, Sacramento, CA.

ciervo aegialian scarab beetle

Andrews, F. 1995. Telephone Conversation. California Department of Food and Agriculture, Plant Test Diagnostics Laboratory, Sacramento, CA.
California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Cartwright, O.L. and Gordon, R. D. 1988. North American Representatives of the Tribe Aegialiini (Coleoptera: *Scarabaeidae*: *Aphodiinae*). Smithsonian Institution Press, Washington, D.C.

Fish and Wildlife Service (FWS). 1995. Fish and Wildlife Service species files and records. Sacramento, CA.

San Joaquin tiger beetle

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Morgan, K.R. 1984. Body Temperature Regulation and Terrestrial Activity in the Ectothermic Beetle Cicindela Tranquebarcia. Department of Biology, University of California, Los Angeles, CA.

Doyen's trigonoscuta dune weevil

Andrews, F. 1995. Telephone Conversation. California Department of Food and Agriculture, Plant Test Diagnostics Laboratory, Sacramento, CA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Fish and Wildlife Service (FWS). 1995. Fish and Wildlife Service species files and records. Sacramento, CA.

heartscale

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Munz, P.A. and D.D. Keck. 1973. A California Flora and Supplement. Berkeley: University of California Press.

brittlescale

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Hickman J.C. (ed.) 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley.

lesser saltscale

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Fish and Wildlife Service (FWS). January 1995. Listed and Proposed Endangered and Threatened Species and Candidate Species for Kaweah River Basin Investigation Study, Tulare and Kings County, CA.

lost hills saltbush

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Plants of California.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Kaweah brodiaea

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Department of Water Resources (DWR). 1990. Vegetation Report: Dry Creek Reservoir Site and Enlarged Kaweah Reservoir. California Department of Water Resources. Sacramento, CA.

slough thistle

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Plants of California.

_____. 1979. Rare Plant Status Report.

recurved larkspur

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Pants of California.

Hickman, J.C. (ed.) 1993. The Jepson Manual Higher Plants of California. University of California Press, Berkeley, CA.

Munz, P.A. 1968. A California flora. Univ. of California Press, Berkeley.

spiny-sepaled coyote-thistle

California Native Plant Society (CNPS). 1988. Inventory of Rare and Endangered Vascular Plants of California.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Hickman J. C. (ed.) 1993. The Jepson Manual: Higher Plants of California. University of California Press, Berkeley, CA.

swainson's hawk

California Department of Fish and Game (DFG). 1979. The Status of the Swainson's Hawk in California.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles.

Peterson, R.T. 1961. A Field Guide to Western Birds. Houghton Mifflin Company: Boston. pp. 52-53.

Terres, J.K. 1980. The Audobon Society Encyclopedia of North American Birds.

U.S. Army Corps of Engineers (Corps). 1991. American River Watershed Investigation, Draft Environmental Impact Report.

Aleutian Canada goose

Beall, J.T. 1980. Distribution, Migration, and Mortality of Aleutian Canada Geese in California, 1979-1980. California Deptment of Fish and Game.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1982. Aleutian Canada Goose Recovery Plan. Prepared by the Aleutian Canada Goose Recovery Team. FWS, Anchorage, AK.

American peregrine falcon

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Terres, J. K. 1980. The Audubon Society Encyclopedia of North American Birds. Published by National Geographic Society.

U.S. Fish and Wildlife Service (FWS). 1982. The Pacific Coast Recovery Plan for the American Peregrine Falcon. Portland, OR.

giant kangaroo rat

Ahlborn, G. 1982. Giant kangaroo rat. *in* Zeiner, et al., eds. California's Wildlife: Volume III, Mammals. California Department of Fish and Game, Sacramento, CA.

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Thelander, C. G. and M. Crabtree, eds. 1994. Life On The Edge: A Guide To California's Endangered Natural Resources: Wildlife. BioSystems Books, Santa Cruz, CA.

fresno kangaroo rat

Ahlborn, G. 1982. Giant kangaroo rat. *in* Zeiner, et al., eds. California's Wildlife: Volume III, Mammals. California Department of Fish and Game, Sacramento, CA.

Hovik, D. 1995. Telephone Conservation. Biologist. U.S. Fish and Wildlife Service, Sacramento Field Office. Sacramento, CA.

NDDB (California Natural Diversity Database). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California

Department of Fish and Game. Sacramento, CA.

Thelander, C. G. and M. Crabtree, eds. 1994. Life On The edge: A Guide To California's Endangered Natural Resources: Wildlife. BioSystems Books, Santa Cruz, CA.

San Benito evening primrose

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Hickman, J. C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1985. Endangered and threatened wildlife and plants; determination of threatened status for *Camissonia benitensis* (San Benito evening primrose). Federal Register Vol. 50, No. 29.

Palmate-bracted bird's beak

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

California Native Plant Society (CNPS). 1989. Rare and Endangered Plant Files.

_____. 1977. Rare Plant Status Report.

Hickman, J. C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1986. Endangered and threatened wildlife and plants; determination of threatened status for *Cordylanthus palmatus* (palmate-bracted bird's beak). Federal Register Vol. 51, No. 126.

Hoover's wooly-star

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Hickman, J. C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1990. Endangered and threatened wildlife and plants; determination of threatened status for *Eriastrum hooveri* (Hoover's wooly-star). Federal Register Vol. 55, No. 139.

San Joaquin wooly-threads

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Hickman, J. C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1990. Endangered and threatened wildlife and plants; determination of threatened status for *Lembertia congdonii* (San Joaquin wooly-threads). Federal Register Vol. 55, No. 139.

Mariposa pussy-paws

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Hickman, J. C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1994. Endangered and threatened wildlife and plants; determination of threatened status for *Calyptridium pulchellum* (Mariposa pussy-paws). Federal Register Vol. 59, No. 191.

Hartweg's golden sunburst

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

California Native Plant Society (CNPS). 1986. California native plant status report: *Psuedobahia bahiifolia*. California Department of Fish and Game Endangered Plant Program and the Natural Diversity Data Base in Collaboration with the California Native Plant Society. Sacramento, CA.

Hickman, J. C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley, CA.

Munz, P.A. 1959. A California flora. University of California Press. Berkeley, CA.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

Stebbins, J.C. 1990. Status survey of two plants endemic to the San Joaquin Valley: *Psuedobahia bahiifolia* and *Psuedobahia peirsonii*. Fresno, CA.

Carpenteria

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Hickman, J.C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1994. Endangered and threatened wildlife and plants; determination of threatened status for *Carpenteria californica* (Carpenteria). Federal Register Vol. 59, No. 191.

Fleshy owl's clover

California Natural Diversity Database (NDDB). 1995. Computer database search of the USGS 7.5-minute Kings, Tulare, Exeter, Visalia, Paige, Taylor Weir, Corcoran, El Rico Ranch, and Hacienda Ranch NW quadrangles. California Department of Fish and Game. Sacramento, CA.

Hickman, J.C. (ed.) 1993. The Jepson manual: higher plants of California. University of California Press, Berkeley.

Skinner, M.W. and B.M. Pavlik, eds. 1994. Inventory of Rare and Endangered Vascular Plants of California. California Native Plant Society. Sacramento, CA.

U.S. Fish and Wildlife Service (FWS). 1993. Endangered and threatened wildlife and plants; determination of threatened status for *Castilleja campestris* ssp. *succulenta* (fleshy owl's clover). Federal Register Vol. 59, No. 191.

APPENDIX A. CORRESPONDENCE WITH U.S. FISH AND WILDLIFE SERVICE

United States Department of the Interior

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

In Reply Refer To:
1-1-95-SP-0360

January 30, 1995

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

Subject: Species List for Proposed Enlargement of the Storage Capacity of Lake Kaweah, Kaweah River Basin Investigation, Kings, Tulare, and Fresno Counties, California

Dear Mr. Yep:

As requested by letter from your agency dated January 5, 1995, you will find enclosed a list of listed, proposed and candidate species that may be present in the subject project area (see Enclosure A). This list fulfills the requirement of the Fish and Wildlife Service to provide a species list pursuant to Section 7(c) of the Endangered Species Act, as amended, (ACT).

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 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.

We have included the candidate species that may be present in the project area (see Enclosure A). These species are currently being reviewed by our service and are under consideration for possible listing as endangered or threatened. Candidate species have no protection under the Endangered Species Act, but are

included for your consideration as it is possible that one or more of these candidates could be proposed and listed before the subject project is completed. Should the biological assessment reveal that candidate species may be adversely affected, you may wish to contact our office for technical assistance. One of the potential benefits from such technical assistance is that by exploring alternatives early in the planning process, it may be possible to avoid conflicts that could otherwise develop, should a candidate species become listed before the project is completed.

We appreciate your concern for endangered species. If you have further questions, please call Laurie Stuart Simons of this office at (916) 979-2725 extension 330. If you have any questions regarding wetlands, contact Mark Littlefield at (916) 979-2113.

Sincerely,

Gary C. Hood

Joel A. Medlin
Field Supervisor

Enclosures

ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN THE AREA OR MAY BE AFFECTED BY PROJECTS IN THE AREA OF THE KAWEAH RIVER BASIN INVESTIGATION KINGS, TULARE, AND FRESNO COUNTIES, CALIFORNIA (1-1-95-SP-0360, January 30, 1995)

Listed Species

Fish
delta smelt, *Hypomesus transpacificus* (T)

Reptiles
blunt-nosed leopard lizard, *Gambelia silus* (E)
giant garter snake, *Thamnophis gigas* (T)

Birds
bald eagle, *Haliaeetus leucocephalus* (E)

Mammals
San Joaquin kit fox, *Vulpes macrotis mutica* (E)
Tipton kangaroo rat, *Dipodomys nitratoides nitratoides* (E)

Invertebrates
valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (T)
vernal pool fairy shrimp, *Branchinecta lynchi* (T)

Plants
California jewelflower, *Caulanthus californicus* (E)

Proposed Species

Fish
Sacramento splittail, *Pogonichthys macrolepidotus* (PT)

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

Plants
Hoover's spurge, *Chamaesyce hooveri* (PT)
Springville clarkia, *Clarkia springvillensis* (PT)
San Joaquin Valley Orcutt grass, *Orcuttia inaequalis* (PE)
San Joaquin adobe sunburst, *Pseudobahia peirsonii* (PE)
Greene's tuctoria, *Tuctoria greenei* (PE)

Candidate Species

Fish
longfin smelt, *Spirinchus thaleichthys* (2)
Kern brook lamprey, *Lampetra hubbsi* (2)

Amphibians
California tiger salamander, *Ambystoma californiense* (1)
western spadefoot toad, *Scaphiopus hammondi* (2)
foothill yellow-legged frog, *Rana boylii* (2)
Mount Lyell salamander, *Hydromantes platycephalus* (2)
southwestern pond turtle, *Clemmys marmorata pallida* (2)

Birds
tricolored blackbird, *Agelaius tricolor* (2)
white-faced ibis, *Plegadis chihi* (2)
mountain plover, *Charadrius montanus* (2)
western snowy plover, interior population, *Charadrius alexandrinus nivosus* (2[illegible])

Mammals
Pacific western big-eared bat, *Plecotus townsendii townsendii* (2)
greater western mastiff-bat, *Eumops perotis californicus* (2)
Nelson's antelope ground squirrel, *Ammospermophilus nelsoni* (1)
spotted bat, *Euderma maculatum* (2)
short-nosed kangaroo rat, *Dipodomys nitratoides brevinasus* (1)

Invertebrates
Ciervo aegialian scarab beetle, *Aegialia concinna* (1)
San Joaquin tiger beetle, *Cicindella tranquebarica* (2)
Doyen's trigonoscuta dune weevil, *Trigonoscuts sp.* (2)

Plants
Ramshaw sand-verbena, *Abronia alpina* (1)
Bodie Hills rock-cress, Arabis bodiensis (2)
heartscale, *Atriplex cordulata* (2)
brittlescale, *Atriplex depressa* (2R)
lesser saltscale, *Atriplex minuscula* (2R)
Lost Hills saltbush, *Atriplex vallicola* (2)
Kaweah brodiaea, *Brodiaea insignis* (2)
Shirley Meadows mariposa, *Calochortus westonii* (1)
slough thistle, *Cirsium crassicaule* (2)
recurved larkspur, *Delphinium recurvatum* (2)
Pierpoint Springs liveforever, *Dudleya cymosa* ssp. *costafolia* (1)
Kern River daisy, *Erigeron multiceps* (2)
mouse buckwheat, *Eriogonum nudum* var. *murinum* (2)
spiny-sepaled coyote-thistle, *Eryngium spinosepalum* (2)
Hockett Meadows lupine, *Lupinus culbertsonii* ssp. *culbertsonii* (2)
DeDecker's lupine, *Lupinus padre-crowleyi* (2)
Sequoia gooseberry, *Ribes tularense* (2)

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

United States Department of the Interior

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

IN REPLY REFER TO:

In Reply Refer To:
1-1-95-SP-1558

September 27, 1995

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

Subject: Request for Species List for Proposed Enlargement of the Storage Capacity of Lake Kaweah, Kaweah River Basin Investigation, Kings, Tulare, and Fresno Counties, California

Dear Mr. Yep:

In response to your request of September 22, 1995, you will find enclosed a list of listed, proposed and candidate species that may be present in the subject project area (see Enclosure A). This list fulfills the requirement of the Fish and Wildlife Service to provide a species list pursuant to section 7(c) of the Endangered Species Act, as amended, (Act).

The Service used your map(s) and/or other information to locate the proposed project on a U.S. Geological Survey (USGS) 7.5 minute quadrangle map(s). The species on the attached list are those species we believe may occur within the USGS quad(s) where your project is planned. Some of the species may not be affected by the proposed action. A trained biologist/botanist, familiar with the habitat requirements of those species, should determine whether these species or habitats suitable for these species may be affected by the proposed action. Fish were not included in the list if it appeared that your project would not affect them.

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 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.

We have included the candidate species that may be present in the project area (see Enclosure A). These species are currently being reviewed by our service and are under consideration for possible listing as endangered or threatened. Candidate species have no protection under the Endangered Species Act, but are included for your consideration as it is possible that one or more of these candidates could be proposed and listed before the subject project is

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.

We appreciate your concern for endangered species. If you have further questions, please call Peter A. Cross of this office at (916) 979-2725.

If you have any questions regarding wetlands, contact Mark Littlefield at (916) 979-2113.

Sincerely,

Cary C. Goude

for Joel A. Medlin
Field Supervisor

Enclosures (2)

ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN OR BE AFFECTED BY PROJECTS IN THE AREA OF FRESNO COUNTY, CALIFORNIA
Reference File No. 95-SP-1558
September 27, 1995

Listed Species

Mammals

giant kangaroo rat, ***Dipodomys ingens*** (E)

Fresno kangaroo rat, ***Dipodomys nitratoides exilis*** (E)

Fresno kangaroo rat critical habitat, ***Dipodomys nitratoides exilis*** (E)

Tipton kangaroo rat, ***Dipodomys nitratoides nitratoides*** (E)

San Joaquin kit fox, ***Vulpes macrotis mutica*** (E)

Birds

Aleutian Canada goose, ***Branta canadensis leucopareia*** (T)

American peregrine falcon, ***Falco peregrinus anatum*** (E)

bald eagle, ***Haliaeetus leucocephalus*** (T)

Reptiles

blunt-nosed leopard lizard, ***Gambelia (=Crotaphytus) silus*** (E)

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

Fish

Delta smelt, ***Hypomesus transpacificus*** (T)

Paiute cutthroat trout, ***Oncorhynchus (=Salmo) clarki seleniris*** (T)

Invertebrates

vernal pool fairy shrimp, ***Branchinecta lynchi*** (T)

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

Plants

San Benito evening-primrose, ***Camissonia benitensis*** (T)

California jewelflower, ***Caulanthus californicus*** (E)

palmate-bracted bird's-beak, ***Cordylanthus palmatus*** (E)

Hoover's wooly-star, ***Eriastrum hooveri*** (T)

San Joaquin wooly-threads, ***Lembertia congdonii*** (E)

Proposed Species

Amphibians

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

Fish

Sacramento splittail, ***Pogonichthys macrolepidotus*** (PT)

Plants

Mariposa pussy-paws, ***Calyptridium pulchellum*** (PE)

carpenteria, ***Carpenteria californica*** (PT)

fleshy owl's-clover, ***Castilleja campestris ssp. succulenta*** (PT)

San Joaquin Valley Orcutt grass, ***Orcuttia inaequalis*** (PE)

Hartweg's golden sunburst, ***Pseudobahia bahiifolia*** (PE)

San Joaquin adobe sunburst, ***Pseudobahia peirsonii*** (PE)

Greene's tuctoria, ***Tuctoria greenei*** (PE*)

Candidate Species

Mammals

Nelson's antelope ground squirrel, ***Ammospermophilus nelsoni*** (1)

short-nosed kangaroo rat, ***Dipodomys nitratoides brevinasus*** (1)

spotted bat, ***Euderma maculatum*** (2)

greater western mastiff-bat, ***Eumops perotis californicus*** (2)

California wolverine, ***Gulo gulo luteus*** (2)

Pacific fisher, ***Martes pennanti pacifica*** (2)

small-footed myotis bat, ***Myotis ciliolabrum*** (2)

long-eared myotis bat, ***Myotis evotis*** (2)

fringed myotis bat, ***Myotis thysanodes*** (2)

long-legged myotis bat, ***Myotis volans*** (2)

Yuma myotis bat, ***Myotis yumanensis*** (2)

San Joaquin Valley woodrat, ***Neotoma fuscipes riparia*** (1)

Southern grasshopper mouse, ***Onychomys torridus ramona*** (2)

Tulare grasshopper mouse, ***Onychomys torridus tularensis*** (2)

California bighorn sheep, ***Ovis canadensis californiana*** (2)

San Joaquin pocket mouse, ***Perognathus inoratus*** (2)

Pale Townsend's big-eared bat, ***Plecotus townsendi pallescens*** (2)

Pacific western big-eared bat, ***Plecotus townsendii townsendii*** (2)

Mt. Lyell shrew, ***Sorex lyelli*** (2)

Candidate Species

Mammals

Sierra Nevada red fox, ***Vulpes vulpes necator*** (2)

Birds

northern goshawk, ***Accipiter gentilis*** (2)

tricolored blackbird, ***Agelaius tricolor*** (2)

western burrowing owl, ***Athene cunicularia hypugea*** (2)

ferruginous hawk, ***Buteo regalis*** (2)

mountain plover, ***Charadrius montanus*** (2)

little willow flycatcher, ***Empidonax traillii brewsteri*** (2)

white-faced ibis, ***Plegadis chihi*** (2)

California spotted owl, ***Strix occidentalis occidentalis*** (2)

Reptiles

silvery legless lizard, ***Anniella pulchra pulchra*** (2)

northwestern pond turtle, ***Clemmys marmorata marmorata*** (2)

southwestern pond turtle, ***Clemmys marmorata pallida*** (2)

San Joaquin whipsnake, ***Masticophis flagellum ruddocki*** (2)

California horned lizard, ***Phrynosoma coronatum frontale*** (2)

Amphibians

California tiger salamander, ***Ambystoma californiense*** (1)

Yosemite toad, ***Bufo canorus*** (2)

Mount Lyell salamander, ***Hydromantes platycephalus*** (2)

foothill yellow-legged frog, ***Rana boylii*** (2)

mountain yellow-legged frog, ***Rana mucosa*** (2)

western spadefoot toad, ***Scaphiopus hammondi*** (2)

Fish

green sturgeon, ***Acipenser medirostris*** (2)

river lamprey, ***Lampetra ayresi*** (2)

Kern Brook lamprey, ***Lampetra hubbsi*** (2)

Pacific lamprey, ***Lampetra tridentata*** (2)

longfin smelt, ***Spirinchus thaleichthys*** (2)

Invertebrates

Ciervo aegialian scarab beetle, ***Aegialia concinna*** (1)

Candidate Species

Invertebrates

San Joaquin tiger beetle, ***Cicindella tranquebarica ssp*** (2)

San Joaquin dune beetle, ***Coelus gracilis*** (1)

Kings Canyon cryptochian caddisfly, ***Cryptochia excella*** (2)

Wooly hydroporus diving beetle, ***Hydroporus diving beetle*** (2)

Hopping's blister beetle, ***Lytta hoppingi*** (2)

moestan blister beetle, ***Lytta moesta*** (2)

molestan blister beetle, ***Lytta molesta*** (2)

Morrison's blister beetle, ***Lytta morrisoni*** (2)

Dry Creek cliff strider bug, ***Oravelia pege*** (2)

Bohart's blue butterfly, ***Philotiella speciosa bohartorum*** (2)

Sierra pygmy grasshopper, ***Tetrix sierrana*** (2)

Plants

obovate-leaved thornmint, ***Acanthomintha obovata ssp. obovata*** (2)

forked fiddleneck, ***Amsinckia vernicosa var. furcata*** (2)

Bodie Hills rock-cress, ***Arabis bodiensis*** (2)

Raven's milk-vetch, ***Astragalus monoensis var. ravenii*** (2)

heartscale, ***Atriplex cordulata*** (2)

brittlescale, ***Atriplex depressa*** (2R)

lesser saltscale, ***Atriplex minuscula*** (2R+)

Lost Hills saltbush, ***Atriplex vallicola*** (2)

South Coast Range morning-glory, ***Calystegia collina ssp. venusta*** (2)

Mono Hot Springs evening-primrose, ***Camissonia sierrae ssp. alticola*** (2)

San Benito spineflower, ***Chorizanthe biloba var. immemora*** (2)

Fresno County bird's-beak, ***Cordylanthus tenuis ssp. barbatus*** (2)

recurved larkspur, ***Delphinium recurvatum*** (2)

mouse buckwheat, ***Eriogonum nudum var. murinum*** (2)

spiny-sepaled coyote-thistle, ***Eryngium spinosepalum*** (2)

hollisteria, ***Hollisteria lanata*** (2)

delta tule-pea, ***Lathyrus jepsonii var. jepsonii*** (2)

royless layia, ***Layia discoidea*** (2)

pale-yellow layia, ***Layia heterotricha*** (2+)

Panoche peppergrass, ***Lepidium jaredii var. album*** (2)

Candidate Species

Plants

long-petaled lewisia, ***Lewisia longipetala*** (2)

orange lupine, ***Lupinus citrinus var. citrinus*** (2)

valley sagittaria, ***Sagittaria sanfordii*** (2)

Keck's sidalcea, ***Sidalcea keckii*** (1?*)

parasol clover, ***Trifolium bolanderi*** (2)

Notes:

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

ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN OR BE AFFECTED BY PROJECTS IN THE AREA OF KINGS COUNTY, CALIFORNIA
Reference File No. 95-SP-1558
September 27, 1995

Listed Species

Mammals

giant kangaroo rat, ***Dipodomys ingens*** (E)

Fresno kangaroo rat, ***Dipodomys nitratoides exilis*** (E)

Tipton kangaroo rat, ***Dipodomys nitratoides nitratoides*** (E)

San Joaquin kit fox, ***Vulpes macrotis mutica*** (E)

Birds

Aleutian Canada goose, ***Branta canadensis leucopareia*** (T)

American peregrine falcon, ***Falco peregrinus anatum*** (E)

bald eagle, ***Haliaeetus leucocephalus*** (T)

Reptiles

blunt-nosed leopard lizard, ***Gambelia (=Crotaphytus) silus*** (E)

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

Fish

Delta smelt, ***Hypomesus transpacificus*** (T)

Invertebrates

vernal pool fairy shrimp, ***Branchinecta lynchi*** (T)

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

Plants

California jewelflower, ***Caulanthus californicus*** (E•)

Hoover's wooly-star, ***Eriastrum hooveri*** (T)

San Joaquin wooly-threads, ***Lembertia congdonii*** (E•)

Proposed Species

Amphibians

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

Fish

Sacramento splittail, ***Pogonichthys macrolepidotus*** (PT)

Candidate Species

Mammals

Nelson's antelope ground squirrel, ***Ammospermophilus nelsoni*** (1)

short-nosed kangaroo rat, ***Dipodomys nitratoides brevinasus*** (1)

greater western mastiff-bat, ***Eumops perotis californicus*** (2)

small-footed myotis bat, ***Myotis ciliolabrum*** (2)

long-eared myotis bat, ***Myotis evotis*** (2)

fringed myotis bat, ***Myotis thysanodes*** (2)

long-legged myotis bat, ***Myotis volans*** (2)

Yuma myotis bat, ***Myotis yumanensis*** (2)

Southern grasshopper mouse, ***Onychomys torridus ramona*** (2)

Tulare grasshopper mouse, ***Onychomys torridus tularensis*** (2)

San Joaquin pocket mouse, ***Perognathus inoratus*** (2)

Pacific western big-eared bat, ***Plecotus townsendii townsendii*** (2)

Sierra Nevada red fox, ***Vulpes vulpes necator*** (2)

Birds

tricolored blackbird, ***Agelaius tricolor*** (2)

western burrowing owl, ***Athene cunicularia hypugea*** (2)

ferruginous hawk, ***Buteo regalis*** (2)

mountain plover, ***Charadrius montanus*** (2)

little willow flycatcher, ***Empidonax traillii brewsteri*** (2)

white-faced ibis, ***Plegadis chihi*** (2)

San Joaquin LeConte's thrasher, ***Toxostoma lecontei macmillanorum*** (2)

Reptiles

silvery legless lizard, ***Anniella pulchra pulchra*** (2)

northwestern pond turtle, ***Clemmys marmorata marmorata*** (2)

southwestern pond turtle, ***Clemmys marmorata pallida*** (2)

San Joaquin whipsnake, ***Masticophis flagellum ruddocki*** (2)

California horned lizard, ***Phrynosoma coronatum frontale*** (2)

Amphibians

California tiger salamander, ***Ambystoma californiense*** (1)

foothill yellow-legged frog, ***Rana boylii*** (2)

western spadefoot toad, ***Scaphiopus hammondi*** (2)

Candidate Species

Fish

Kern Brook lamprey, ***Lampetra hubbsi*** (2)

Invertebrates

Ciervo aegialian scarab beetle, ***Aegialia concinna*** (1)

San Joaquin dune beetle, ***Coelus gracilis*** (1)

molestan blister beetle, ***Lytta molesta*** (2)

Doyen's trigonoscuta dune weevil, ***Trigonoscuta sp.*** (2)

Plants

forked fiddleneck, ***Amsinckia vernicosa var. furcata*** (2)

heartscale, ***Atriplex cordulata*** (2)

Lost Hills saltbush, ***Atriplex vallicola*** (2)

slough thistle, ***Cirsium crassicaule*** (2)

recurved larkspur, ***Delphinium recurvatum*** (2)

pale-yellow layia, ***Layia heterotricha*** (2*)

Notes:

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

ENCLOSURE A

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CANDIDATE SPECIES THAT MAY OCCUR IN OR BE AFFECTED BY PROJECTS IN THE AREA OF TULARE COUNTY, CALIFORNIA
Reference File No. 95-SP-1558
September 27, 1995

Listed Species

Mammals

giant kangaroo rat, ***Dipodomys ingens*** (E)

Fresno kangaroo rat, ***Dipodomys nitratoides exilis*** (E)

Tipton kangaroo rat, ***Dipodomys nitratoides nitratoides*** (E)

San Joaquin kit fox, ***Vulpes macrotis mutica*** (E)

Birds

Aleutian Canada goose, ***Branta canadensis leucopareia*** (T)

American peregrine falcon, ***Falco peregrinus anatum*** (E)

bald eagle, ***Haliaeetus leucocephalus*** (T)

Reptiles

blunt-nosed leopard lizard, ***Gambelia (=Crotaphytus) silus*** (E)

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

Fish

Delta smelt, ***Hypomesus transpacificus*** (T)

Little Kern golden trout, ***Oncorhynchus (=Salmo) aquabonita whitei*** (T)

Little Kern golden trout critical hab., ***Oncorhynchus (=Salmo) aquabonita whitei*** (T)

Invertebrates

vernal pool fairy shrimp, ***Branchinecta lynchi*** (T)

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

Plants

California jewelflower, ***Caulanthus californicus*** (E)

Hoover's wooly-star, ***Eriastrum hooveri*** (T)

San Joaquin wooly-threads, ***Lembertia congdonii*** (E•)

Proposed Species

Amphibians

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

Proposed Species

Fish

Sacramento splittail, ***Pogonichthys macrolepidotus*** (PT)

Plants

Hoover's spurge, ***Chamaesyce hooveri*** (PT)

Springville clarkia, ***Clarkia springvillensis*** (PT)

Greenhorn adobe-lily, ***Fritillaria striata*** (PT)

Piute Mountains navarretia, ***Navarretia setiloba*** (PT)

San Joaquin Valley Orcutt grass, ***Orcuttia inaequalis*** (PE*)

San Joaquin adobe sunburst, ***Pseudobahia peirsonii*** (PE)

Greene's tuctoria, ***Tuctoria greenei*** (PE*)

Candidate Species

Mammals

Nelson's antelope ground squirrel, ***Ammospermophilus nelsoni*** (1)

short-nosed kangaroo rat, ***Dipodomys nitratoides brevinasus*** (1)

spotted bat, ***Euderma maculatum*** (2)

greater western mastiff-bat, ***Eumops perotis californicus*** (2)

Pacific fisher, ***Martes pennanti pacifica*** (2)

small-footed myotis bat, ***Myotis ciliolabrum*** (2)

long-eared myotis bat, ***Myotis evotis*** (2)

fringed myotis bat, ***Myotis thysanodes*** (2)

long-legged myotis bat, ***Myotis volans*** (2)

Yuma myotis bat, ***Myotis yumanensis*** (2)

Southern grasshopper mouse, ***Onychomys torridus ramona*** (2)

Tulare grasshopper mouse, ***Onychomys torridus tularensis*** (2)

California bighorn sheep, ***Ovis canadensis californiana*** (2)

San Joaquin pocket mouse, ***Perognathus inoratus*** (2)

Pale Townsend's big-eared bat, ***Plecotus townsendi pallescens*** (2)

Pacific western big-eared bat, ***Plecotus townsendii townsendii*** (2)

Sierra Nevada red fox, ***Vulpes vulpes necator*** (2)

Birds

northern goshawk, ***Accipiter gentilis*** (2)

tricolored blackbird, ***Agelaius tricolor*** (2)

western burrowing owl, ***Athene cunicularia hypugea*** (2)

Candidate Species

Birds

ferruginous hawk, ***Buteo regalis*** (2)

mountain plover, ***Charadrius montanus*** (2)

little willow flycatcher, ***Empidonax traillii brewsteri*** (2)

white-faced ibis, ***Plegadis chihi*** (2)

California spotted owl, ***Strix occidentalis occidentalis*** (2)

San Joaquin LeConte's thrasher, ***Toxostoma lecontei macmillanorum*** (2)

Reptiles

northwestern pond turtle, ***Clemmys marmorata marmorata*** (2)

southwestern pond turtle, ***Clemmys marmorata pallida*** (2)

San Joaquin whipsnake, ***Masticophis flagellum ruddocki*** (2)

California horned lizard, ***Phrynosoma coronatum frontale*** (2)

Amphibians

California tiger salamander, ***Ambystoma californiense*** (1)

Relictual slender salamander, ***Batrachoseps relictus (=pacificus)*** (2)

Kern Canyon slender salamander, ***Batrachoseps simatus*** (2)

yellow-blotched ensatina, ***Ensatina eschscholtzii croceator*** (2)

Mount Lyell salamander, ***Hydromantes platycephalus*** (2)

foothill yellow-legged frog, ***Rana boylii*** (2)

mountain yellow-legged frog, ***Rana mucosa*** (2)

western spadefoot toad, ***Scaphiopus hammondi*** (2)

Fish

Kern Brook lamprey, ***Lampetra hubbsi*** (2)

Volcano Creek golden trout, ***Oncorhynchus (=Salmo) mykiss aquabonita*** (2)

Kern River rainbow trout, ***Oncorhynchus (=Salmo) mykiss gilberti*** (2)

Invertebrates

San Joaquin tiger beetle, ***Cicindella tranquebarica ssp*** (2)

Denning's cryptic caddisfly, ***Cryptochia denningi*** (2)

Kings Canyon cryptochian caddisfly, ***Cryptochia excella*** (2)

Hopping's blister beetle, ***Lytta hoppingi*** (2)

moestan blister beetle, ***Lytta moesta*** (2)

molestan blister beetle, ***Lytta molesta*** (2)

Candidate Species

Invertebrates

Morrison's blister beetle, ***Lytta morrisoni*** (2)

San Emigdio blue butterfly, ***Plebulina emigdionis*** (2)

Plants

Ramshaw sand-verbena, ***Abronia alpina*** (1)

Bodie Hills rock-cress, ***Arabis bodiensis*** (2)

heartscale, ***Atriplex cordulata*** (2)

brittlescale, ***Atriplex depressa*** (2R)

valley spearscale, ***Atriplex joaquiniana*** (2*)

lesser saltscale, ***Atriplex minuscula*** (2R*)

Vernal pool saltbush, ***Atriplex persistens*** (2R)

scalloped moonwort, ***Botrychium crenulatum*** (2)

Kaweah brodiaea, ***Brodiaea insignis*** (2)

Shirley Meadows mariposa, ***Calochortus westonii*** (1)

recurved larkspur, ***Delphinium recurvatum*** (2)

Pierpoint Springs liveforever, ***Dudleya cymosa ssp. costafolia*** (1)

Kern River daisy, ***Erigeron multiceps*** (2)

mouse buckwheat, ***Eriogonum nudum var. murinum*** (2)

Twisselmann's buckwheat, ***Eriogonum twisselmannii*** (2)

spiny-sepaled coyote-thistle, ***Eryngium spinosepalum*** (2)

Tulare horkelia, ***Horkelia tularensis*** (2)

DeDecker's lupine, ***Lupinus padre-crowleyi*** (2)

flax-like monardella, ***Monardella linoides ssp. oblonga*** (2)

Twisselmann's nemacladus, ***Nemacladus twisselmannii*** (2)

Charlotte's phacelia, ***Phacelia nashiana*** (2)

Nine-Mile Canyon phacelia, ***Phacelia novenmillensis*** (2)

Sequoia gooseberry, ***Ribes tularense*** (2)

Keck's sidalcea, ***Sidalcea keckii*** (1)

Notes:

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

KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA

PROTECTED SPECIES REPORT

August 1995

CONTENTS

Topic	Page
INTRODUCTION	766
METHODOLOGY	766
Area of Consideration	766
Species Included in This Report	768
Survey Procedure	769
RESULTS	770
Birds	770
Mammals	772
Reptiles	772
Amphibians	773
Invertebrates	774
Plants	774
FINDINGS	778
Bald Eagle	779
Valley Elderberry Longhorn Beetle	779
Southwestern Pond Turtle	780
Tricolored Blackbird	780
White-Faced Ibis	780
Spiny-Sepaled Button-Celery	780
Kaweah Brodiaea	781
Other Species	781
REFERENCES	782
APPENDIX A: ELDERBERRY BUSH CHARACTERISTICS	784

Figures

Number		
1	Study Area	767
2	Sensitive Plant Locations	776

INTRODUCTION

The proposed U.S. Army Corps of Engineers (Corps) project in the Kaweah River Basin could have adverse effects on species protected by Federal and State of California Endangered Species Acts. This report identifies the protected species in the project area (Figure 1) and evaluates the potential for adverse effects on these species. The Corps, together with Kaweah Delta Water Conservation District (KDWCD), is investigating alternatives to increase the capacity of Lake Kaweah. Increased capacity of the reservoir would increase flood protection to areas downstream of the dam and provide additional storage for water supply. This report will be incorporated into the Biological Data Report (BDR) which will accompany the Biological Assessment. The Biological Assessment and BDR will be forwarded to the U.S. Fish and Wildlife Service (USFWS) for review and Biological Opinion. The BDR will be part of the Environmental Impact Statement/Environmental Impact Report for this project.

METHODOLOGY

Area of Consideration

The study area, which includes Lake Kaweah, the Kaweah River downstream from Terminus Dam, and the Tulare lakebed contains suitable habitat for Federally and State-listed and proposed species. Project construction activities would be limited to the Terminus Dam site and Horse Creek Bridge, while the areas around the reservoir would be affected due to the larger reservoir area. Adverse effects would also occur in the Tulare lakebed due to a reduction in flooded area. The Land Use Report, Appendix E, has determined that there would be minimal land use changes as a result of the project. Therefore, the survey report concentrates on direct effects due to the project and focuses on the following areas:

1. The area around Lake Kaweah between the existing maximum inundation level and the proposed post-project maximum inundation level. The width of this band varies from less than 50 feet, where the banks are near vertical, to approximately 0.75 mile, where the Kaweah River enters the lake.

2. The area around Terminus Dam where spillway and bridge modifications would occur and all sites associated with the modifications, including equipment storage sites and borrow/spoil sites.

3. The area around Horse Creek Bridge and sites associated with bridge relocation activities.

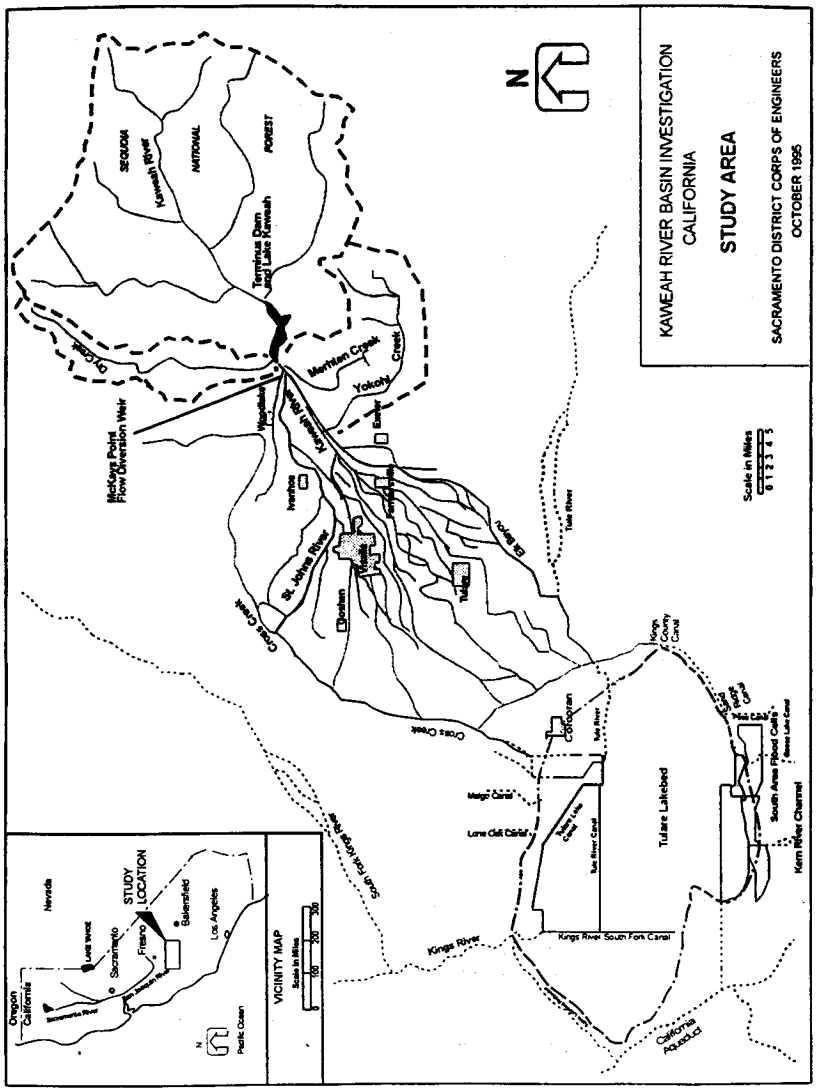

KAWEAH RIVER BASIN INVESTIGATION
CALIFORNIA
STUDY AREA
SACRAMENTO DISTRICT CORPS OF ENGINEERS
OCTOBER 1995
N
SEQUOIA
NATIONAL
FOREST
Kaweah River
Terminus Dam and Lake Kaweah
Dry Creek
Merritan Creek
Yokohl Creek
McKays Point Flow Diversion Weir
Kaweah River
Woodlake
Exeter
Ivanhoe
St. Johns River
Goshen
Tulare
Elk Bayou
Tule River
Cross Creek
Corcoran
Kings County Canal
Tulare Lakebed
Kern River Channel
South Area Flood Cells
Lone Oak Canal
Kings River South Fork Canal
Kings River
South Fork Kings River
California Aqueduct
Scale in Miles
0 1 2 3 4 5
VICINITY MAP
Scale in Miles
0 100 200 300
STUDY LOCATION
Oregon
California
Nevada
Sacramento
Fresno
Bakersfield
Los Angeles
Pacific Ocean

Figure 1

In addition, potential impacts to the species listed below were considered in the Tulare lakebed, which would receive less floodwater in some years due to the increased storage capacity in Lake Kaweah.

The above areas will be referred to in this report as the "focus area" to distinguish them from the entire study area.

Species Included in This Report

The Corps determined that the species listed below should be surveyed for potential occurrence based on the following criteria:

1. Presence of suitable habitat in the focus area.
2. Potential for direct effect.
3. Latest occurrence in the focus area.
4. Species current federal and State status.

Listed Species

Blunt-nosed leopard lizard, *Gambelia silus* (FE/CE)
San Joaquin kit fox, *Vulpes macrotis mutica* (FE/CE)
Tipton kangaroo rat, *Dipodomys nitratoides* (FE/CE)
Valley elderberry longhorn beetle, *Desmocerus californicus dimorphus* (FE)
California jewelflower, *Caulanthus californicus* (FE/CE)

Proposed Species

San Joaquin adobe sunburst, *Pseudobahia peirsonii* (PE/CE)

Candidate Species

Foothill yellow-legged frog, *Rana boylei* (C2)
Tricolored blackbird, *Agelaius tricolor* (C2)
White-faced Ibis, *Plegadis chihi* (C2)
Mountain plover, *Charadrius montanus* (C2)
Western snowy plover, interior population, *Charadrius alexandrinus nivosus* (C2)
Heartscale saltbush, *Atriplex cordulata* (C2)
Brittlescale, *Atriplex depressa* (CEQA)
Lesser saltscale, *Atriplex miniscula* (CEQA)
Lost Hills saltbush, *Atriplex vallicola* (C2)
Kaweah brodiaea, *Brodiaea insignis* (C2/CE)
Recurved larkspur, *Delphinium recurvatum* (C2)
Spiny-sepaled button-celery, *Eryngium spinosepalum* (C2)

In addition, the following species were identified as worthy of consideration by the California Department of Fish and Game and local experts:

Bald eagle, *Haliaeetus leucocephalus* (FE/CE)
Southwestern pond turtle, *Clemmys marmorata pallida* (C1)
California red-legged frog, *Rana aurora draytonii* (C1)

Status Definitions

FE	Federally listed "endangered"
CE	State of California listed "endangered"
PE	Federally "proposed endangered"
C1	Federal candidate species, Category 1 (not officially listed but enough data on file to support listing)
C2	Federal candidate species, Category 2 (probably warrants listing, but biological information to support a proposed rule is lacking)
CEQA	Not in the listing process yet but worthy of consideration under the California Environmental Quality Act

Survey Procedure

The initial survey for this project included a literature search to determine the likelihood of these species occurring in the focus area. In addition, local experts provided crucial information not available in the literature.

Based on the literature search and consultation with local experts, each species listed above was evaluated for its potential to occur in the focus area and its likelihood of being adversely affected by the project. When there was insufficient information to make these determinations, field surveys were performed. The following species required field surveys:

Valley elderberry longhorn beetle
Spiny-sepaled button-celery
Kaweah brodiaea
Sensitive bat species

Local experts were consulted and known populations of both plant species were surveyed to familiarize surveyors with plant characteristics. Transects were then performed in portions of the focus area where topographic and edaphic factors warranted, and the previously identified population was relocated and characterized. The shoreline of Lake Kaweah was surveyed by boat to locate all potentially affected elderberry bushes. A telescoping survey rod was used to determine the relative location of the bushes to the existing high-water mark. Bushes that had the potential to be inundated were then characterized and investigated for signs of valley elderberry longhorn beetle occurrence. Horse Creek

Bridge and the spillway and bridge on Terminus Dam were investigated for signs of use by bats.

RESULTS

Following are the survey results for each species and an analysis of the project's potential for impact on each species.

Birds

Tricolored Blackbird

Occurrence: Within the focus area, this species is known to occur in the Tulare lakebed when habitat areas are flooded in such a way as to promote cattail growth (Barnum pers comm, 1995). The species is not known to inhabit Lake Kaweah, probably due to a lack of suitable habitat (Hansen pers comm, 1995). There was no occurrence of this species around Lake Kaweah indicated in the California Natural Diversity Data Base (CNDDB). A search of the California Natural Diversity Data Base (CNDDB) revealed no occurrence of this species around Lake Kaweah.

Effects: Existing water management decisions which influence the extent of the cattail habitat used by this species in the Tulare lakebed probably have a greater influence on this species than the amount of available flooded acreage. Therefore, a reduction in flooded acreage due to the project is not likely to have a direct effect on this species. The project mitigation plan, which calls for flooding approximately 366 acres for 150 days each year, would include some cattail growth which could be suitable habitat for this species.

Bald Eagle

Occurrence: This species is known to winter in the focus area primarily around Lake Kaweah, where it uses perch trees and preys on fish and probably waterfowl (ECOS, 1990). Bald eagles are rarely seen in the Tulare lakebed (Barnum pers comm, 1995). The breeding range for this species is mainly in mountainous habitats near reservoirs in the northern one-third of the State (CDFG, 1992).

Effects: Foraging habitat for the bald eagle at Lake Kaweah would likely remain the same as without-project conditions. Currently, there is aboout 1,000 acre-feet of sediment storage space left in the reservoir. This space is expected to fill in by the year 2000 without the project. In the past, water has remained in the reservoir during the winter because of sediment storage space and precipitation parameters which can be used in dry years to keep winter carryover water in the reservoir. With the proposed project, there would be no additional sediment space added to the reservoir. The remaining sediment storage space woould fill in by the year 2000, the same as without project conditions. Without additional sediment

storage space there would be less water available in the reservoir in the winter which could reduce the foraging habitat for the bald eagle. These conditins would exist with or without the project. The reservoir could be completely drawn down in the winter for flood control purposes. However, precipitation parameters would still be in place that would allow some water to remain in the reservoir during dry winters depending on the rainfall conditions in the waterhsed. Therefore, foraging habitat may decrease in some years with- or without-the-project.

Alternatives to add sediment storage space (which would allow winter carryover water) are currently being considered. A plan for additional sediment storage space will be considered and may be added to the final EIS/EIR. Any plan to add sediment storage space to the reservoir would increase the foraging habitat for the eagle. If a plan for additional sediment storage space is added to the project, effects to the bald eagle would be analyzed further in the final EIS/EIR. If any mitigation measures are needed they would be added in the final document.

White-Faced Ibis

Occurrence: Within the focus area, this species is known to occur in the Tulare lakebed and nest there when habitat conditions are favorable (Barnum pers comm, 1995).

Effects: Reductions in floodwater from the Kaweah River system would probably have an incremental effect on this species. To compensate for this loss of habitat, the project mitigation plan would address this species' specific habitat requirements.

Western Snowy Plover, Interior Population -

Occurrence: This small shore bird is an obligate salt water species (Barnum pers comm, 1995) known to use evaporation ponds in the vicinity of the Tulare lakebed.

Effects: Since this is an obligate salt water species, there is no suitable habitat in the focus area, and no adverse effects are anticipated.

Mountain Plover

Occurrence: This species is known to winter in the San Joaquin Valley, particularly on the west side where it forages in dry, upland sites such as grasslands and agricultural fields (Goss pers comm, 1995). The CNDDB gives no indication of this species' occurrence in the focus area.

Effects: Since this species only has the potential to winter in the focus area where it forages in dry, upland sites, no effects are anticipated.

Mammals

San Joaquin Kit Fox

Occurrence: The San Joaquin kit fox (SJKF) occurs in the remaining native vegetation associations of the valley floor and surrounding foothills from southern Kern County north to Los Banos. This species has the potential to occur throughout the valley, primarily in dry, scrub habitats on the valley floor (CDFG, 1992). However, based on USFWS range maps, the Tulare lakebed is the only portion of the focus area that lies within the SJKF's range. The nearest known sighting of this species was in 1973 near the town of Ivanhoe, which is approximately 15 miles from the Lake Kaweah (CDFG, 1995). Local experts believe that the SJKF is not likely to use the area around Lake Kaweah as habitat (Hansen and Presley pers comm, 1995). Further, surveys ECOS, Inc., in 1989 in much of the survey area below Terminus Dam found no conclusive evidence of SJKF presence.

Effects: The only portion of the focus area where the SJKF is likely to occur is the Tulare lakebed. Since the only project-related effects in this area would be an incremental reduction in floodwater storage, no adverse project-related effects to this species are anticipated.

Tipton Kangaroo Rat

Occurrence: Tipton kangaroo rats (TKR) originally occupied a range that included the Tulare Lake Basin in portions of Fresno, Kings, Tulare, and Kern Counties (CDFG, 1992). The TKR require friable soils in desert and alkaline playa communities that are free from flooding (Williams, 1985). The Tulare lakebed is the only portion of the focus area that lies within the known range of the TKR and could contain the required habitat characteristics.

Effects: The incremental reduction of flooded acreage in the Tulare lakebed would not likely affect this species' habitat. Therefore, no adverse effects on the TKR are anticipated.

Reptiles

Blunt-Nosed Leopard Lizard

Occurrence: The blunt-nosed leopard lizard (BNLL) occurs in scattered locations in the San Joaquin Valley and in eastern portions of the coast ranges, where it inhabits sparsely vegetated plains, alkali flats, low foothills, grasslands, canyon floors, large washes, and arroyos (CDFG, 1992). The nearest occurrence to Lake Kaweah, as shown in the CNDDB, is more than 50 miles away. The Tulare lakebed is the only portion of the focus area that lies within the range of this species.

Effects: No adverse project-related effects are anticipated for this species since only a reduction in flooded acreage would occur in that portion of the focus area where the BNLL has the potential to occur.

Southwestern Pond Turtle

Occurrence: This species favors a variety of permanent and intermittent waters with large amounts of basking sites, although it appears to fare poorly in reservoirs created by dams (Holland, 1991). No specific surveys were performed for this species, and no pond turtles were seen during other surveys. There are no CNDDB records for the focus area. However, the turtles are believed to occur at Lake Kaweah based on previous sightings (Hansen pers comm, 1995), and turtles (species unknown) have been seen in the Kaweah River at the east end of the lake (Fabion pers comm, 1995). Furthermore, this species was once abundant in Tulare Lake before the lake was drained (Holland, 1991). The species is now unlikely to occur in the Tulare lakebed due to the lack of permanent water (Barnum pers comm, 1995).

Effects: Based on the above habitat description, the greatest potential for adverse effects to this species within the focus area is the construction site at Horse Creek Bridge. To avoid adverse effects, disturbance in areas adjacent to Horse Creek should be kept to a minimum. Before construction begins, the site would be examined by a biologist to determine if turtles are present. A plan would be developed with CDFG and USFWS to deal with any turtles found in the construction area.

Amphibians

Foothill Yellow-Legged Frog

Occurrence: This species historically occurred in the focus area where Lake Kaweah now lies. Ongoing, extensive surveys have been performed in the Kaweah watershed down to the town of Three Rivers, which is just upstream of the lake. This species is currently found only at high elevations in Sequoia National Park (Werner pers comm, 1995). A CNDDB search revealed no known occurrences in the focus area, with the nearest occurrences upstream of Lake Kaweah in 1970 in both the north and south forks of the Kaweah River.

Effects: Since this species is unlikely to occur in the focus area, no adverse effects are anticipated.

California Red-Legged Frog

Occurrence: Although once common in the San Joaquin Valley, this species has been eliminated from the majority of its range and is unlikely to occur in the project area (Hansen and Werner pers comm, 1995). A CNDDB search did not

reveal any sightings in the focus area, with the nearest sighting occurring in Stanislaus County.

Effects: Since this species is unlikely to occur in the focus area, no adverse effects are anticipated.

Invertebrates

Valley Elderberry Longhorn Beetle

Occurrence: The valley elderberry longhorn beetle (VELB) is a cylindrical beetle less than an 1 inch long that feeds and lays eggs on elderberry shrubs. The larvae bore into the pithy core of the elderberry stems and mine passages in the wood for as long as 2 years, until they emerge as adults (Steinhart, 1990). VELB are known to occur both above and below Lake Kaweah (Haines pers comm, 1995). Every potentially affected elderberry bush in the focus area was surveyed for VELB or signs of its presence. No VELB were seen during the surveys; however, VELB exit holes were identified in two potentially affected elderberry bushes at the east end of Lake Kaweah.

Effects: The only two elderberry bushes in the focus area that indicate signs of VELB use are likely to be inundated by the project. One other elderberry bush would also be inundated, and two bushes would be affected during construction of Horse Creek Bridge. Their locations and characteristics are listed in Appendix A and shown in Figure 2. Mitigation involving the planting and establishment of elderberry shrubs is likely to be necessary and consultation with USFWS would be required. Maintaining habitat for VELB around Lake Kaweah is important to retain continuity between the VELB populations above and below the lake.

Plants

San Joaquin Adobe Sunburst

Occurrence: This species requires heavy adobe soils (Hickman, 1993; Stebbins pers comm, 1995) and is unlikely to occur in the project area based on consultation of Natural Resources Conservation Service soil survey maps that indicate no suitable habitat exists in the focus area. A CNDDB search shows that the last known sighting near the focus area was near Rocky Hill, approximately 15 miles to the south in 1936.

Effects: Since this species is unlikely to occur in the focus area, no adverse effects are anticipated.

Recurved Larkspur

Occurrence: This perennial herb favors poorly drained, fine, alkaline, grassland soils (Hickman, 1993). The only portion of the focus area with potentially suitable habitat is the Tulare lakebed. A CNDDB search did not show any records for the focus area although there are numerous records in the vicinity.

Effects: Since the effect in the Tulare lakebed portion of the focus area would be a reduction in flooded acreage, no adverse effects to this species are anticipated.

California Jewelflower

Occurrence: This species is highly unlikely to occur in the focus area since suitable habitat consists of sandy, grassland soils on the valley floor (Woodward-

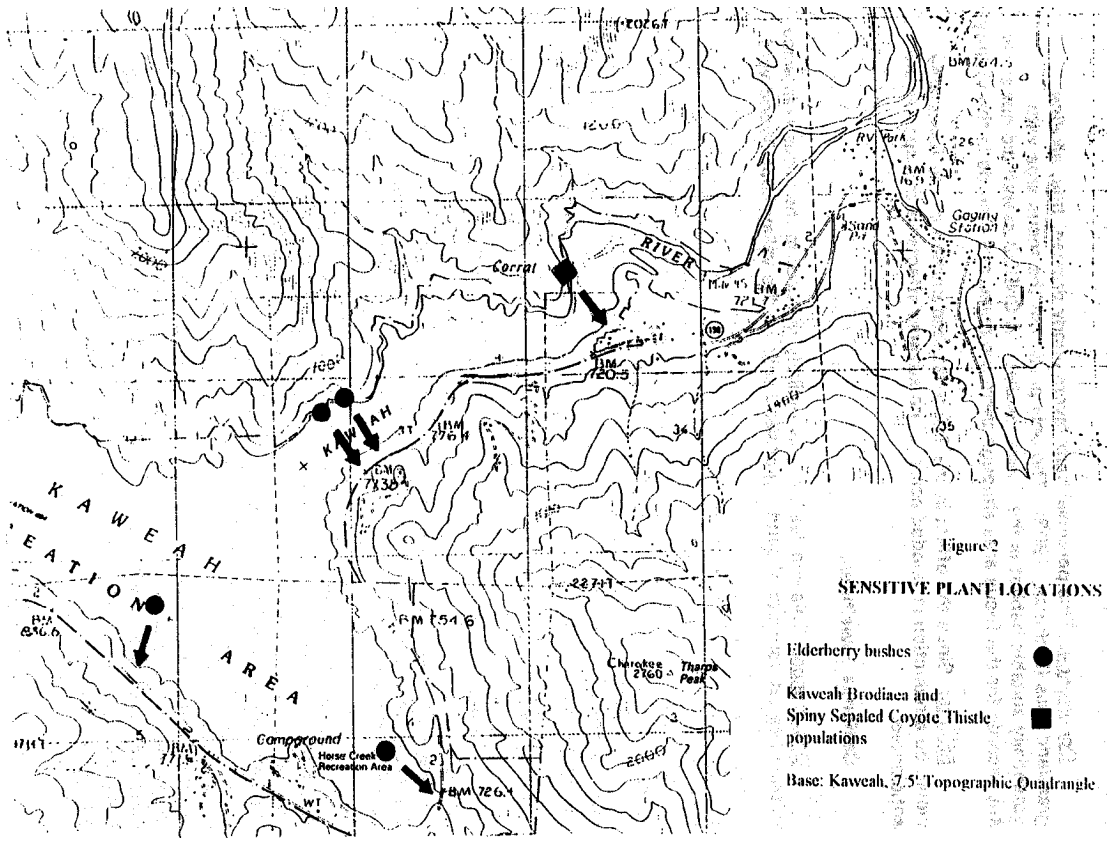


Figure 2

SENSITIVE PLANT LOCATIONS

Clyde, 1992). A CNDDB search indicates no recorded occurrences of this species in Tulare County since 1960.

Effects: Since this species is unlikely to occur in the focus area, no adverse effects are anticipated.

Spiny-Sepaled Button-Celery

Occurrence: This species was identified at one location in the current focus area during vegetation surveys performed by John Stebbins for the Department of Water Resources (DWR, 1991). Ground surveys in May 1995, relocated this population and showed that it was smaller, with approximately 50 plants versus 300 in 1989.

Effects: The elevation of this population was originally estimated by Stebbins to be approximately 720 feet. This elevation is very close to the proposed new maximum inundation level of 715, feet and the population may, in fact, be inundated. A topographic survey would be required to make a definitive determination. The site is currently on land administered by the Corps and will remain so. Salvage may be warranted if suitable alternate habitat can be found. The site should receive protection from such disturbances as the construction of public facilities and firebreaks. Such protection might include exclusionary fencing. Experts on this species should be consulted for other management options.

Kaweah Brodiaea

Occurrence: Stebbins did not find this species when this site was previously surveyed (DWR, 1991). A new population of this species was discovered in May 1995 during surveys to relocate the previously delineated Eryngium population. Approximately five individual plants were located directly adjacent to the Eryngium population.

Effects: Effects and recommendations are the same as for the adjacent Eryngium population. The elevation was originally estimated by Stebbins to be approximately 720 feet. This elevation is very close to the proposed new maximum inundation level of 715 feet, and the population may be inundated. A topographic survey would be required to make a definitive determination. The site is currently on land administered by the Corps and will remain so. Salvage may be successful since the Brodiaea's ecological requirements may be broader than for the Eryngium. The site should receive protection from such disturbances as the construction of public facilities and firebreaks. Such protection might include exclusionary fencing. Experts on this species should be consulted for other management options.

Heartscale Saltbush

Occurrence: This species is an annual herb found in alkaline habitat on the valley floor (Skinner and Pavlik, 1994). Suitable habitat for this species potentially exists in the Tulare lakebed portion of the focus area. There are no CNDDB records for this species in the lakebed, but it does occur in the vicinity.

Effects: The only effect in this portion of the focus area would a reduction in flooded acreage. Therefore, no adverse effects are anticipated.

Lost Hills Saltbush

Occurrence: This species is an annual herb found in alkaline habitat on the valley floor (Skinner, 1994). Suitable habitat for this species potentially exists in the Tulare lakebed portion of the focus area. There are no CNDDB records for this species in the lakebed, but it does occur in the vicinity.

Effects: The only effect in this portion of the focus area would be a reduction in flooded acreage. Therefore, no adverse effects are anticipated.

Brittlescale Saltbush

Occurrence: This species is an annual herb found in alkaline habitat on the valley floor (Skinner, 1994). Suitable habitat for this species potentially exists in the Tulare lakebed portion of the focus area. There are no CNDDB records for this species in the lakebed, but it does occur in the vicinity.

Effects: The only effect in this portion of the focus area would be a reduction in flooded acreage. Therefore, no adverse effects are anticipated.

Lesser Saltscale Saltbush

Occurrence: This species is an annual herb found in alkaline habitat on the valley floor (Skinner, 1994). Suitable habitat for this species potentially exists in the Tulare lakebed portion of the focus area. There are no CNDDB records for this species in the lakebed, but it does occur in the vicinity.

Effects: The only effect in this portion of the focus area would be a reduction in flooded acreage. Therefore, no adverse effects are anticipated.

FINDINGS

Based on the surveys and evaluation of occurrence and effects, only two listed species and five candidate species are likely to be affected by this project. A discussion of findings for each of the five species is included below.

- Listed Species

  Bald eagle
  Valley elderberry longhorn beetle

- Candidate Species

  Southwestern pond turtle
  Tricolored blackbird
  White-faced Ibis
  Kaweah brodiaea
  Spiny-sepaled button-celery

Bald Eagle

This species winters in the focus area where it forages primarily for fish and waterfowl at Lake Kaweah and very rarely in the Tulare lakebed. Since this project would not reduce the amount of water in Lake Kaweah, and therefore foraging habitat, there should be no negative impact to bald eagles. The project may benefit this species in that the increased capacity of the reservoir would allow more water to remain in the reservoir during the winter after drawdown in anticipation of spring floodwaters. This water would provide more fish and waterfowl habitat and increase the eagle's prey base. There would be a reduction in flooded acreage in the Tulare lakebed, which is in the focus area. However, as the bald eagle rarely uses this area, any effects would be minimal.

Valley Elderberry Longhorn Beetle

Although this species was not found in the focus area, exit holes indicating former use were found in two elderberry shrubs at the east end of Lake Kaweah, which makes it very likely that the area around Lake Kaweah provides habitat for this species. Three elderberry bushes would be inundated by the new gross pool, and two bushes would be affected during the removal of the existing Horse Creek Bridge abutments. A complete description of the potentially affected shrubs is included in Appendix A.

Mitigation involving the planting and establishment of elderberry shrubs would be necessary and consultation with USFWS would be required. Preliminary, informal consultation with USFWS (Deblin Mead pers comm, 1995) indicated that although USFWS usually prefers transplanting imperiled shrubs, the three shrubs in danger of inundation should be left where they are due to the difficulty of moving them successfully. As a consequence, the mitigation ratio should be increased to compensate for the unlikely survival of these shrubs. The exact mitigation ratio must be determined through consultation with USFWS, but it varies from 2:1 to 5:1 with an 80-percent survival ratio after 10 years. There are suitable sites around Lake Kaweah where the mitigation plantings could be established without much difficulty. Maintaining habitat for VELB around Lake Kaweah is important to

retain continuity between the VELB populations upstream and downstream of the lake.

Southwestern Pond Turtle

This species was not found in the focus area. However, due to occurrence records in the vicinity and the opinion of local experts, it is likely that turtles occur in the lake and/or its tributaries near the lake. The area with the greatest potential for impact is Horse Creek, since the habitat is suitable and there would be construction activity in the riparian area adjacent to the creek and probably in the creek itself. Direct effects to this species can be largely avoided by inspecting the site immediately prior to construction. This inspection should be done by a qualified biologist or another expert acceptable to CDFG and USFWS who is familiar with pond turtles. Construction crews should be notified that pond turtles may be present. A plan should be developed with CDFG and USFWS to deal with any turtles found in the construction area.

Tricolored Blackbird

This species is known to occur in the Tulare lakebed when habitat conditions are favorable. A loss of flooded acreage due to the project may not have a direct impact on this species, but a loss may affect water management decisions which would have the same result. The project mitigation plan would address this species' specific habitat requirements.

White-Faced Ibis

Reductions in floodwater would probably have an incremental impact on this species. To compensate for this loss of habitat, the project mitigation plan would address this species' specific habitat requirements.

Spiny-Sepaled Button-Celery

The elevation of this population was originally estimated by Stebbins to be 720 feet. This elevation is very close to the proposed new maximum inundation level of 715 feet, and the population may be inundated. A topographic survey would be required to make a definitive determination. The site is currently on land administered by the Corps and will remain so. Salvage may be warranted if suitable alternate habitat can be found. The site should receive protection from disturbance such as the construction of public facilities and firebreaks. Such protection might include exclusionary fencing. Experts on this species should be consulted for other management options.

Kaweah Brodiaea

Effects and recommendations are the same as for the adjacent Eryngium population. The elevation of this site was originally estimated by Stebbins to be approximately 720 feet. This elevation is very close to the proposed new maximum inundation level of 715 feet and the population may be inundated. A topographic survey would be required to make a definitive determination. The site is currently on land administered by the Corps and will remain so. Salvage may be successful since the Brodiaea's ecological requirements may be broader than for the Eryngium. The site should receive protection from disturbance such as the construction of public facilities and firebreaks. Such protection might include exclusionary fencing. Experts on this species should be consulted for other management options.

Other Species

In addition, cursory field surveys were performed to determine if any bats were present in Horse Creek Bridge or the bridge over the spillway at Terminus Dam. No bats or bat sign were found. However, swallows were seen in the vicinity of Terminus Dam. Swallows are protected by the Migratory Bird Treaty Act and are known to nest under bridges. Provisions must be made to avoid effects to nesting swallows. CDFG and USFWS should be consulted for appropriate methods.

REFERENCES

Literature Cited

California Department of Fish and Game. 1995. California Natural Diversity Data Base. Sacramento.

____. 1992. *Annual Report on the Status of California State Listed Threatened and Endangered Animals and Plants*. Sacramento. 203pp.

California Department of Water Resources. 1995. *Kaweah River Basin Investigation, California. Land Use Appendix*. Sacramento. 30pp.

____. 1991. *Kaweah River Basin Investigation, California, Vegetation Report, Dry Creek Reservoir Site and Enlarged Kaweah Reservoir*. Red Bluff. 44pp.

ECOS, Inc. 1990. *Final Biological Data Report, Kaweah River Basin Project, Tulare County, California*. Prepared for California Department of Water Resources, San Joaquin District, Fresno. 54pp.

Hickman, James C., ed. 1993. *The Jepson Manual. Higher Plants of California*. University of California Press. Berkeley. 1,400pp.

Holland, D.C. 1991. *A Synopsis of the Ecology and Current Status of the Western Pond Turtle (Clemmys marmorata)*. Final Report to U.S. Fish and Wildlife Service, San Simeon, California. 180pp.

Skinner, Mark W. and Pavlik, Bruce M., eds. 1994. *Inventory of Rare and Endangered Vascular Plants of California*. Fifth Edition. California Native Plant Society. Sacramento. 338pp.

Steinhart, Peter. 1990. *California's Wild Heritage. Threatened and Endangered Animals in the Golden State*. California Department of Fish and Game. 108pp.

U.S. Army Corps of Engineers. 1995. *Kaweah River Basin Investigation, California*. Scope of Work. Sacramento. 3pp.

Williams, Daniel F. 1985. *A Review of the Population Status of the Tipton Kangaroo Rat, Dipodomys nitratoides*. Final Report to U.S. Fish and Wildlife Service. Sacramento, California. 44pp.

Woodward-Clyde Consultants. 1992. *Focused Biological Surveys for Eight Target Species in Tulare County*. Bakersfield, California. 25pp.

Personal Communications

Barnum, Doug. July 1995. Wildlife Biologist. National Biological Survey. Kern National Wildlife Refuge. Delano, California. Telephone conversations.

Fabion, Mike. July 1995. Park Ranger. U.S. Army Corps of Engineers. Lake Kaweah. Site visit.

Goss, Rod. July 1995. Environmental Specialist. California Department of Fish and Game. Fresno, California. Telephone conversations.

Haines, R. Dennis. April 1995. Staff Agricultural Biologist. Tulare County, California. Telephone conversations.

Hansen, Robert B. May 1995. Biological Consultant. Visalia, California. Telephone conversation.

Mead, Deblin. May 1995. Entomologist. Endangered Species Division, U.S. Fish and Wildlife Service. Sacramento, California. Telephone conversations.

Presley, Gail. April 1995. Wildlife Biologist. California Department of Fish and Game. Visalia, California. Letter and telephone conversations.

Werner, Harold. April 1995. Wildlife Biologist. Sequoia National Park. Telephone conversation.

Stebbins, John. May 1995. Botanical Consultant. Fresno, California. Fax, telephone converstation and herbarium visit.

APPENDIX A: ELDERBERRY BUSH CHARACTERISTICS

ELDERBERRY 1

Location: NW¼, NE¼, Sec. 5, T18S, R28E Kaweah quadrangle, as indicated on Figure 2. Approximately 5 feet above current high-water mark on southwest shore of lake.

Characteristics: Single, mature shrub in excellent condition (90+ percent living stems). Approximately 25 feet high and 30 feet in diameter.

Size Class (inches)	Number of Stems
12+	1
9-12	3
6-9	4
3-6	12
1-3	30
0-1	100+

VELB sign: None

ELDERBERRY 2

Location: NE¼, SW¼, Sec. 33, T17S, R28E, Kaweah quadrangle, as indicated on Figure 2. Approximately 15 feet above current high-water mark on southeast shore of lake.

Characteristics: Single, mature shrub in good condition (70+ percent living stems). Approximately 15 feet high and 15 feet in diameter.

Size Class (inches)	Number of Stems
12+	0
9-12	0
6-9	0
3-6	1
1-3	15
0-1	50+

VELB sign: Hole 1 – 3 feet above ground in 1.5-inch stem, 3 feet from main stem.
Hole 2 – 3 feet above ground in 2.5-inch stem, 1 foot from main stem.
Hole 3 – 8 feet above ground in 3-inch (main) stem.
Hole 4 – 10 feet above ground in 1-inch stem.

Holes did not appear to be from this year's hatch.

ELDERBERRY 3

Location: NE¼, SW¼, Sec. 33, T17S, R28E, Kaweah quadrangle, as indicated on Figure 2 (approximately 150 feet east of bush 2). Approximately 15 feet above current high-water mark on southeast shore of lake.

Characteristics: Single, mature shrub in good condition (70+ percent living stems). Approximately 15 feet high and 25 feet in diameter.

Size Class (inches)	Number of Stems
12+	0
9-12	0
6-9	1
3-6	5
1-3	8
0-1	50+

VELB sign: Hole 1 – 4 feet above ground in 3-inch stem 7 feet from main stem.
Hole 2 – 2.5 feet above ground in 1-inch stem, 3 inches from main stem.

Holes did not appear to be from this year's hatch.

ELDERBERRY 4

Location: NW¼, SE¼, Sec. 4, T18S, R28E, Kaweah quadrangle, as indicated on Figure 2 (northeast corner of bridge abutment).

Characteristics: Single, young shrub in excellent condition (90+ percent living stems). Approximately 7 feet high and 10 feet in diameter.

Size Class (inches)	Number of Stems
12+	0
9-12	0
6-9	0
3-6	1
1-3	6
0-1	15

VELB sign: None

ELDERBERRY 5

Location: NW¼, SE/¼, Sec. 4, T18S, R28E, Kaweah quadrangle, as indicated on Figure 2 (south of State Route 198 by access road). Note: This shrub can probably be avoided by erecting a protective barrier.

Characteristics: Single, young shrub in excellent condition (90+ percent living stems). Approximately 7 feet high and 15 feet in diameter.

Size Class (inches)	Number of Stems
12+	0
9-12	0
6-9	0
3-6	0
1-3	5
0-1	15

VELB sign: None

APPENDIX C. VALLEY ELDERBERRY MITIGATION GUIDELINES

February 26, 1993

General Compensation Guidelines for the
Valley Elderberry Longhorn Beetle

The valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) was listed as a threatened species in 1980 (45 Federal Register 52807). This animal is fully protected under the Endangered Species Act of 1973, as amended (Act). The larvae of the beetle feed and mature within elderberry (*Sambucus* sp.) shrubs. Use of the plants by the early stages of this insect, a wood borer, is very rarely apparent. Frequently, the only exterior evidence of use of the shrub is the exit hole created by the larvae prior to the pupal stage. The beetle has been found in elderberry plants with stems possessing a diameter of one inch or greater. The range of the animal extends from Redding south to Bakersfield and from the western foothills of the Sierra Nevada to the eastern foothills of the coast range (Barr 1991; U.S. Fish and Wildlife Service 1984).

An adequate survey should be completed by a qualified biologist for the valley elderberry longhorn beetle and its elderberry foodplant if the proposed project site is located within the range of the animal. The report should include the precise location of all elderberry shrubs, their height and diameter, the presence of adult exit holes and the general condition of the plants. The diameter of the stems should be measured at ground level. A map should also be included with the report indicating the major vegetational communities present on site. The completed study should be sent to the U.S. Fish and Wildlife Service (Service) for review.

Take incidental to an otherwise lawful activity may be authorized by one of two procedures. If a Federal agency is involved with the permitting, funding, or carrying out of the project, then initiation of formal consultation between that agency and the Service pursuant to section 7 of the Act is required if it is determined that the proposed project may affect a federally listed species. Such consultation would result in a biological opinion that addresses the anticipated effects of the project to the listed species and may authorize a limited level of incidental take. If a Federal agency is not involved with the project, and federally listed species may be taken as part of the project, then an incidental take permit pursuant to section 10(a) of the Act would need to be obtained. The Service may issue such a permit upon completion of a satisfactory conservation plan for the listed species that would be affected by the project.

The following mitigations should be undertaken for the valley elderberry longhorn beetle:

Avoid Habitat Whenever Possible

Fence and flag each elderberry shrubs or group of these plants so that the construction crew can avoid them. There should be a setback of at least twenty feet from the dripline of each elderberry shrub. The area must be designated to prevent isolation of the beetle population from other populations located in adjacent areas. The area should be designated as habitat for the valley elderberry longhorn beetle in perpetuity.

Brief contractors on the requirements to avoid damaging the elderberry plants and the possible penalties for not complying with these provisions. These areas should be adequately signed with the following information: "This area is habitat of the valley elderberry longhorn beetle, a threatened species, and must not be disturbed. This species is protected by the Endangered Species Act of 1973, as amended. Violators are subject to prosecution, fines and imprisonment." The signs should be clearly readable from a distance of at least twenty feet.

Work crews should be informed about the status of the threatened valley elderberry longhorn beetle and the need to protect its elderberry host plant. All on-site personnel should receive instruction regarding the presence of the federally protected animal.

Transplant Elderberry Shrubs

Elderberry shrubs should be transplanted if they can not be avoided by the proposed project. All elderberry plants with a stem diameter of 1.0 inch or greater in size should be transplanted to a mitigation area. In some cases, a shrub that would be extremely difficult to remove because of access problems or one that is in such poor condition that it is unlikely to survive being transplanted may be exempted from this requirement at the Service's discretion.

A qualified biologist (monitor) should be on-site for the duration of the transplanting of the elderberry shrubs to insure that no unnecessary take of the valley elderberry longhorn beetle occurs. The biologist utilized should have the authority to stop all activities until appropriate corrective measures have been completed. The biologist should also be required to report violations immediately to the Service and the California Department of Fish and Game.

1. Timing.--Elderberry shrubs with stems equal to or greater than 1.0 inches in diameter should be transplanted when the plant is dormant (approximately November through the first two weeks in February) after they have lost their leaves and, thus, the plants essentially are not transpiring or actively growing. Planting during the non-growing season will reduce the shock to the plant and increase transplantation success.

2. Procedure to plant elderberry shrubs.

   a. Cut tree back to 3 to 6 feet from the ground or to 50 percent of its height (whichever is greater) by removing branches and stems above this height. The trunk and all stems greater than 1.0 inches in diameter (measured 1 to 6 inches from the ground surface) should be replanted.

   b. Excavate a hole 3 to 4 feet deep to receive the planting;

   c. Dig plant up using Vemeer spade, backhoe, front end loader, or other suitable equipment, taking as much of the root ball as possible, and replant immediately at the compensation site. Move plant only by the root ball. If the plant is to be moved and transplanted off site, wrap

the root ball in burlap and secure with wire. Dampen burlap with water, as necessary, to keep root ball wet;

d. The elderberry shrub should be planted in a water retention basin 40 feet by 40 feet in size (1600 square feet). After removing the burlap and wire (if any), plant the root ball so it is level with the existing ground. Compact the soil sufficiently so that settlement does not occur. Five seedling elderberry shrubs and associated native vegetation (see number 4 below) should be planted in each of the basins;

e. Saturate soil with water. Do not use fertilizers or other supplements or paint the tips of stems with pruning substance as the effects of these compounds on the beetle are unknown;

f. Monitor to ascertain if additional watering is necessary:

1. if sandy, well-drained soil, plants may need to be watered weekly or possibly twice monthly;

2. if clay, poorly-drained soil, it may not be necessary to water after the initial saturation.

A drip watering system and timer would be ideal. However, in situations where this is not possible, a water truck or other apparatus may be used.

Sixteen hundred (1600) square feet should be provided for each avoided elderberry shrub, each transplanted elderberry shrub, and every five transplanted elderberry shrubs and associated native plants (see sections 3 and 4 below). The mitigation area should be designated as habitat for the valley elderberry longhorn beetle in perpetuity. The mitigation area should be designated to prevent isolation of the beetle population from other populations located in adjacent areas. A conservation easement or fee title for the mitigation area should be given to a resource agency or appropriate private organization. The Service should be provided with a map and written details specifically identifying the mitigation area prior to the initiation of the mitigation program. The applicant should receive written approval from the Service that the mitigation area is acceptable prior to initiation of the mitigation program.

3. Procedure to plant additional stems.--Each stem 1.0 inches or greater in diameter that is moved or destroyed will be replaced with seedling elderberry plants in the mitigation area using a ratio from 2:1 to 5:1. This replacement requirement applies even if the elderberry shrub is transplanted. Replacement stock should be obtained from local sources. The approval of the Service should be obtained prior to initiating the compensation program. The ratio is determined as follows:

Ratio of 2:1 Elderberry shrubs with stem diameters 1.0 inch or greater and there are no adult emergence holes.

Ratio of 3:1 Elderberry shrubs with stem diameters 1.0 inch or greater. Beetles are present as evidenced by emergence holes, and occur in 50 percent or less of the shrubs.

Ratio of 5:1 Elderberry shrubs with stem diameters 1.0 inch or greater in size. Beetles are present as evidenced by emergence holes, and occur in 51 percent or greater of the shrubs.

4. Plant associated native plants: Recent studies have found that beetles are more abundant in more dense native plant communities with a mature overstory and mixed understory versus a young overstory and low understory. Therefore, a mix of native plants associated with the elderberry shrubs at the project site should be planted at a ratio of at least two specimens of all native tree and shrub species for every five elderberry shrubs. These plantings also must be monitored with the same survival criteria utilized for the elderberry plants. The saplings and seedlings, as appropriate, should be from native populations at the project site or from the immediate project vicinity. The approval by the Service of the native plant donor sites must be obtained prior to initiation of any of the revegetation work.

Example 1

Total number of elderberry shrubs on project site: 20
Associated native plants: interior live oak (*Quercus wislizenii*), foothill pine (*Pinus sabiniana*), and California buckeye (*Aesculus californica*)
Number of elderberry shrubs with evidence of the the valley elderberry longhorn beetle: 12
Number of stems equal or greater than 1 inch: 100
Compensation: Transplant the 20 elderberry shrubs that will be impacted, plant 500 elderberry seedlings (ratio of 5:1), plant 40 interior live oaks, 40 foothill pines, 40 California buckeyes
Total area required: 4.41 acres

Example 2

Total number of elderberry shrubs: 10
Associated native plants: interior live oak (*Quercus wislizenii*)
Number of elderberry shrubs with evidence of the valley elderberry longhorn beetle: 0
Number of stems greater or equal to 1.0 inch: 0
Compensation required - None

Example 3

Total number of elderberry shrubs: 5
Associated native plants: cottonwood (*Populus fremontii*)
Number of elderberry shrubs with evidence of the valley elderberry longhorn beetle: 0
Number of stems equal or greater than 1.0 inch: 15
Compensation required: Transplant the 5 elderberry shrubs, plant 30 elderberry seedlings (ratio 2:1), plant 6 cottonwoods
Total area required: .40 acre

Example 4

Total number of elderberry shrubs: 25
Associated native plants: none
Number of elderberry shrubs with evidence of the
the valley elderberry longhorn beetle: 7
Number of stems equal or greater than 1.0 inch: 150
Compensation required: Transplant the 25 elderberry shrubs, plant 450
stems (ratio 3:1)
Total area required: 4.22 acres

Provide Habitat for the Beetle in Perpetuity

Weeds and other plants that are not native to the mitigation area should be removed at least once a year or at the discretion of the Service or the California Department of Fish and Game. Mechanical means should be used; herbicides should be prohibited.

Measures should be taken to insure that no pesticides, herbicides, or other chemical agents enters the mitigation area. No spraying of these agents should be conducted within one hundred (100) feet of the area or if they have the potential to drift, flow or be washed into the area in the opinion of biologists or law enforcement personnel from the California Department of Fish and Game or the Service. The Service should be provided with written documentation that this condition will be carried out in perpetuity.

No dumping of trash or other material should occur within the mitigation area. Any trash or other material should be removed within ten (10) working days of discovery. The Service should be provided with written documentation that this condition will be carried out in perpetuity.

Biologists and law enforcement personnel from the California Department of Fish and Game and the Service should be given complete access to the project site to monitor transplanting activities. Personnel from both these agencies should be given complete access to the project and the mitigation area to monitor the valley elderberry longhorn beetle and its elderberry shrub habitat in perpetuity.

Permanent fencing should be placed completely around the mitigation area to prevent unauthorized entry by off-road vehicles, equestrians, or other parties that may damage or destroy the habitat of the beetle. The applicant should receive written approval from the Service that the fencing is acceptable prior to initiation of the mitigation program.

A minimum of two prominent signs should be placed and maintained in perpetuity at the mitigation area noting that the site is habitat of the federally threatened valley elderberry longhorn beetle and including information on the beetle's biology and ecology. The signs should be approved by the Service. They should be replaced or repaired within ten (10) working days if they are found to be damaged or destroyed.

Monitoring Program

The population of the adults of the threatened valley elderberry longhorn beetle, the general condition of the mitigation area, and the elderberry plants and associated native plants located at the mitigation area should be monitored by a qualified biologist annually for a period of ten years beginning with the date the mitigation program is initiated. Two visits between February 14 and June 30 of each year should be made beginning the year the mitigation is begun. The study should include a population census of the adult beetles, including the actual number of animals observed, their condition, behavior, and precise location at the site; a census of the elderberry shrubs and associated native plants, including the number of plants observed, their size, and condition; and a general assessment of the habitat, including any real or potential threats to the beetle, and its food plants, such as erosion, excessive grazing by livestock, off-road vehicle use, etc. Random-walk counts should be used; mark-recapture or other methods that involve handling or harassment shall not be utilized. The materials and methods that will be utilized for this study should be reviewed and approved by the Service. All appropriate Federal and State permits should be obtained prior to initiating the field studies.

A written report analyzing the data from the monitoring of the threatened valley elderberry longhorn beetle at the mitigation area and the elderberry shrubs and associated native plants located at the project site should be conveyed to the Service and the Department of Fish and Game (Supervisor, Environmental Service, Department of Fish and Game, 1416 Ninth Street, Sacramento, California 95814, and Staff Zoologist; California Natural Diversity Data Base, Department of Fish and Game, 1220 S Street, Sacramento, California 95814) by December 31 of each year for a ten year period beginning with the date the program is initiated. The report should include, but not be limited to, the raw data collected during the field surveys and a basic analysis of the population dynamics of the valley elderberry longhorn beetle at the compensation sites. The following should be analyzed for the beetle: estimated population size (using both open and closed population models), and spatial distribution. Maps showing where the individual adult beetles and exit holes were observed should be included. For the elderberry shrubs and associated native plants the following should be analyzed: the survival rate, condition, and size of the plants. Real and likely future threats should be addressed along with suggested mitigations (e.g. fencing access to off-road vehicles, more frequent removal of exotic vegetation, etc.). The original field notes, photographs, correspondence, and all other pertinent material, as well as a copy of the report should be deposited and accessioned into the Natural History Museum of Los Angeles County (Senior Curator, Entomology Section, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, California 90007) by December 31 of each year for a ten year period beginning with the date the mitigation program is initiated. The Sacramento Field Office should be provided with the accession numbers given to this material by the Natural History Museum of Los Angeles County.

Success Criteria

A survival rate of 80% of the elderberry shrubs and associated native plants should be obtained at the end of the ten year monitoring program. The Service will make the determination as to the compensator's replacement responsibilities arising from circumstances beyond its control such as plants damaged or killed as the result of severe flooding or vandalism.

Future Revisions

Revegetating with elderberries and the responses of the beetle to such revegetation efforts is a relatively new procedure. As data become available on which to evaluate this technique, revisions to these guidelines are anticipated.

Service Contact

These guidelines were prepared by Chris Nagano, Sacramento Field Office, U.S. Fish and Wildlife Service, 2800 Cottage Way, Room E-1823, Sacramento, California 95825. Please refer any questions on these guidelines to him at the above address or call (916) 978-4866.

Literature Cited

Barr, C.B. 1991. The distribution, habitat, and status of the valley elderberry longhorn beetle *Desmocerus californicus dimorphus*. Sacramento Field Office, U.S. Fish and Wildlife Service, Sacramento, California

U.S. Fish and Wildlife Service. 1984. Recovery plan for the valley elderberry longhorn beetle. Endangered Species Program. Portland, OR.

APPENDIX D

CULTURAL RESOURCES

REPORT

KAWEAH RIVER BASIN
INVESTIGATION
DRAFT EIS/EIR

795

United States Army Corps of Engineers
Sacramento District, California

Contract No. DACW05-89-C-0028

KAWEAH RIVER BASIN INVESTIGATION SURVEY, TULARE COUNTY, CALIFORNIA: CULTURAL RESOURCES INVENTORY AND EVALUATION

Prepared by:

Thomas L. Jackson
C. Kristina Roper Wickstrom
Clinton M. Blount
Brian P. Wickstrom
Jeffrey T. Hall
Jennifer M. Ducat

BioSystems Analysis, Inc.
303 Potrero St., Suite 203
Santa Cruz, California 95060

March 1990

J-417

ABSTRACT

A cultural resources inventory and evaluation was conducted for the proposed construction of eleven alternative flood control and water storage projects in the Kaweah River basin. The focus of the archeological survey and the ethnographic and historical research is on the Dry Creek valley. Supplemental archeological, ethnographic, and historical data were developed previously for the Lake Kaweah area in studies by the University of California at Los Angeles (UCLA).

Pedestrian survey of ca. 1,905 acres in the Dry Creek valley and ca. 42 acres along the Lake Kaweah shoreline were completed. An enhanced archeological survey was conducted in the Dry Creek valley to assess the effectiveness of the initial survey which was conducted under poor environmental conditions in the spring. In the Dry Creek project area 29 previously unrecorded archeological sites and one isolated artifact find were documented. No newly discovered archeological resources were found in the Lake Kaweah area. One previously recorded site along the Kaweah River could not be relocated and may have been destroyed, but three other known sites were relocated and evaluated. Seven sites reported by UCLA in the Lake Kaweah area were also evaluated.

Prehistoric archeological research in the Dry Creek valley resulted in the recording of both complex sites composed of multiple cultural features such as lithic scatters, midden, milling features, and rock art, as well as sites apparently used for more limited functions, in this case, milling of vegetal foods such as acorns and seeds. This suite of occupation and task-specific localities has great potential to produce data central to the discussion of a comprehensive cultural system which is reflected by all contemporaneous sites in the area.

Ethnographic research and consultation with Native American residents has established that a wealth of cultural information about Native American lifeways is still available for the Dry Creek portions of the study area, particularly regarding to such topics as subsistence technology and foods processing, ethnobotany, and ethnohistory. Native American concerns for the cultural resources were recorded.

Historical research has documented early Euro-American settlement in the Dry Creek valley. Two early homesteads were found to have archeological manifestations and one or both of these homesteads may be related to efforts on the part of an early pioneer to established a government-recognized rancheria.

Of the various projects proposed the Limekiln Lake alternative would result in the greatest effects to cultural resources, with 24 sites potentially affected. The smaller Dry Creek alternatives would affect between 14 and 16 sites. Increasing the elevation of the Lake Kaweah pool by 21 feet would affect three sites. Maintaining the current Lake Kaweah pool elevation would not affect any additional cultural resources.

All of the archeological resources of the Dry Creek valley project area are recommended for inclusion as part of a nomination to the National Register of Historic Places as a district. Each of the sites is considered significant within the context of a research design outlined for the area. Additionally, certain ethnographically documented resources would potentially be eligible for nomination to the National Register. Three sites recommended by UCLA are also considered eligible for nomination to the National Register.

ACKNOWLEDGMENTS

The ethnographic portion of this research would not have been possible without the assistance of several members of the Wukchumni community. We are especially grateful to Hector Franco, Susan Weese, and Martha Taplaras who helped us better understand the cultural and environmental resources in the study area and their significance to the Wukchumni people. We wish especially to thank the Wukchumni people who were so cordial during the interview program. Mr. Wally Varela of the Tule River Indian Reservation participated in the archeological field survey. We also appreciate the assistance of Mr. William Johnson of the California Native American Heritage Commission and Detective Tom Crabtree of the Tulare County Sheriff's Department.

We acknowledge the kind help provided in locating and describing rock art in the project area by Mr. Dick Burns. We also thank Ms. Mary Gorden who most generously shared her notes and insights regarding the important rock art at site CA-TUL-341. Historical information for the project area was provided in conversations with Dr. William C. Tweed, National Park Service, and Ms. Annie Mitchell.

Contract administration was handled deftly by United States Army Corps of Engineers Study Manager Ms. Carol Calza and by Ms. Sannie Osborn. We appreciate their genuine interest in our studies. We extend thanks to Mr. Robert J. Jackson of the State Office of Historic Preservation for his advice and consultation. Finally, we wish to thank the various landowners in the Dry Creek and Lake Kaweah areas who kindly allowed us access to their property in order to perform the investigation reported herein.

TABLE OF CONTENTS

		page
	ABSTRACT	796
	ACKNOWLEDGEMENTS	797
	TABLE OF CONTENTS	798
	LIST OF TABLES	799
	LIST OF FIGURES	800
	LIST OF MAPS	801
1.0	INTRODUCTION	802
	Scope of Work	802
	Environmental and Cultural Setting	804
	Environmental Background	804
	Previous Cultural Resource Investigations	806
	Archeological Background	807
	Ethnographic Background	808
	Historic Background	810
2.0	RESEARCH METHODS	819
	Archeological Research Methods	819
	Initial Archeological Survey	819
	Enhanced Archeological Survey	821
	Describing Soil Color and pH	823
	Ethnographic Research Methods	825
	Historical Research Methods	827
3.0	RESEARCH FINDINGS	828
	Archeological Resources	828
	Dry Creek Drainage	828
	Kaweah River and Lake Kaweah Area	840
	Results of the Enhanced Archeological Survey	843
	Ethnographic Findings	843
	Subsistence Technology: Findings and Research Potential	844
	Ethnobotanical Resources and Research Potential	845
	Ethnographic Sites and Locales	845
	Ethnohistoric Research Potential	849

TABLE OF CONTENTS (cont'd)

page

4.0 POTENTIAL PROJECT EFFECTS AND CULTURAL RESOURCE EVALUATIONS 851
Potential Project Effects 851
Evaluations of Cultural Resources 852
Archeological Research Domains and Evaluation 852
Ethnographic Research Domains and Evaluation 857
Recommended NRHP Eligibility Status for Cultural Resources 858
Native American Heritage Concerns: Analysis and Recommendations 859
Archeological Sites (Cemeteries, Burial Sites and Rock Art) 859

5.0 REFERENCES CITED 861

6.0 GLOSSARY 865

APPENDIX 1: Site Survey and Historic Property Inventory Records
APPENDIX 2: Enhanced Survey Localities Map
APPENDIX 3: Ethnographic Site Location Map
APPENDIX 4: Project Photographic Materials
APPENDIX 5: Consultant and Data Sources
APPENDIX 6: Recommendations for Additional Testing and Evaluation of Historical Properties in the Dry Creek Area

LIST OF TABLES

Table	Title	page
1	Land Ownership by Section 1876-1920	816
2	Summary of Shovel Scrapes and Auger Borings	822
3	Results of Soil Color and pH Analysis	824
4	Alternative Spillway Elevations and Potentially Inundated Historic Properties	853
5	Historical Properties within the APE	856

LIST OF FIGURES

Figure	Title	page
1	Mortar cups on a granite outcrop adjacent to Dry Creek -- a common cultural feature in the project area	805
2	Remains of lime kilns at the site of Terminus	811
3	Recording a pictograph feature at CA-TUL-1255	820
4	Looking southwest toward pictograph feature at CA-TUL-1253	832
5	Detail of black pigment figure noted on pictograph feature at CA-TUL-1453	832
6	Looking west toward pictograph feature at CA-TUL-1455	834
7	Closeup of red pigment figure noted on pictograph feature at CA-TUL-1455	834
8	Detail of figures #1-4 in Pictograph 1 at CA-TUL-1455	835
9	Detail of figure 1 in Pictograph 3 at CA-TUL-1455	835
10	Looking west toward granite boulder rock shelter at CA-TUL-111	839
11	Detail of red pigment figure noted on interior wall within rock shleter at CA-TUL-11	839
12	One of two standing domestic structures at the Homer Ranch Complex	841
13	Tank house and rear view of second standing domestic structure at the Homer Ranch Complex	841
14	Outbuildings at the Homer Ranch Complex	842
15	Looking north along stone wall at eastern edge of Homer Ranch Complex	842

LIST OF FIGURES (cont'd)

Figure	Title	page
16	Native American consultant Felix Icho with seed pod of jimsonweed (Datura meteloides)	846
17	Native American consultant with dried milkweed (Asclepias speciosa) stalk	846

LIST OF MAPS

Map	Title	page
1	Vicinity Map	803
2	Kaweah River Basin Project	back pocket
3	Ethnographic Groups in Kaweah River Basin	809
4	Historic Settlements in the Dry Creek Area, T16S/R27E	813
5	Historic Settlements in the Dry Creek Area, T17S/R27E	814

1.0 INTRODUCTION

The United States Army Corps of Engineers (USACE) is sponsoring this study to assess the potential effects upon cultural resources which could result with the construction of various alternatives for improving flood control and water storage capabilities in the Kaweah River Basin, Tulare County, California (Map 1). These alternatives include: (1) expanding of the existing Lake Kaweah by raising the pool elevation as much as 21 feet; and/or (2) constructing a new dam (known as the Limekiln Dam) on the Kaweah River just downstream from the river's confluence with Dry Creek; and (3) building a dam on Dry Creek which could have a variety of designs, including a "dry dam" configuration for flood control purposes, or a water storage capability with reservoir pool elevations ranging from 617 feet to 708 feet in elevation.

The cultural resources survey and evaluation within the project's Area of Potential Effect (APE) is carried out pursuant to the National Historic Preservation Act of 1966 (as amended, 16 USC 469), and Corps of Engineers ER-1105-2-100. The objective of the cultural resources investigation is to identify, locate, describe, and evaluate cultural properties within the project APE which may be eligible for nomination to the National Register of Historic Places pursuant to 36 CFR 60.4, and to prepare recommendations for the management of significant cultural resources.

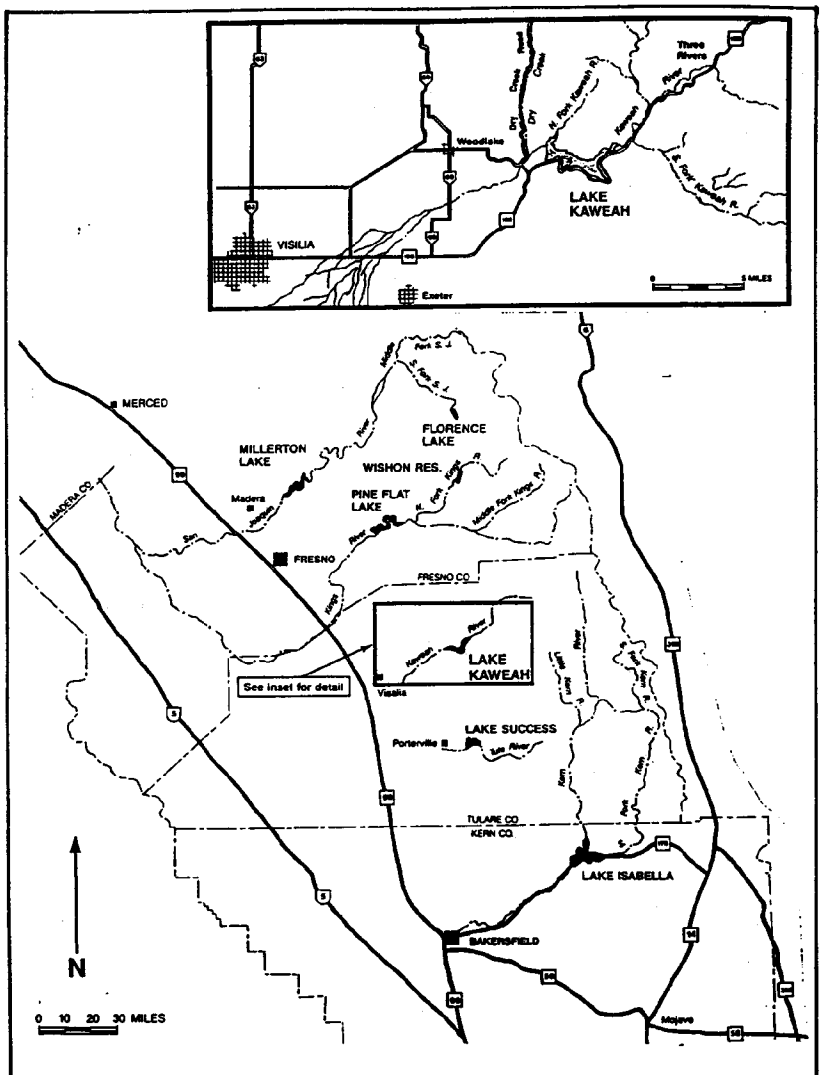
SCOPE OF WORK

The Scope of work for the Kaweah River Basin Project Cultural Resources Survey includes the following tasks:

1) execute a complete/intensive pedestrian archeological survey of all lands in the project APE which are on slopes of less than 30% grade, and on lands for which the USACE had obtained rights-of-entry (Map 2; in pocket);

2) record and otherwise describe any discovered historic properties;

3) conduct an enhanced archeological survey of specific portions of the project area with the objective of (a) evaluating the success of the initial phase of survey, (b) determining the potential for subsurface archeological remains in areas where none were found initially, and (c) defining "midden" soils by some relatively objective means;



Map 1. Vicinity Map.

4) review the history of the project area and supplement historical summaries prepared previously and reported in Meighan et al. (1988);

5) conduct ethnographic studies to supplement those undertaken by Conton and Gehr and reported in Meighan et al. (1988);

6) make recommendations as to the eligibility for nomination to the National Register of Historic Places of cultural resources in the APE, and assess the potential for adverse effects upon historical properties which could result from the completion of various alternate project designs.

ENVIRONMENTAL AND CULTURAL SETTING

The following sections briefly address the environmental setting, prehistory and previous archeological studies, ethnography, and history of the project area. These summaries are deliberately brief, and only supplement the more elaborate discussions found in Meighan et al. 1988.

Environmental Background

The geologic and geographic history of the project area is dominated by the development of the Sierra Nevada. Mostly covered by seas during the early Paleozoic era, the area underwent contemporaneous sedimentary, volcanic, erosional, and warping episodes culminating in the late Jurassic intrusion of the granitic Sierra Nevada batholith. A period of relative stability lasted through the early Cenozoic. During the Pliocene, the region underwent massive uplifting, tilting, and faulting, raising the Sierra crest from its estimated Eocene elevation of 3000-5000 feet to its present height of 9000+ feet. Finally, Pleistocene glaciation of higher elevations, ending about 9500 years ago, has led to the area's present day topographic and erosional condition.

Running north to south, the Dry Creek valley is a structural feature formed along the contact of metamorphic and granitic rocks. The valley floor has a thin alluvial cover with even thinner soil cover on the slopes above the valley. Cobbles of granite, schist, and basalt are abundant along the creek channel. The ubiquitous granite outcrops provide pounding and grinding platforms for the plant processing facilities that are the most common archeological feature in the valley (Figure 1).

The study area climate is characterized by cool, wet winters and hot, dry summers. Mean annual temperature is 61.8 degrees F.; July averages 80.0 degrees F. while January averages 45.7 degrees F. Precipitation is heaviest during January while July and August are the driest months. Annual precipitation averages 20.5 inches (Meighan et al. 1988). Snowfall is rare.

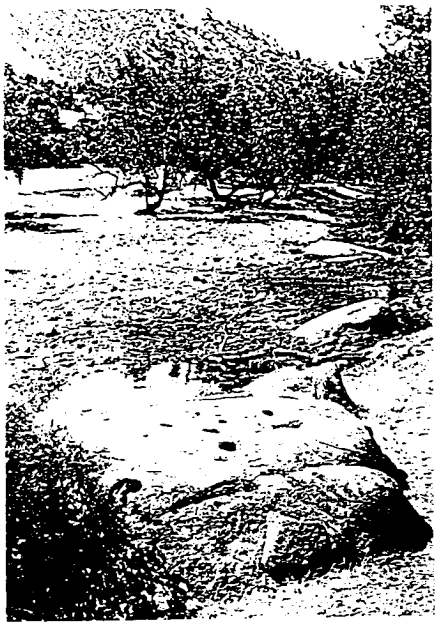


Figure 1: Mortar cups on a granite outcrop adjacent to Dry Creek -- a common cultural feature of the project area.

Elevation, rainfall, and soil geology act as limiting factors on distributions of terrestrial vegetation. Following Holland's (1986) scheme, at least 5 major natural vegetation communities are found in the project vicinity. The valley floor is dominated by Valley Oak Woodland, including valley oak (*Quercus lobata*), blue oak (*Q. douglasii*), and wild rye (*Elymus* sp.). This community intergrades with Blue Oak Woodland on drier savannas and slopes. Along with blue oak, notable species include California buckeye (*Aesculus californica*), manzanita (*Arctostaphylos* sp.), and other oaks (*Q. wislizenii, Q. kelloggii*). The Great Valley Oak Riparian Forest community is found along the margins of streams and rivers. On Dry Creek, western sycamores (*Platanus racemosa*) are common. Notable bunchgrasses of the Valley Needlegrass Grassland community are purple needlegrass (*Stipa pulchra*) and foothill bluegrass *Poa scabrella*). The non-native grassland community has been introduced into the area in historic times.

A diversity of animal life would have populated the study area in prehistoric times. Native fish include rainbow trout (*Salmo gairdneri*), squawfish (*Ptychocheilus*

grandis), and suckerfish (*Catostomus occidentalis*). Avian species include quail (*Lophortyx californica*), dove (*Zenaidura macroura*), perching birds such as jays (*Aphelocoma californica*) and blackbirds (*Euphagus cyanocephalus*), blue heron (*Ardea herodias*), bald and golden eagles (*Haliaeetus leucocephalus, Aquila chrysaetos*) and various hawks (*Accipiter* sp., *Buteo* sp.). California condors (*Gymnogyps californianus*) may have once ranged through the study area. Important mammals include cottontail (*Sylvilagus audubonii*), beaver (*Castor canadensis*), coyote (*Canis latrans*), black bear (*Ursus americanus*) and grizzly bear (*Ursus arctos*), and mule deer (*Odocoileus hemionus* ssp.). It is likely that antelope (*Antilocapra americana*) and elk (*Cervus nannodes* ssp.) at least occasionally ranged into the foothill zone in prehistoric times.

Previous Cultural Resources Investigations

The first systematic archeological investigation in the study area was conducted in the 1940s by Franklin Fenenga as part of the Smithsonian Institution River Basin Survey program. Fenenga's survey focused on the area of the Kaweah River that would be inundated as a result of the construction of Terminus Dam. Most notable was the discovery of the Greasy Creek (CA-TUL-1) and Slick Rock Village (CA-TUL-10) sites as well as an extensive pictograph complex (CA-TUL-2).

Excavated by Fenenga in 1950, the Slick Rock Village site was attributed to Wukchumni Yokuts occupation based on the presence of grass thatch as house covering and "burial in the flesh" (Fenenga 1952:339) as the primary mode of inhumation. Of the eight burials excavated at CA-TUL-10, two were tightly flexed, three were loosely flexed, one was extended, and two were secondary cremations (Fenenga 1952:342). The cremations were seen as evidence of Patwisha Mono intrusion. Berryman and Elsasser (1966:19) and Fee (1980:44) are apparently in error when they state, respectively, that the "eight inhumations all lay on bedrock in tightly flexed positions"; and "eight of the ten burials encountered were in a tightly flexed position." Although chipped stone projectile points were relatively rare, the possible multi-component nature of CA-TUL-10 is suggested by the presence of both small, notched obsidian points (presently referred to a Desert Side-notched and/or Cottonwood Triangular point types), and large, concave-base points.

The Greasy Creek (CA-TUL-1) site, excavated in the late 1950s by Pendergast and Meighan (1959), exhibited stronger evidence of long term occupation. Slightly less than two meters in depth, the midden appeared to be stratified. The lower component contained core choppers and scrapers, hammerstones, and large obsidian projectile points while small projectile points, steatite and *Olivella* beads, and pottery were concentrated in the upper 12" to 16" of the deposit. The upper component was seen as contemporaneous with Slick Rock village occupation

(Pendergast and Meighan 1959:6). It has also been suggested that large housepits (27' to 48' diameter) found at CA-TUL-1 represent guest houses occupied during the Yokuts mourning ceremony (Meighan et al. 1988).

Additional survey and excavation in the Lake Kaweah area was performed by Von Werlhof in the late 1950s and early 1960s. Excavation at the Cobble Lodge (CA-TUL-145) site revealed an extensive burial complex characterized by use of red ocher, wooden posts around burials, burnt clay or plaster as burial fill, and presence of secondary, flexed burials placed in baskets. At the Hospital Rock (CA-TUL-24) site, located approximately 12 miles east of Lake Kaweah, a similar burial complex was found along with rock art and a diverse artifact assemblage. Von Werlhof theorized that Cobble Lodge and Hospital Rock represented the westernmost occupation of Patwisha Mono in the Kaweah drainage in the late period. Meighan et al. (1988) suggest a similar cultural succession with early Yokuts occupation followed by Patwisha Mono occupation.

Additional work of note in the Kaweah drainage includes a study of the aboriginal trails of the Kaweah Basin (von Werlhof 1961), a popular summary of history and prehistory by Berryman and Elsasser (1966), a discussion of sub-glacial erosion of granite outcrops by Barnes (1985), and a thorough summary of historical, ethnographic, and archeological research by UCLA (Meighan et al. 1988) resulting from a cultural resources survey of USACE lands bordering Lake Kaweah. In the Dry Creek drainage, a recent avocational study of CA-TUL-341 by Gorden (1989) has revealed an extensive prehistoric site with midden, bedrock mortars, slicks, cupules, and a petroglyph and pictograph complex.

Archeological Background

The major themes for archeological research in the southern Sierra Nevada include establishing local and regional culture histories, studying subsistence-settlement patterns, and identifying ethnolinguistic groups. Because the archeological record of the study area and adjacent locales has been summarized by, among others, Moratto (1972,1984), TCR/ACRS (1984), and Meighan et al. (1988), only the briefest review is offered here.

A cultural chronology specific to the Kaweah River basin has not been established, and there are no radiocarbon dates available. Obsidian hydration rim measurements of 4.7, 6.4, and 9.5 microns for artifacts from site CA-TUL-1044 are estimated by Meighan et al. (1988) to represent chronological ages of either A.D. 1140, 830, and 270 or A.D. 800, 380, and 380 B.C. The lack of any obsidian source determination and absence of temperature constants for the Kaweah River basin make conversion of hydration rim values into calendric equivalents untenable.

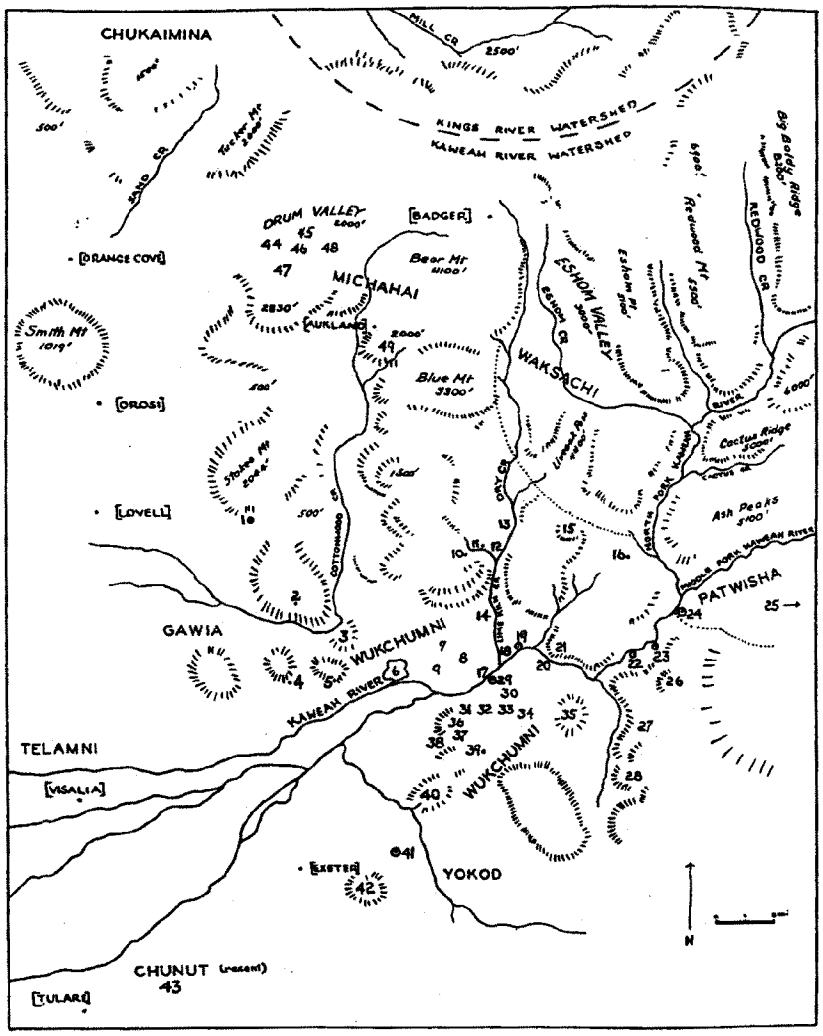
Other suggestions for the chronological ordering of prehistoric cultures in the Kaweah basin are inferred on typological grounds or from the extension of neighboring regional sequences into the subject area. As Moratto (1972:203) states, "the overwhelming likeness of the Terminus assemblages to those of dated phases at Buchanan would suggest chronologic equivalencies as well for the two localities." This extrapolation is perhaps unwise, however, as others warn that "the danger is that the assumption that the known sequence applies to the unknown area becomes accepted as truth, rather than being tested" (TCR/ACRS 1984:163). What is known is that the Greasy Creek (CA-TUL-1) site, located at the confluence of Greasy Creek and the Kaweah River, exhibits the best evidence of long term occupation in the Kaweah River basin. Based on the presence of Sierra Concave Base projectile points in the lower levels, the occupation history may span the last 3000 years.

Basic questions concerning subsistence-settlement patterns in the southern Sierra focus on the apparent shift from an earlier, presumably relatively mobile hunting based economy to a later, relatively more sedentary subsistence-settlement economy more focused on plant resources collecting and storage. Assemblages dominated by large projectile points and seed milling equipment, and apparently lacking acorn processing equipment, perhaps indicate an early seed gathering/hunting orientation. Site components with small arrow points and acorn milling implements (including bedrock milling facilities) may reflect a more sedentary adaptation based on processing and storage of acorns.

Basgall (1987) has discussed the development of "acorn economies" in California within the context of economic intensification models. The mechanisms and temporal placement of this apparent shift in adaptive mode are poorly understood but are consistent with an evolutionary model in which human populations shift from the exploitation of primarily "low cost" subsistence resources to "high cost" resources, including those which require substantial processing time (cf. Bettinger 1987). Excavation of selected Kaweah basin sites with finely tuned temporal and typological control could resolve aspects of this apparent subsistence shift and related socio-cultural transformations.

Ethnographic Background

The project area is within the territory attributed by ethnographers to the Wukchumni Yokuts (Gayton 1948; Kroeber 1925; Latta 1977; see Map 3). Conton and Gehr (in Meighan et al. 1988) have summarized the ethnographic literature and also conducted limited ethnographic interviews relating to the Lake Kaweah area. Our more extensive discussion of the ethnography of the Dry Creek part of the project area will follow in the "Methods" and "Results" sections of this report.



Map 3. Ethnographic Groups in Kaweah River Basin.
(Gayton 1948)

Historical Background

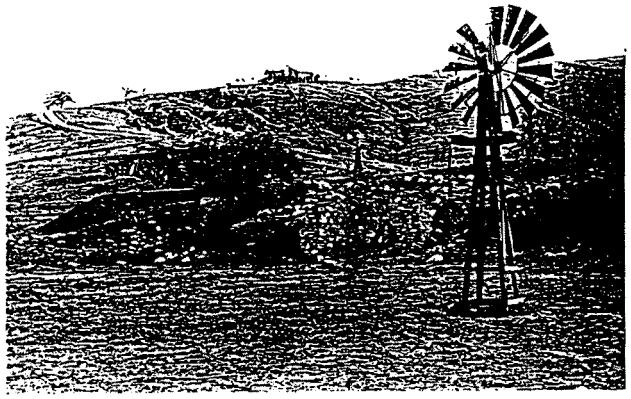
Given the extensive historical background research conducted as part of the 1983 UCLA survey of government-owned lands at Lake Kaweah (Meighan et al. 1988), historical records research for this study was performed only for the Dry Creek portion of the current project area, which was not covered in the UCLA survey report. The reader is referred to the Historical Background Section of the UCLA report for a more thorough presentation of historic-period land use within the general project area.

The earliest identified use of the Dry Creek area following White settlement in the Kaweah forks area is related to the mining and processing of lime deposits located near the base of Limekiln Hill northeast of Lemon Cove and west of the present Terminus Dam. The lime deposits, discovered in 1859, were initially mined by William Connens (Menefee and Dodge 1913:84; Mitchell 1972:68; 1776:127). Three 500-pound lime kilns were constructed at the site, the remains of which are present within the project area (Figure 2). The lime quarry was mined by several companies well into the twentieth century (Meighan et al. 1988:264-265). These quarries gave the original name of "Lime Kiln" to both the creek and the settlement in the general area. Following construction of Terminus Dam in the 1960s, the creek was renamed Dry Creek.

During the initial period of Anglo-European settlement in the general Visalia area, the economy centered upon raising cattle, sheep, and horses (Mitchell 1976). Several stockmen settled in the Dry Creek drainage in the late 1850s and early 1860s, including Alfred Balaam, Louis L. and Charles C. Bequette, Joseph Homer, John Hambright, J.W.C. Pogue, H.O. Ragle, and A. Hilliard (Mitchell 1976:40).

The Homestead Act of 1862 allowed a settler to occupy 160 acres. The claim was then "proved" following the fulfillment of certain improvements to the land. Many of the settlers thus obtained property in the Dry Creek drainage. By 1876, W.S. Leary, J.W.C. Pogue, C.C. Bequette, and Joseph Cutler all owned land in the area; Pogue having moved to Dry Creek following the floods of 1858 which washed out his property at Stringtown on nearby Bravo Lake (Pogue 1971:10; Mitchell 1976:77). A structure is depicted on the 1876 Map of Tulare County (Baker 1876) in the immediate vicinity of the present-day Homer Ranch in the southwest corner of Section 2, Township 17S Range 27E; however, no name is listed in connection with this structure. Land patents on file with the Tulare County Recorders Office include grants of land in the Dry Creek Valley to Louis Bequette (1863), C.C. Bequette (1863), and James Barton (1879), among others.

An 1883 map of Tulare County compiled by Alfred Bannister lists the owners of much of the Dry Creek area. Louis and Frank Bequette, N.P. Dillon, and J.W.C.



a. Looking northeast toward remains of lime kilns.

b. Looking west toward remains associated with lime kilns.

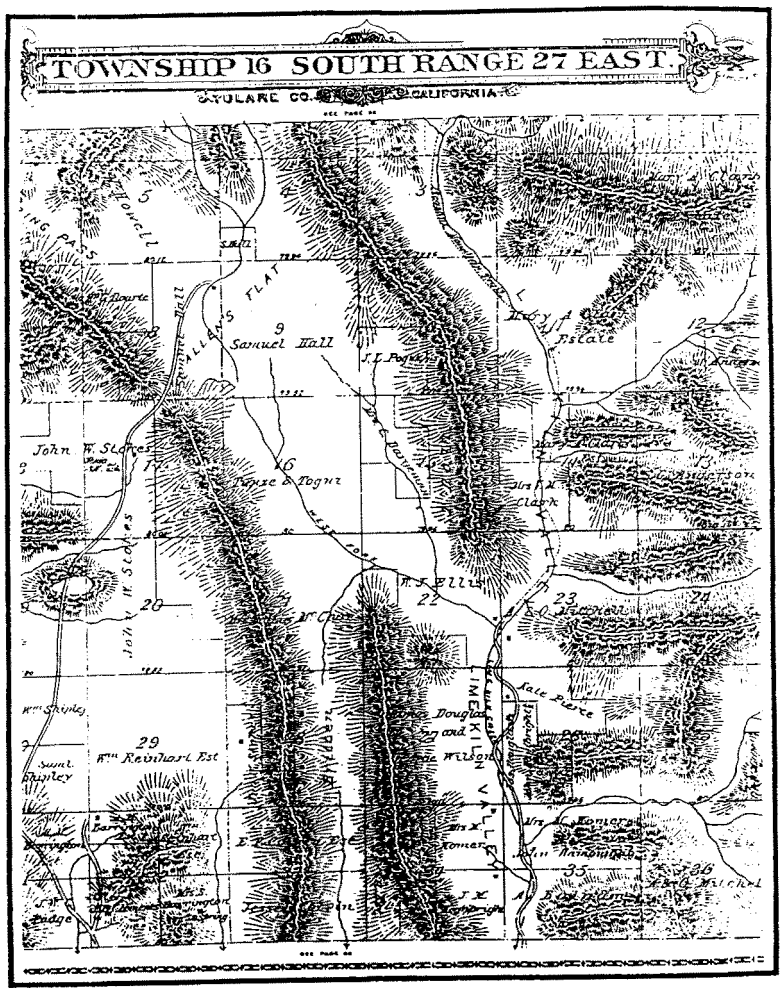
Figure 2. Remains of lime kilns at the site of Terminus.

Pogue owned much of the Dry Creek area at this time. H.C. Adkinson, who homesteaded 160 acres in 1882, owned the land now included within the Clayton-Vincent holdings in the Homer Ranch area in the southern half of Section 2, Township 17S, Range 27E. By 1883, the Southern Pacific Railroad also had acquired substantial holdings in the area. Much of these holdings were later sold off to private individuals. In 1887 Frank Bequette bought for $400.00 the SW 1/4 of Section 11 (T17S/R27E) from Southern Pacific Railroad (Grant of Deed April 5, 1887).

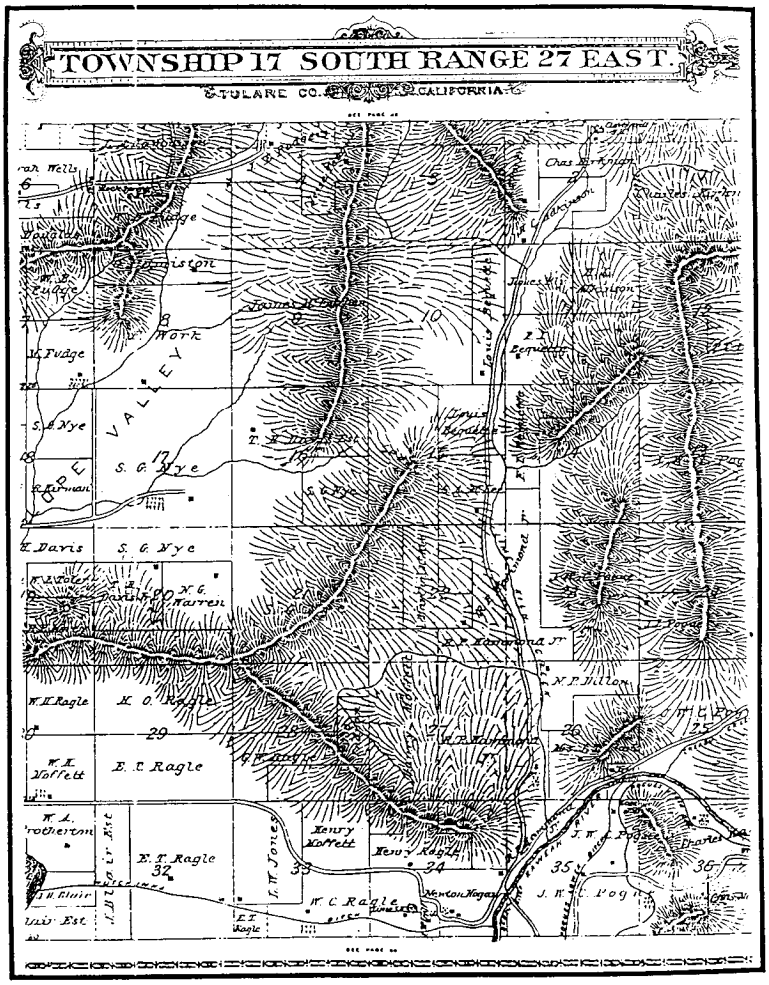
Not all activity in the Dry Creek Valley centered around stock raising. In 1877 J.W.C. Pogue started plantings of citrus trees in his family garden, including several varieties of lemons and oranges (Mitchell 1976:77). In 1879, due to problems with malaria, Pogue moved his family to Lemon Cove and into a large 2-story brick building which also functioned as a hotel. Pogue, along with Crocker and Wallace, built the hotel to serve the miners travelling to the Mineral King area. Pogue moved his citrus trees in 200-pound balls of earth to Lemon Cove; 20 survived (Mitchell 1976:77). Thus began a very successful, valley-wide citrus industry. In order to supply water to his orchards, Pogue constructed an extensive system of ditches in 1886 (Pogue 1971:24). By 1892 Pogue had sold off most of his Dry Creek land.

Following the death of his partner Wallace in 1881, Pogue acquired sole interest in the hotel, known as The Cottonwoods. In 1894 Pogue surveyed 15 acres of his ranch holdings into town lots and renamed the new town Lemon Cove (Mitchell 1976:127); in 1895 the Post Office changed its name from Lime Kiln to Lemon Cove. By 1913 the town included the hotel, a large general store, livery stable, blacksmith shops, and a bakery and butcher shop (Menefee and Dodge 1913:85). The hotel, which is still standing, presently houses the Lemon Cove Women's Club. The building was donated in 1938 by Pogue's daughter, Nora Pogue Montgomery. The Visalia Electric Railroad connected Lemon Cove to Exeter in the early 1900s, and by 1909 regular passenger service was established (Pogue 1971:34).

Thompson's 1892 atlas of Tulare County provides additional land ownership history for the Dry Creek area (Maps 4 and 5). By 1892, all available land in the area had been claimed. In 1882 Martha Homer, the widow of Joseph Homer and sister of Alfred Balaam, homesteaded in the Dry Creek area with her sons (Smith 1974:161). In 1892 Mrs. Homer, along with her sons and son-in-law John Hambright owned sections 34 and 35, Township 16S, Range 27E, located in the northern portion of the project area. Much of this land remains in the Homer family today. Two structures are depicted on the 1892 maps, the possible remains of which have been recorded as CA-TUL-1443H and -1444H. Several other structures are shown on this map including a structure on the L. Bequette property located just north of Bequette Canyon; a light scatter of potentially historic-period



Map 4. Historic Settlements in the Dry Creek Area, T16S/R27E. (Thompson 1892)



Map 5. Historic Settlements in the Dry Creek Area, T17S/R27E. (Thompson 1892)

debris was noted at this approximate location in a drainage adjacent to prehistoric site CA-TUL-1456. An additional structure, also on land owned by L. Bequette, is depicted on the USGS 1928 Lemon Cove topographic quadrangle map at the mouth of Bequette Canyon. The remains of a cast-iron, wood-burning stove, recorded as Isolate Find IF-CA-TUL-6, may be linked with this structure.

On the creek terrace adjacent to the boundaries on CA-TUL-1464, a fragment of sun-tinted amethyst glass and a sparse scatter of other miscellaneous historic-period materials were noted. The Thompson map indicates that the Cleveland School House occupied this spot in 1892, although no mention of this school has been discovered so far in local histories. Examination of county school district records may yield more information about this structure.

An isolated fire place, recorded as site CA-TUL-1470H, is located at the mouth of a small unnamed drainage, approximately 250 meters north of the mouth of Ragle Canyon. At various times Joseph Cutler, N.P. Dillon, and R.P. Hammond, Jr., and L.F. (Fred) and A. Ward owned the area surrounding this isolated find. Fred Ward owned a large horse ranch in Dry Creek (Ballew 1982, cited in Meighan et al. 1988:245), and this find may be related with this ranch. By 1909 land owned by L.F. and A. Ward at the southern end of Dry Creek in Sections 22, 23, 27, and 26 (T17S/R27E) was referred to as the Alma Colony, and was subdivided into small lots (Smith 1909; Denny 1911; Moye 1920).

The Bequettes, Homers, Hambrights, Wards, and Hilliards remained in the Dry Creek area through the 1920s (Smith 1901, 1909; Moye 1920); many of these families were related through marriage. The area now known as the Homer Ranch was the home of Truman John Homer, son of the original Tulare County settler Joseph Homer and his wife Martha. The Homer family still owns property in the Dry Creek area, at the northern end of the project area in Section 35, Township 16S, Range 27E, in the portion originally homesteaded by Martha Homer. Land ownership from 1876 through 1920 within the project area in Dry Creek, as listed on historical maps consulted during this project, is compiled by township, range, and section in Table 1.

Between 1910 and 1935, the Terminus Beach area was a popular resort. Henry Ginner, who purchased the property from a group of Native Americans living in the area, built a swinging foot bridge across the Kaweah River and laid out a golf course on the site of the old Oo'-now rancheria (Ballew 1982, cited in Meighan et al. 1988:238). The beach and resort area was later washed away in the flood of 1955.

In 1962 the United States Army Corps of Engineers completed Terminus Dam, a large earth-filled dam located at Limekiln Hill, creating five-mile long Lake Kaweah and inundating 1,913 acres (Meighan et al. 1988:268). The name Terminus comes from the name of the easternmost station on a spur of the Visalia Electric Railroad (Berryman and Elsasser 1966:1).

Table 1. Land Ownership by Section, 1876-1920*

Township 16 South, Range 27 East:

	Section 34	Section 35
1876	-	-
1883	-	-
1892**	Mrs. Homer T. Homer J.M. Hambright	Mrs. M. Homer & John Hambright A. Balaam
1901	M.J. Homer Estate J.M. Hambright	M.J. Homer Estate Southern Pac. RR
1909	J. Homer John Hambright	T. Homer J. Hambright Southern Pac. RR
1920	L.D. Hilliard T.J. & T. Homer A.D. Homer	T.J. & T. Homer

Township 17 South, Range 27 East

	Section 2	Section 10	Section 11	Section 15	Section 14
1876	-	-	-	-	W.S. Leary "V"
1883	H.C. Adkinson	-	H.C. Adkinson	L. Bequette Southern Pac. RR	F.L. Bequette N.P. Dillon
1892	T. Fridley Chas. Kirkman H.C/ Adkinson	Louis Bequette	James Fly H.C. Adkinson F.I. Bequette	Louis Bequette S.A. McKee	F.I. Bequette R.P. Hammond, Jr.
1901	L. Fridley T.J. Homer J. Hambright	L. Bequette	E.W. Strong J.C. Fly Southern Pac. RR	L. Bequette S.A. McKee Southern Pac. RR	Leo. Bequette

Township 17 South, Range 27 East (continued)

	Section 2	Section 10	Section 11	Section 15	Section 14
1909	L.I. Hillard T.J. Homer	L. Bequette	C.K. Avery E.W. Strong	L. Bequette SA. McKee	S.A. McKee
1920	L.D. Hilliard T.J. & T. Homer	L. Bequette S.A. McKee	C.K. Avery W. Stressman	Louis Bequette	Leonard Bequette

	Section 22	Section 23	Section 27	Section 26	Section 35
1876	J.W.C. Pogue	Joseph Cutler	-	J.W.C. Pogue Joseph Cutler C.C. Bequette	-
1883	J.W.C. Pogue Southern Pac. RR	N.P. Dillon J.W.C. Pogue Southern Pac. RR	J.W.C. Pogue Southern Pac. RR	N.P. Dillon C.C. Bequette J.W.C. Pogue	Jacob Limekiln P.O.
1892	Martha McKee R.P. Hammond, Jr.,	R.P. Hammond, Jr., J.W.C. Pogue	Henry Moffett R.P. Hammond, Jr.	N.P. Dillon R.P. Hammond, Jr. Mrs. J.T. Clark Jim Indian	R.P. Hammond, Jr. J.W.C. Pogue
1901	S.A. McKee Allen & McAfee	L.F. & A. Ward	Allen & McAfee Southern Pac. RR	Allen & McAfee L.F. & A. Ward	Allen & McAfee J.W.C. Pogue Ohio Lemon Co.
1909	S.A. McKee	L.F. Ward	"Alma Colony" Southern Pac. RR	"Alma Colony"	L.F. Ward Kaweah Lemon Co. Ohio Lemon Co. Central Cal W & I
1911	"Alma Colony"	"Alma Colony"	"Alma Colony"	"Alma Colony"	

Township 17 South, Range 27 East (continued)

	Section 22	Section 23	Section 27	Section 26	Section 35
1920	Leonard Bequette "Alma Colony"	Alma Ward "Alma Colony"	"Alma Colony" Southern Pac. RR	"Alma Colony"	L.F. Ward Kaweah Lemon Co. Marx Bros. H. Ginner Ohio Lemon Co. M. Baier

* *Land ownership compiled from the following map sources: P.Y. Baker 1876, Alfred Bannister 1883, Thompson 1892, Smith 1901, Smith 1909, Edw. Denny 1911, Moye 1920.*

** *Portions of Thompson's 1892 atlas is included as Figures 4 and 5.*

2.0 RESEARCH METHODS

The research methods employed to complete the various tasks for the Kaweah River basin study are detailed in this section. Archeological, ethnographical, and historical investigations were necessary to identify the range of cultural resources that might potentially be affected by the proposed project.

ARCHEOLOGICAL RESEARCH METHODS

Intensive pedestrian survey and inventory in the project's APE (Fig. 2) was performed during the weeks of March 6-11 and May 22-26, 1989. Survey was restricted to those private properties for which the USACE had obtained right-of-entry. During the May fieldwork, an enhanced survey strategy was implemented to re-examine specific areas where earlier survey (March 6-11) was hampered by poor conditions. This included completing a series of shovel scrapes, auger borings, and collecting soil samples for chemical (pH) analysis.

Initial Archeological Survey

All surveyed areas within the APE of 30-degree slope or less were subject to intensive on-foot archeological examination using zig-zag paths within 20-m wide search corridors. The total area surveyed comprised approximately 1,905 acres in Dry Creek Valley and approximately 42 acres along the shore line of the eastern arm of Lake Kaweah. Ridge summits, stream courses, and granite facings received rigorous inspection. Some areas of greater than 30-degree slope were inspected where potential rock art bearing granite outcrops were observed. Areas of steep slope along the Lake Kaweah shoreline were reconnoitered from a small boat, leading to the conclusion that no additional sites were likely to be discovered on the severe slopes. Accessible cultural resources identified by Meighan et al. (1988) in the APE of the current project were relocated and re-examined.

Cultural resources encountered during the survey were recorded following procedures outlined in the *California Archeological Inventory Handbook for Completing an Archeological Site Record.* The locations of all identified cultural resources were plotted on USGS topographic quadrangles. Site forms were initially completed in the field and then transferred to computer using WordPerfect 5.0 word processing software. Site mapping was accomplished using metric tapes and/or pacing and Brunton-type pocket transit/compass. Datum points were established for each site and bearing and distance measurements were recorded for features and various landmarks. Feature areas (e.g., bedrock mortars) were illustrated in separate drawings. Bedrock mortar and cupule locations on boulders

and outcrops were plotted and their dimensions measured. Pictographs were recorded by tracing the discernable pigment outline onto 2-mm transparent polyethelene sheeting, resulting in a 1:1 scale rendering (Figure 3). Site, feature, and pictograph illustrations were subsequently redrafted to standards defined in the *Handbook*.

Archeological "sites" were defined as areas within boundaries defined to incorporate the observed spatial distribution of cultural remains, including individual artifacts (e.g., debitage, formed tools), features (e.g., rock outcrops with mortars), or identifiable midden soil. Areas of concentrations of cultural remains separated by more than 30 meters were generally distinguished as separate sites unless such remains were features (especially bedrock mortars) which reasonably could be assumed to be associated with a nearby locus of other cultural remains. This reasoning also applied where cultural remains were separated by Dry Creek Road, and where it seemed likely that road construction (as early as 1883) and later improvements had removed or covered intervening cultural deposits or features.

Figure 3 Recording pictograph feature at CA-TUL-1455.

At the recommendation of the Central San Joaquin Valley Information Center of the California Archaeological Inventory, several features which had been originally recorded as "isolated finds" were re-recorded as "sites" (CA-TUL-1467 through -1470H). Recent trash dumps and miscellaneous ranching debris (e.g., fencing, cans and bottles, vehicle parts) were not recorded.

All sites and associated features were photographed using both black-and-white print and color slide 35mm film and a film catalog was maintained. This information was transferred to computer using dBASE IV software.

A single isolated artifact (a woodstove) was recorded in the field using the "Isolate Record" format defined in the *Handbook*. The stove was photographed and plotted on the appropriate USGS topographic quadrangle.

Enhanced Archeological Survey

Field studies in the first week were hampered by very poor survey conditions. These circumstances included tall and/or dense springtime vegetation cover over virtually all of the survey area, wet soils which did not demonstrate the range of color and texture necessary to detect culturally altered soils, and apparently heavy alluviation. It was felt that these conditions contributed to a biased archeological survey inventory in which certain categories of archeological phenomena may not have been identified.

In consultation with the USACE and SHPO, an "enhanced archeological survey" was initiated to test the validity of the survey results. Five localities were selected in the project area where it was felt that archeological resources may have been overlooked using basic pedestrian survey methods under adverse environmental conditions or where archeological models for the region (e.g., TCR/ACRS 1984) would predict the occurrence of archeological resources. These five localities were: (1) the broad valley floor south of Arrastra Canyon; (2) the creek terrace at the mouth of Ragle Canyon; (3) the broad bench at the mouth of the creek downstream from TUL-1446 and -1469; (4) the bench west of TUL-1455 bedrock mortar features; and, (5) the broad bench south of Live Oak Canyon (Table 2). A map depicting the enhanced survey localities is included in Appendix 5.

The enhanced survey techniques included shovel scrapes, auger borings, and soil chemistry tests. Shovel scrapes consisted of removing the vegetation cover from a 1x1 meter area, excavating the upper 5 cm of soil, and passing it through 6-mm mesh screen. The screened soil was then rescreened through 3-mm mesh screen. Auger borings were then taken within the shovel scrape. Soils retrieved in the 10-cm diameter auger bucket were passed through 3-mm mesh screen. Augering continued until either bedrock or a rock obstruction was encountered or soil

Table 2: Summary of Shovel Scrapes and Auger Borings

Provenience	Datum	Depth	Cultural Remains	Auger Depth	Soil Sample
Locality 1	Power Tower #169.2				
30N/0W		0-3cm	No	--	--
60N/0W		0-3cm	No	--	--
135N/0W		0-3cm	No	--	Yes
135N/60W		0-3cm	No	--	Yes
180N/0W		0-3cm	No	--	--
180N/90W		0-3cm	No	--	--
225N/90W		0-3cm	No	--	--
330N/15W		0-3cm	No	--	--
Locality 2	Mouth of Ragle Canyon				
0N/0W	Lone Oak	0-3cm	No	70cm	
20N/0W	103° @ 120m	0-3cm	No	10cm	Yes
40N/0W		0-3cm	No	70cm	--
60N/0W		0-3cm	No	60cm	Yes
60N/30E		0-3cm	No	40cm	Yes
Locality 3	TUL-1469				
0N/0W*	Feature 1	0-3cm	No	60cm	--
5N/0W	90° @ 65m	0-3cm	No	30cm	--
23N/0W		0-3cm	No	20cm	--
Locality 4	TUL-1456				
13N/0W	Feature 1	0-3cm	No	10cm	--
23N/0W		0-3cm	No	30cm	--
33N/0W		0-3cm	No	25cm	--
43N/0W		0-3cm	No	25cm	--
53N/0W		0-3cm	No	50cm	Yes
Locality 5	TUL-1466				
0N/0W	Feature 1/Cup 1	0-3cm	No	7cm	--
7N/0W	230° @ 5m	0-3cm	No	20cm	Yes
7N/7W		0-3cm	No	13cm	--

* Bearing of transect is 30°

slippage from the bucket prevented retrieval of matrix. A total of 17 soil samples were collected from shovel scrape units, from suspected midden localities, and from corresponding "offsite" control areas. These samples were subsequently analyzed for soil color and soil pH.

The placement of the shovel scrapes depended upon the size and topographic variation at each locality. Generally, the first unit was established with a measured distance and bearing to a prominent topographic feature and the remaining units were placed along a baseline oriented to true north. The exception to this pattern was the line of shovel test units at Locality 1 which began at the north-west leg of power line tower 160-2 and followed beneath the western line at a bearing of 332 degrees. Four units were spaced along this line and four units were located west and perpendicular to the power line.

Describing Soil Color and pH

Soil color and pH determinations were made as part of the enhanced archeological survey to define midden characteristics which were masked by the wet seasonal conditions. Produced by the accumulation of discarded organic materials during intensive occupation, midden soils are generally more alkaline and darker in color than natural soils. For example, the pH measurement of midden soils at Kerckhoff Reservoir sites ranged from 7.0 to 8.0+ in areas of dense refuse accumulation. This contrasts with pH readings of less than 6.5 for the natural soil (Varner and Bernal 1976:4.29).

A total of 17 soil samples were collected and processed. Nine samples were taken from enhanced survey localities 1, 2, 4, and 5. No samples were collected from locality 3 because, upon field inspection of the soils, it was clearly a non-midden area. For comparison, eight samples were collected from various on-site and off-site locations at seven prehistoric sites which had apparent midden soils (Table 3).

The soil samples were processed by first passing the soil through 1/8" mesh screen to remove organic material and gravel. Then, 1/4 cup of soil was mixed with an equal part of distilled water and allowed to stabilize for 1 hour. The pH meter probe was inserted and allowed to stabilize for a minimum of 1/2 minute. Consistency between the measurements was monitored by checking the pH meter calibration after reading half the specimens and after reading the last specimen. The calibration varied less than 0.1 of a pH factor. Concurrent with the pH measurement, a Munsell soil color chart was compared with the remaining dry soil to determine the color of each specimen.

Table 3: Results of Soil Color and pH Analysis

Site/Area	Location	Color	pH	Comment
CA-TUL-111	Adj. to F1	10YR3/3 dark brown	6.2	midden
CA-TUL-111	25m E. of D.	10YR5/3 brown	5.6	road cut
CA-TUL-111	10m S. of F25	10YR4/3 brown	5.9	off site
CA-TUL-1453	7m S. of F22	10YR4/2 dark grayish brown	7.4	midden
CA-TUL-1453	1m W. of F29	10YR3/3 dark brown	6.4	on site
CA-TUL-1453	Base of F36	10YR5/3 brown	5.7	on site
CA-TUL-1453	S. of site	10YR5/3 brown	6.2	off site
CA-TUL-1453	N. of site	10YR5/3 brown	5.8	off site
CA-TUL-1454	10m N. of F6	10YR4/2 dark grayish brown	6.3	on site
CA-TUL-1454	40° 25m to D.	10YR5/3 brown	5.6	on site
CA-TUL-1455	10m S. of P1	10YR4/2 dark grayish brown	7.4	midden
CA-TUL-1455	Base of F13	10YR4/2 dark grayish brown	5.9	non-midden
CA-TUL-1455	20m E. of P1	10YR5/3 brown	5.7	non-midden
CA-TUL-1460	Adj. to F3	10YR4/2 dark grayish brown	5.6	on site
CA-TUL-1460	35m E. of F3	10YR5/3 brown	5.7	off site
Locality 1	135N/0W	10YR5/3 brown	5.9	off site
Locality 1	135N/60W	10YR5/3 brown	6.3	off site
Locality 2	20N/0W	10YR4/3 brown	6.3	off site
Locality 2	60N/0W	10YR4/3 brown	5.7	off site
Locality 2	60N/30E	10YR4/3 brown	6.3	off site
Locality 4	53N/0W	10YR5/3 brown	5.9	off site
Locality 4	13m, 346°, F1	10YR5/4 yellowish brown	5.8	off site
Locality 4	21m, 61°, F6	10YR4/2 dark grayish brown	5.9	CA-TUL-1456
Locality 5	7N/0W	10YR5/3 brown	5.1	CA-TUL-1466

ETHNOGRAPHIC RESEARCH METHODS

The purpose of the ethnographic survey of the Kaweah River Basin study area is to address those areas not discussed in the previous assessment prepared by UCLA (Conton and Gehr, in Meighan et al. 1988). This discussion does not contain either a full ethnographic overview or review of the history of the Native American communities in the project vicinity. A comprehensive synthesis for the region is provided in the overview of cultural resources for the Sierra and Sequoia national forests and the Bakersfield District of the Bureau of Land Management (TCR and ACRS 1984: chapters 2, 3 and 4). The present research focuses on the discovery and assessment of specific sites, locales and resources which possess scientific research potential or are of concern to present day Native American communities in the project vicinity.

In the early stages of research it became clear that the primary area of interest to these communities is the Dry Creek portion of the proposed project. The majority of the research effort was directed to the Dry Creek area, resulting in excellent primary ethnographic and ethnogeographic data. The data are basic to our assessment of the research potential for the study area, and define any future mitigation level research. In addition, since the project alternatives affecting Dry Creek carry the greatest potential impacts to all types of cultural resources, an effort was made to derive very specific management and mitigation recommendations for sites and other resources found along Dry Creek. Although no additional information was obtained for the Lake Kaweah expansion area, the general mitigation recommendations apply to this area as well.

Ethnographic research began with a complete review of the background literature for the region including the monographs of pioneer ethnographers such as Anna Gayton, A.L. Kroeber, and Frank F. Latta, and more recent documents aimed at resource management. Of particular importance are Gayton's ethnography of the Wukchumni Yokuts and Latta's more general treatment of the traditional Yokuts lifeway (Gayton 1948:55-132; Latta 1977). Gayton's fieldwork, conducted in the 1920s was salvage ethnography in the purest sense. Gayton's goal was to retrieve as much information as possible about traditional Wukchumni society, including material culture, settlement and population patterns, social life, religious practices and subsistence technologies. Because Gayton's interests were so broad and her recording so detailed, the monograph serves as a valuable base line from which to develop present-day ethnographic research and assess current findings. Latta's work also provides valuable data particularly in the description of material culture and Yokuts ethnogeography. Gayton also prepared several additional monographs of a more ethnological nature which constitute the core of information on Yokuts as well as the Western Mono (Monache) groups (Gayton 1930a, 1930b, 1945, and 1946).

The fieldwork conducted by Conton and Gehr for the recent UCLA survey of the Lake Kaweah project is focused on the issues surrounding the identification and management of cultural resources in the Kaweah River drainage. Their study serves as a basis for the present fieldwork, and the analysis of the settlement patterns and history of the project vicinity and is a valuable summary of existing data.

Following a review of the available literature, ethnographers contacted representatives of the Wukchumni community in the Visalia and Woodlake areas and at the Tule River Reservation near Porterville. From these contacts, a preliminary list of Native American consultants was developed. The Wukchumni Council of Visalia also provided a list of suggested consultants. Consultants were selected for the express purpose of addressing the history and traditional resources of the Dry Creek portion of the project area. Each consultant had either lived in the area or was familiar with Dry Creek through close family ties and shared memories. Interviews were held either at the consultant's home or in the Dry Creek area. Interviews were loosely structured and guided by topics rather than a set list of questions. The interviewer often followed the lead of the consultant, especially when unforseen topics or issues arose during the interview. The interviews tended to be lengthy, most lasting from two to five hours. Notes were recorded in field notebooks. No audio or video tapes were made, although interviewers carried 35mm cameras and took several rolls of slide and black and white film.

The field and off-site interviews were very productive in several topical areas: (1) the recent history of the Dry Creek area; (2) the potential botanical resources of the Dry Creek area; (3) the subsistence technology represented by the numerous bedrock mortars and grinding slicks found at sites along Dry Creek. The field interviews also produced information on residential areas and possible historic period cemetery locations. Several discussions were held with representatives of the Wukchumni community to define project impacts from the community perspective. These meetings produced a lengthy and relatively detailed list of preliminary recommendations for heritage preservation and mitigation. These recommendations should form the basis for future mitigation discussions and negotiations. The researchers found the members of the Wukchumni community to be cordial and very helpful, and anticipate that future research and discussions will be equally productive.

The reliability or verifiability of the data derived through these interviews is an important, and often troublesome issue. As Gayton notes in the introduction to her ethnographic monograph, a researcher is often reaching back to record a lifestyle that exists perhaps only in the consultant's memory (Gayton 1948:1-2). It is fair to say that since Gayton's work in the 1920s, or even Latta's fieldwork in the 1960s

and 1970s, memories and information about the pre-contact Native American lifestyle have continued to disappear. Given this unavoidable effect of acculturation and other historical processes, the researchers approached their fieldwork with the aim not of capturing an increasingly distant past, but to record elements of traditional Yokuts and Wukchumni society which have remained viable to the present. Within this perspective must lie the concept that tradition is not measured as the ability of a community to replicate old practices, rather tradition is seen as the process whereby elements of the past are preserved or even changed to fit the social contexts of living Native Americans. Put simply, some elements of the traditional lifestyle have remained important, for a number of reasons, and other practices or beliefs have not been preserved. Cultural resource management has the twin responsibility of documenting elements of traditional culture that remain important and why they remain important. This perspective has been an important aspect in the preparation of analyses of potential impacts from the project alternatives and mitigation recommendations.

HISTORICAL RESEARCH METHODS

A variety of sources were consulted for research and documentation of historic period properties within the project area. Land patent and grant deed records spanning the years 1855 to 1892 were consulted at the Tulare County Recorders Office, Visalia, California. Historical maps (Baker 1876; Bannister 1883; Denny 1911; Moye 1920; Smith 1901, 1909; Thompson 1892) on file at either the Shields Library, University of California, Davis or the Tulare County Library provided data on historical ownership of lands in the Dry Creek valley. Individuals who provided other historical background information include Dr. William Tweed, Management Assistant for Sequoia and Kings Canyon National Parks, and Ms. Annie Mitchell, local historian and author.

3.0 RESEARCH FINDINGS

In this section we describe the findings of the cultural resource studies for the Kaweah River Basin Project. Archeological survey results are summarized in brief descriptions of the archeological sites and the single isolated find. Details of the archeological resources will be found in Confidential Appendix B. The ethnographic study results are reported here as well. No additional historical data are presented beyond those in the introductory chapter, although certain historical data are incorporated into the appropriate archeological site descriptions.

ARCHEOLOGICAL RESOURCES

Archeological resources in the project's APE are described briefly in the following section. Further review of the potential significance and eligibility of each site will be found in Section 4.0: Potential Project Effects and Resource Evaluations.

Dry Creek Drainage

A variety of cultural resources were identified within the Dry Creek drainage. Three previously recorded sites were relocated during the field survey phase of the project (CA-TUL-111, -341, and -836), and twenty-nine previously unrecorded historic properties were discovered and documented (CA-TUL-1442 through -1470H). A single isolated find (IF-6-TUL), consisting of a cast iron stove, was also identified within this area. Due to the portable nature of the isolated find, it lacks integrity of location and is thus not considered further for significance evaluation purposes.

CA-TUL-1442

This site is 175 m long (NW/SE axis), 50 m wide (NE/SW axis), and consists of six granite milling features with a total of 15 mortar cups, one slick, and 11 granite pestles, with a sparse scatter of basalt and obsidian flaking debris and a possible midden deposit. A single obsidian flake was found between Features 2 and 3. A single fragment of a large mammal bone was observed near the obsidian flake. The site has suffered no conspicuous damage or alteration from erosion or other natural agencies or human activities.

CA-TUL-1443H

This site consists of an historic rock alignment "enclosure" marked by a minimum of three linear rock alignments, with three rock features including one stacked feature, one piled, and a dug-out, rock lined pit. The site is 70 m long (E/W axis)

by 60 m wide (N/S axis). Additional above-ground features which may have been present, including any structures, are no longer present. These may have been destroyed by fire, as was the structure across the road at CA-TUL-1444H (F. Homer, personal communication 1989). Disturbances to the site include downslope erosion and impacts as a result of cattle grazing.

According to F. Homer, a local property owner in the Dry Creek area, the Hambright family lived at this site "in the 1920s"; J.M. Hambright is listed as property owner on the 1892 Thompson Atlas Map of Tulare County. Native American consultants reported that an older "white man" who owned the property at the northern end of the APE, possibly in the vicinity of CA-TUL-1443H and -1444H had attempted to form a government-recognized rancheria on his property. Although the rancheria was never officially acknowledged, several Native American families lived at this location, and several individuals were reportedly buried on the property. An alternate location for this proposed rancheria is in the vicinity of the Homer Ranch within the CA-TUL-111 area.

CA-TUL-1444H

CA-TUL-1444H contains the remains of an historic homestead including a fireplace, well, and several exotic trees. In 1882 Martha Homer, widow of Joseph Homer (an early settler of this region), homesteaded 160 acres in this area, including this site. The *Official Historical Atlas Map of Tulare County* (Thompson 1892) depicts a structure at this location, with the land owner listed as Mrs. M. Homer & John Hambright, her son-in-law. Forrest Homer, the present property owner, stated that the structure which existed within this site burned down when he was a child, sometime in the 1920s or '30s. Additional impacts to the site include minor stream erosion and recent dumping of miscellaneous ranching debris immediately downstream of the site boundaries.

CA-TUL-1445

This site consists of eight granite bedrock milling features with a minimum of 39 mortar cups, one cupule, six slicks, seven associated granite cobble pestles, five housepit depressions, two localized midden deposits, and a sparse to moderate scatter of basalt and obsidian flaking debris. A single obsidian flake was seen near Feature 1, and all noted pestles are clustered around Features 1 and 4. No faunal or human remains are known at this site. Existing adverse impacts to this site are a result of downslope wash, stream erosion, and cattle grazing.

CA-TUL-1446

At the lower reaches of an unnamed canyon is a site consisting of two granite milling features with a total of three mortar cups. No other artifact, faunal, or cultural remains are known at this site. Visible disturbances to this site include minimal downslope wash and stream erosion.

CA-TUL-1447

Located at this site are 28 milling features with a total of 85 mortar cups and cupules, three slicks, and three granite cobble pestles in association with Features 4, 7, and 8. No other cultural remains are known at this site. Noticeable disturbances to CA-TUL-1447 are a result of minimal stream erosion and cattle grazing.

CA-TUL-1448

CA-TUL-1448 site consists of a single granite milling feature with six mortar cups, and one slick. No other cultural materials are noted on the site. Site disturbances, which include minimal downslope wash, have not altered the site's integrity.

CA-TUL-1449

This site consists of a northeast/southwest-trending linear cluster of 26 granite milling features with a total of 68 mortar cups and 4 slicks. A single granite cobble pestle is in association with milling Feature 18. No other cultural remains are noted. There is no significant erosional or other alteration of the resource.

CA-TUL-1450

This site, which is 11 m long (N/S axis) by 5 m wide (E/W axis), is located at the mouth of a small, unnamed canyon. One bedrock milling feature, with a total of two mortar cups and five slicks is present at the site. No other cultural materials are noted and site disturbance appears nominal.

CA-TUL-1451

CA-TUL-1451 is comprised of a single granite outcropping with a total of three slicks and one mortar cup and an igneous, tabular, unifacial cobble tool. No disturbances to the site other than those related to cattle grazing are visible.

CA-TUL-1452

This site consists of four milling features on granite outcrops, totaling 5 mortar cups and three slicks. No other cultural remains were noted and there is apparently insignificant disturbance to the site area from cattle grazing.

CA-TUL-1453

Forty granite milling features were mapped at CA-TUL-1453, with a total of 169 mortar cups and cupules and 8 slicks. A conspicuous, dark grayish brown midden (10YR4/2) soil is present (pH 7.4). Other cultural remains at the site are basalt, chert, and obsidian debitage, granite cobble pestles and one handstone, ceramic brownware sherds, a steatite disk bead, an *Olivella* chipped disk bead with a perforation probably made with a steel needle, and a multichrome pictograph panel with numerous elements, many of which are not clearly distinguishable (Figures 4 and 5). In the midden are several basalt and chert (possibly heat treated) edge-modified pieces, many fragments of burned, non-identifiable bone, and very small fragments of shell.

Portions of the midden area have sustained damage from the grading of a track along the flank of the hillock upon which the site is situated. The site area is currently used to pasture horses, and the animals have trampled the area and use the midden soil for dusting themselves. It is also likely the site has been subject to "pot-hunting" (based on comments by the landowner), but overall the site area appears in good condition.

CA-TUL-1454

This site is comprised of six granite milling features with a total of 27 mortar cups, one slick, and one complete and two fragmentary pestles. The pestle fragments are associated with Feature one, while the other, a long, cylindrical, partially shaped granite pestle (33 cm long, 10 cm max. dia., 4 cm min. dia.), is located in the western portion of the site area away from any milling features. No other cultural materials are noted at this site.

Construction of a paved access road has removed a significant amount of soil from the center portion of this site, possibly also affecting one of the milling features. Additional damage has probably been sustained from bulldozing in the northeastern and northwestern portions of the site area. Damage to the site area is regarded as severe, although large areas of the site are probably intact.

Figure 4. Looking southwest toward pictograph feature at CA-TUL-1253.

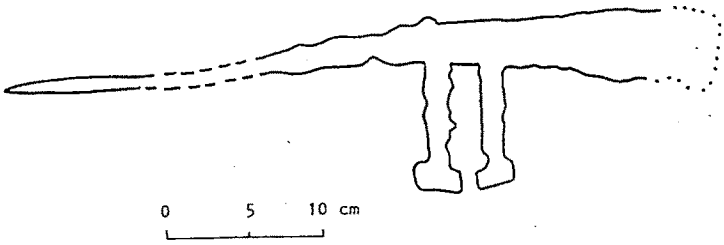


Figure 5. Detail of black pigment figure noted on pictograph feature at CA-TUL-1253.

CA-TUL-1455

The most remarkable cultural features at this site are the monochrome (red, black or yellow) and multichrome (black and red) pictograph panels on three separate boulders (Figures 6 to 9). In addition, there are 13 milling features with a total of 47 mortar cups and cupules, and one slick. The site is 90 m long (NE/SW axis) and 30 m wide (SE/NW) axis). A distinct midden soil (10YR4/2; pH 7.4) is found in the southeast quadrant of the site. No formed artifacts are noted in the site soil although basalt debitage and thermally altered rock wee observed.

Road construction probably affected the southeastern portion of the site, although the extent of any damage cannot be assessed with present information. The majority of the site area is grazed by cattle and there is slope wash over most of the site. The site, for the most part, is regarded as in good condition.

CA-TUL-1456

CA-TUL-1456 consists of ten granite milling features with a total of 80 mortar cups and small anvil cups or "cupules," three slicks, and one associated granite cobble pestle. No other cultural materials are found at this site. The site is bisected by Dry Creek Road. It seems likely that additional bedrock mortars and other features were destroyed during road construction, although there is no direct evidence of this.

CA-TUL-1457

CA-TUL-1457 contains eight milling features with a total of 50 mortar cups and cupules, one slick, and seven cobble pestles. The milling features are associated with a midden deposit, and a sparse to moderate basalt and obsidian debitage scatter (no flaked stone tools were found). Five of the seven pestles are directly associated with bedrock mortar Feature 1. Several small mammal and bird bone fragments are present in the midden soil exposed along a road cut. Skull fragments of one human burial were noted during survey in this same road cut and have since been relocated by members of the Wukchumni Council of Visalia, California.

Road construction has resulted in significant impacts to the midden area at CA-TUL-1457, and portions of the largest bedrock milling feature have also been damaged. Pieces of granite with mortar holes and displaced midden soil are found east of the road. The vast majority of the site area appears to be intact.

Figure 6. Looking west towards pictograph feature at CA-TUL-1255.

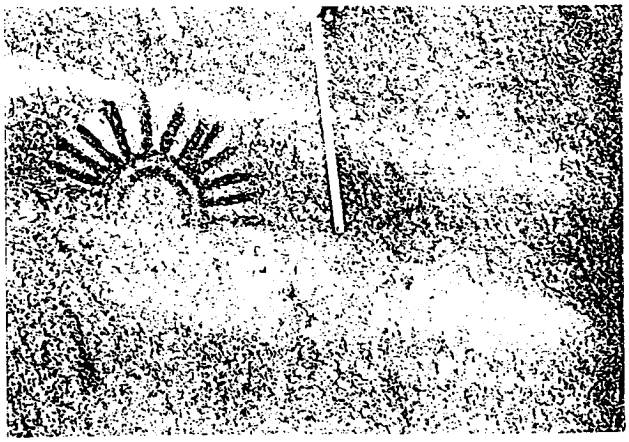


Figure 7. Closeup of red pigment figure noted on pictograph feature at CA-TUL-1455.

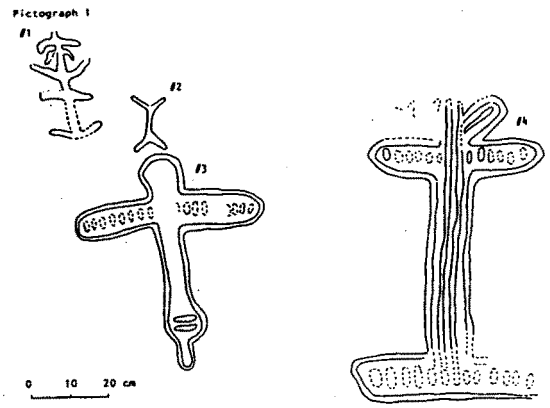


Figure 8. Detail of figures #1-4 in Pictograph 1 at CA-TUL-1455.

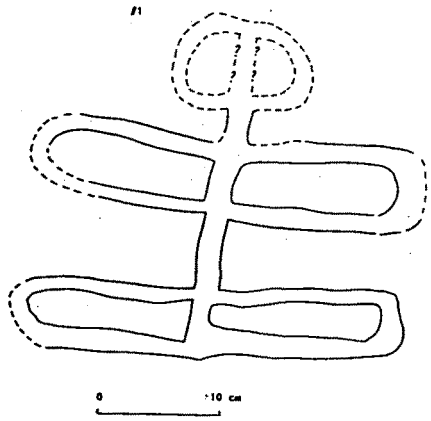


Figure 9. Detail of figure 1 in Pictograph 3 at CA-TUL-1455.

CA-TUL-1458

CA-TUL-1458 consists of a single milling feature on a granite boulder with a total of two mortar cups. No other cultural materials are noted on this site. Although a bulldozed access road is adjacent the site, there is no evidence to suggest that any other cultural remains are associated with the milling feature, in which case the site is intact.

CA-TUL-1459

This resource is located on a gently sloping stream terrace and is made up of six small granite boulders with a total of 10 mortar cups and cupules. No other cultural remains are noted. The site has sustained no conspicuous damage.

CA-TUL-1460

This site is located at the base of the steep slopes at the western valley edge. Two granite boulders with a total of four mortar cups can be found at this site. There is also a stacked rock alignment between two large granite boulders, the function of which may be interpreted as a hunting blind. No other cultural remains are noted at this site. The site appears to be in good condition although the immediate area is used for cattle grazing and a stock pond has been constructed nearby.

CA-TUL-1461

Recorded at this site are four granite milling features with a total of eight mortar cups and one slick. The site is 50 m long (E/W axis) by 20 m wide (N/S axis). No artifact or other cultural remains besides the milling features are noted on this site.

Construction of Dry Creek Road has adversely impacted portions of the site, with at least one milling feature moved from its original position. It is our impression that there has not been a significant loss of resource integrity.

CA-TUL-1462

Discovered on this site are two milling features in small granite boulders with a total of six mortar cups. The site contains no other observed cultural remains, and has sustained no obvious adverse effects.

CA-TUL-1463

CA-TUL-1463 consists of a single bedrock milling feature with five mortar cups with three associated rough granite cobble pestles. No other cultural remains are present. The site has sustained no apparent adverse effects.

CA-TUL-1464

Incorporating an area 60 m long (E/W axis) and 40 m wide (N/S axis), this site is situated on a wide creek terrace. On the site are two bedrock milling features with a total of four mortar cups. The site also exhibits a very light scatter of historic period debris containing one shard of sun-tinted amethyst glass, two small wooden boxes (1"x2"x1"), and a light scatter of metal and wooden debris.

The significance of the historic debris is uncertain. The Thompson's (1892) atlas map shows this to have been the approximate location of the Cleveland school house ca. 1892, however no foundation or other structural remains were observed at the site during survey. The location of the site on the flood plain of Dry Creek makes it possible that the historical debris has been washed into place from homestead sites upstream.

The site area has almost certainly been flooded periodically, perhaps resulting in the loss of archaeological deposits. Dry Creek road is immediately adjacent the site, although there is no evidence that construction of the road resulted in adverse effects to the cultural resource.

CA-TUL-1465

This site consists of a single milling feature with three mortar cups and one associated rough granite pestle (24 cm long, 9 cm thick, 12 cm wide). No other remains are noted at this site and no conspicuous damage to the site area is discernable.

CA-TUL-1466

The site is located east of Dry Creek on a low knoll at the base of the hills east of the Dry Creek valley. The site consists of three bedrock milling features with a total of six mortar cups. No other artifacts or cultural remains were found at this site. Site soils have a pH reading of 5.57, indicating no culturally related modification. A bulldozed vehicle track passes near the site and the area has been heavily grazed, but the site has not been affected.

CA-TUL-1467

This location consists of one small mortar cup and two cupules or small acorn anvil depressions located on three small granite boulders. CA-TUL-1467 is probably a milling area associated with CA-TUL-1442, but the 150-m distance from that recorded site requires its recording as a separate resource. The site has sustained no apparent damage.

CA-TUL-1468

This site is located on a granite outcrop above a developed spring which feeds into three stock tanks. The site consists of a single bedrock mortar cup (9x8.5 cm, 2 cm deep) on a granite boulder (4x2 m). CA-TUL-1468 has been slightly disturbed due to stream erosion and downslope wash.

CA-TUL-1469

A single, large mortar cup (22x20 cm, 15 cm deep), situated on a small, low granite boulder (1x1 m) is now designated CA-TUL-1469. There has been no significant disturbance of the site.

CA-TUL-1470H

At this location a fireplace, constructed of tabular stream stones with mud mortar, is present. The structure is 180 cm across the back, 107 cm deep, and 75 cm high. Examination of historic records including land patents, grant deeds, and various historic maps and atlases fail to provide any identity regarding the ownership or origin of the structure which is assumed to be represented by this feature and a nearby scatter of bricks and miscellaneous debris.

CA-TUL-111

CA-TUL-111 was originally recorded by J. C. von Werhlof in 1960, and simply described as a large village site. The site is 500 m long (N/S axis) by 300 m wide (E/W axis), and consists of an inventory of 24 bedrock milling features with a total of 147 mortar cups and cupules and 8 slicks, a small granite boulder rock shelter with red linear pictographs on the rear interior wall (Figures 10 and 11), several loci of midden soils with obsidian, basalt, and quartzite flaking debris. Obsidian flakes found at the site have physical characteristics of glass from the Casa Diablo and Coso sources. Also observed are small fragments of burned mammal bone, and possible thermally-altered rock, in addition to several possible housepit depressions. Chemical analysis of midden soil adjacent to Feature 1 yield a pH reading of 6.2.

Figure 10. Looking west toward granite boulder rock shelter at CA-TUL-111.

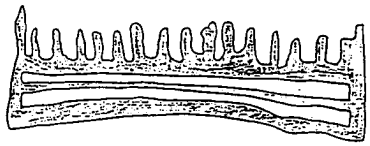


Figure 11. Detail of red pigment figure noted on interior wall within rock shelter at CA-TUL-111.

Historic period construction and occupation activities have altered portions of this site, including the destruction of part of one bedrock milling feature. The vast majority of the site area appears to be in excellent condition.

CA-TUL-341

Rights-of-entry to the property on which this site is located could not be obtained. Nevertheless, the site has been recently visited by Mrs. Mary Gorden who kindly shared with us her notes and observations about the site, as did Mr. Dick Burns. The existing site record does not do justice to the extensive and unique rock art at the site, including both multichrome pictographs and petroglyphs. The site area is estimated to be at least three times larger than originally recorded. Bedrock milling features and midden soils are also reported. The site is a major cultural resource.

CA-TUL-836

Our visit to this site was curtailed when our right-of-entry was questioned. It is evident that while the original site record is a reasonably accurate description of the character and extent of the resource some discrepancies exist. Reported housepits could not be relocated, nor was reported midden soil identified. As concerns the latter, we acknowledge that at the time of our visit the soil was thoroughly wet and recognizing midden would have been very difficult.

Homer Ranch Complex

Several standing structures including two domestic structures, a tank house, and several associated outbuildings, corrals, and stone walls are located in the Dry Creek area at the northern end of CA-TUL-111 (Figures 12-15). This ranch complex is labeled the Homer Ranch on the USGS Woodlake 7.5' quadrangle map. Examination of historic records indicate that the home of Truman John Homer, son of Joseph and Martha Homer, was located in this area as early as 1901 (Table 1, pg. 15). Due to uncertainty as to the age of the existing structure, it is not known whether the existing structures are part of this early homestead. Additional historical research and architectural assessment are needed to evaluate these structures in terms of National Register significance and potential eligibility. In addition, subsurface testing is needed to evaluate the potential for associated archeological deposits such as privies, trash dumps, and other buried features which may be associated with the historic ranch complex (see Appendix 6).

Kaweah River and Lake Kaweah Area

Our efforts at relocating CA-TUL-93 met with uncertain success. No evidence of the site was found at its mapped location just downstream of Terminus Dam. A

Figure 12. One of two standing domestic structures at the Homer Ranch Complex.

Figure 13. Tank house (at right) and rear view of second standing domestic structure at the Homer Ranch Complex.

Figure 12. One of two standing domestic structures at the Homer Ranch Complex.

Figure 13. Tank house (at right) and rear view of second standing domestic structure at the Homer Ranch Complex.

single piece of obsidian was found on a low terrace approximately 150 m ESE of the reported site location, but no other remains were discovered and the reported pictograph was not rediscovered.

No additional archeological sites were found in our examination of the project's APE around Lake Kaweah. It should be noted that very few of the private land holdings were accessible to survey crews. Sites previously recorded by the UCLA team were found to be as reported, although the "petroglyph" at CA-TUL-1044 could not be relocated.

Results of the Enhanced Archeological Survey

The enhanced archeological survey provided a rather unique perspective on the prehistoric cultural resources of the Dry Creek valley. Augering and shovel scrapes at five localities (see Appendix 2) yielded no additional evidence of cultural remains, despite the fact that each locality was judged as being a likely site location based on current settlement pattern models.

A much more interesting aspect of the enhanced survey work was the chemical identification of midden soils. Although dark colored, friable soils were observed at several sites and other localities, it became apparent (due to the absence of artifacts and other cultural remains) that soil color and texture were not definitive indicators of culturally altered soils. Table 3 (pg. 24) summarizes the provenience, soil color, and pH results for the sampled sites and localities. Off-site native soils are typically brown or yellow in color, with pH values between 5.7 and 6.3. At CA-TUL-1453 and -1455, dark grayish brown friable soils with pH of 7.4 are considered "midden". Curiously, a dark brown, friable soil surrounding a bedrock milling feature at CA-TUL-111, what one might otherwise consider midden, has a pH of 6.2, within the range of native, culturally unmodified soils in the valley. We conclude that a functional definition of "midden" in this area must incorporate a demonstrated pH value of approximately 7.4.

ETHNOGRAPHIC FINDINGS

The ethnographic fieldwork resulted in several findings relevant to the overall assessment of the cultural resource sensitivity of the Dry Creek drainage. Specific data were retrieved on historic period residential areas and cemetery locations. In addition, field research revealed that important information on traditional Wukchumni subsistence activities is still available. The findings of the interview program are arranged first by topic, followed by a description of what may be termed ethnographic sites or locales. The resource areas which can be accurately mapped have been included on the map in Appendix 3.

Subsistence Technology: Findings and Research Potential

Obtaining information about traditional Native American methods of collecting and processing traditional foods is a significant element of contemporary ethnographic research (McCarthy et al. 1985). Recent research has focused on retrieving information about traditional methods of processing staple foods using the milling technology represented by bedrock mortars, grinding or milling slicks and portable mortars. Work in the Bass Lake (Crane Valley) and Dinkey Creek regions of Fresno County has pointed to the possibility of developing a functional model of the use of these ubiquitous site features. Such models are aimed at explaining the variability in size and shape of these features. Field interviews revealed that the possibility of developing a model of milling feature use is not only possible, but highly probable for the Dry Creek drainage.

Several knowledgeable consultants were asked about the variation in size and shape of the mortars at the Dry Creek sites. These consultants stated that they had either been trained in the use of bedrock mortars or had witnessed their use over a long period of time. In all cases, the consultants asserted that classes of mortars (and correspondingly, classes of pestles) existed and that each discernable type had a defined use or range of uses. Although the present study did not aim to retrieve these data in detail, it became apparent that mortars may be defined by size and shape relative to function.

Acorn processing was a basic activity for the Wukchumni woman, an activity which probably persisted well into the twentieth century. Two acorns appear to have been preferred, the readily available "white" oak acorn (*Quercus douglasii*) and the black oak (*Q. kelloggii*) which was collected directly from higher elevations or was traded with neighboring Monache communities. Consultants indicated that two mortar types were used for processing acorn, a large, deep mortar followed by a smaller, shallow mortar. Consultants were consistent in their statements that a deep mortar was used to begin the milling process because white acorns have a tendency to shatter when first struck with a pestle. Subsequent processing in a smaller mortar reduced the acorn meal to a flour.

Several other foods were processed in bedrock mortars including dried meats, various seeds and dried berries. In addition, several mortar types apparently were used either exclusively or predominantly for processing burned fresh water clam shell, tobacco, jimpson weed (*Datura* sp.) and various medicinal plants.

The possibility of linking mortar function to mortar size and shape carries a number of potential research rewards. The development and verification of a model of mortar function allows greater precision in determining the activities that occurred at a given site. Second, such knowledge contributes to a more sophisticated

assessment of the natural resource base exploited by the prehistoric and historic period Wukchumni and neighboring Yokuts groups. The field methods and techniques needed to develop and test such a functional model are discussed in the recommendations section below.

Ethnobotanical Resources and Research Potential

Active use of traditional plants by Native Americans apparently continued well into the 1940s and it is probable that collecting has continued, perhaps in a less intensive fashion, to the present. Field research did not reveal that the Dry Creek area is used actively at the present time, rather, the information was the product of memories of the use of plants by family members of ascending generations. Wukchumni consultants still possess important traditional knowledge about plant resources in the Kaweah River drainage. In addition to information about the use of acorns, consultants discussed a number of seeds and berries that were gathered, and plants used for medicinal purposes (Figures 16 and 17).

Plants remembered by consultants to have been collected in the Dry Creek drainage are:

1. White oak acorns (*Quercus douglasii*)
2. Sourberry berries (*Rhus trilobata*)
3. Native tobacco (*Nicotiana* cf. *glauca*)
4. Jimson weed or datura (*Datura meteloides*)
5. Several varieties of seeds, not yet identified
6. Several varieties of bulbs and tubers (eg. *Brodiaea*), not yet identified
7. Several species of plants used exclusively for medicine (not yet identified)
8. Utilitarian plants such as the stock of common milkweed which was used for its fiber.

Collecting and analyzing the currently available information about traditional plant gathering and use is one method in the study of traditional subsistence practices and, perhaps, the analysis of dietary and economic changes that occurred after Contact. Gayton (1948), for example, provides a valuable, although very basic description of plant resource collecting and use. Additional data will add to the knowledge of Yokuts use of foothill and riparian plant resources.

Ethnographic Sites and Locales

In the course of field interviews several specific locales in the Dry Creek drainage were investigated. The first interviews focused on the Native American interpretation of archeological sites discovered during the recent survey, but it soon

Figure 16.

Native American consultant Felix Icho with seed pod of jimsonweed (Datura meteloides).

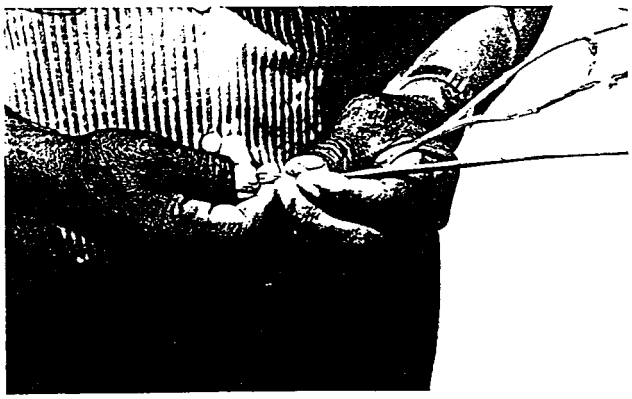


Figure 17. Native American consultant with dried milkweed (Asclepias speciosa) stalk.

became clear that a productive avenue of research centered on each consultant's memories of the recent occupation of the drainage. Consultants were asked to recall all they could about the appearance of these settlement areas. An attempt was made to identify the families or individuals who lived at a given place, the history of their tenure, and the everyday and unusual activities that took place at the residential locales. In many instances consultants' memories were vague, perhaps because their experience at a place happened when they were very young, or they visited the Dry Creek area infrequently. At the present time gaps in the data for any given locale are many, although it is the impression of the field interviewers that more intensive field interviews will result in a much clearer picture of the history of many of these sites.

The Jim Bridges Place (DCE 1)

The Jim Bridges Place, as it was called by two consultants, was an historic period settlement located at the extreme southern end of the Dry Creek study area. There was considerable agreement among consultants concerning the site, although one elderly consultant, who had stayed here during his youth, was able to provide the most detailed account of its history and appearance.

This locality was occupied by one or more Wukchumni families, and apparently was owned by a Wukchumni individual, perhaps as late as the 1930s. The place is referred to as Moi'ya ku by one consultant (a name translated by the consultant to mean "the place of the origin of the whirlwind"). This name corresponds with the Latta's Moiyuk, although Latta's locational information does not appear to correspond to the location provided by the consultant (Latta 1977:185; Conton and Gehr 1984:164).

Consultants indicated that this was a part-time residence of Henry and Maggie Icho, an older woman known as Lena, and a Wukchumni man possibly named Claude Osborn (information on Osborn was very sketchy). In the early part of the century there were three houses at the site, including a "long" house occupied by Osborn and two smaller houses occupied by Lena and the Ichos. Several consultants recalled that the women who lived there continued to use the bedrock mortars located east of Dry Creek road, probably until the time they left the area. (These mortars are part of archeological site TUL-341). Of particular importance are the memories of one elderly consultant who witnessed several "fandangos" or traditional Native American gatherings in the large flat near the residence and on the west bank of Dry Creek. The consultant described one large gathering which included traditional dancing and curing by doctors. During this ceremony the consultant remembered seeing the "circle dance" which was conducted in the open (no enclosure or ceremonial house was located at the site) around a large fire. On the

periphery of the dance area the consultant recalled seeing doctors practicing around smaller fires.

One consultant was able to provide some details on the later history of the site. Apparently one of the houses was occupied by the Icho family, first on a permanent basis and later, intermittently, as they traveled from their allotment near the Three Rivers vicinity to work at ranches in the Woodlake and Visalia areas. This consultant, who was born at or near this place, also stated that the Ichos used the house when they traveled south from another residence in the Dunlap area (on the Kings River drainage).

At present no structures are extant at the site. Right of entry to this property was not secured for this study, so specific details of the layout of the residences were not recorded. Several consultants certainly will be able to contribute to this ethnographic effort.

The Pohot Family Place and Cemetery (DCE 2)

The Pohot family figures prominently in the recent history of the Wukchumni people. The well known residence of the Pohot family is documented in Latta (1977:183) and Gayton (1948:59), and referred to as "Buckeye Springs." Conton and Gehr (in Meighan et al. 1988:164) were able to provide some additional information about the site, and several individuals consulted during the present investigation were able to supplement the location information. Researchers did not have rights of access to this property. It seems clear that several consultants could contribute to a detailed site evaluation should access be secured. As noted by Conton and Gehr, the Pohot Family cemetery located west of the Pohot residence is a very important locale for the Wukchumni community. Several Wukchumni consultants stated a strong desire to visit the cemetery and one elderly consultant indicated that he had plans to reconstruct the fence and reset several of the markers which have been lost. While the Pohot cemetery appears to be well outside the boundaries of the proposed reservoir, several consultants were concerned about problems of access, should a reservoir be constructed.

Possible Cemetery Site (DCE 3)

One elderly consultant stated that several individuals were buried at this location, many during the 20th Century. The consultant witnessed one funeral, and had heard that there had been many more here.

Proposed Rancheria Site (DCE 4)

One elderly consultant indicated that a temporary settlement existed at the extreme northern end of Dry Creek study area. According to this consultant, whose memories were somewhat vague, an elderly white man had attempted to develop a government recognized rancheria in the area. During this period several families were said to have taken up temporary residence at the site (possibly the man's ranch) and lived there until plans for the rancheria fell through. The consultant was not sure why the plan failed; whether due to the man's death or the government's lack of approval for the rancheria. It is likely that these events occurred during the first decade of the century at a time when several rancherias were established in California for "landless" Indians.

Ethnohistoric Research Potential

A significant area for future research is the examination of the history of the Dry Creek region from the time of Contact to the present. Of particular importance are the related research topics of Indian/non-Indian relationships, acculturation and accommodation to the significant pressures wielded by the surrounding non-Indian society. As Gayton notes, the Wukchumni and neighboring groups were mostly spared the effects of the two major events which decisively altered Native American society in California: missionization and the Gold Rush of 1849. As a result, many groups, or remnants of groups maintained elements of their traditional lifestyle, memories of which are now accessible through contemporary consultants. Many consultants were able to provide substantial information about the forces of change which affected their families as the acculturation process continued. Research in these areas may reveal much about the largely unwritten history of the Wukchumni and neighboring Yokuts groups during the post-contact period.

The Dry Creek study area holds promise for important and significant ethnographic research. As noted above, several research domains were explored during ethnographic fieldwork: ethnohistorical reconstruction, ethnobotany, and subsistence technologies. Each of these research areas is explored further with regard to their potential elaboration in any future studies.

Ethnohistorical Reconstruction

The historic period residential sites in the Dry Creek drainage span an important period of cultural change for the Wukchumni Yokuts, a period which is little understood for the Yokuts groups and all other Native American communities in the Central and San Joaquin Valley and Sierra Nevada. Research should concentrate on the documentation of the Icho and Pohot residences (DCE 1&2) from both an on-site and documentary perspective. This would be completed best

through intensive on- and off-site interviews with descendants of the Icho and Pohot families. It is also likely that county land records, and possibly the records of the Bureau of Indian Affairs (BIA) will contain documentary material relevant to these sites.

A second area of interest is the history of the attempt to establish a rancheria along Dry Creek. Records of this effort may be found in BIA archives, perhaps in local repositories, and in family documents held by descendants of the persons involved. Members of the archeological survey team discussed this locale with a local resident and it is possible that oral history interviews will shed some light on the history of the site.

Ethnobotanical Resources

The Dry Creek drainage was clearly an important resource area for the Wukchumni and it is apparent that much information on plant gathering, preparation and use is still available from Wukchumni consultants. A detailed ethnobotanical field survey should be undertaken. This survey should be guided by knowledgeable Wukchumni consultants and should consider the seasonality of traditional plants. An emphasis on the late winter to early summer period appears to be warranted, due to the importance of early emergent bulbs, greens (e.g., clover) and seed grasses, all of which disappear in the hot summer months.

Subsistence Technology

Several consultants possess detailed information about the use of bedrock mortars, grinding slicks, pestles and similar implements for processing traditional foods. Because knowledge of this technology, particularly first hand knowledge, is fading with each passing generation, it is important to retrieve as much information as possible, as quickly as possible. The goal of this research should be the description of resource processing techniques. As part of this effort it may be possible to develop models or partial models which will contribute to an understanding of variability of these common site features. This field effort should include recording of as much of the process as possible, beginning with resource collecting and continuing through the milling or grinding process, and resource consumption. McCarthy et al. (1985) have established a field program for such studies which might be used as a guide for the recommended research.

4.0 POTENTIAL PROJECT EFFECTS AND CULTURAL RESOURCE EVALUATIONS

Each proposed project alternative which involves increasing the pool elevation of the existing Lake Kaweah alone or with the construction of a new flood control structure, or permanent reservoir has the potential to affect cultural resources. Project effects on cultural resources, as they are understood based on present planning, are summarized in this section. The significance of each potentially affected cultural resource is evaluated vis-a-vis Section 106 procedures and a preliminary assessment of the eligibility of the cultural resources for nomination to the National Register of Historic Places (NRHP) is made (cf. 36 CFR 60.4). Additionally, comments, recommendations, and evaluations of cultural resources made by Native American consultants are provided.

POTENTIAL PROJECT EFFECTS

The USACE Kaweah River Basin Investigation includes eleven different alternatives for increasing flood protection and water supply in the Kaweah River basin. These alternatives range from no changes in spillway elevation for Lake Kaweah with no flood control on Dry Creek, to the impoundment of Limekiln Lake by constructing a dam which spans the Kaweah River approximately one mile downstream from the existing Terminus Dam. Building any of the eleven alternatives potentially will affect identified historic properties, possibly resulting in adverse effects due to construction-related activities, inundation, wave erosion as a result of fluctuating pool levels, and exposure.

Additional potentially adverse effects may result from the relocation of Dry Creek Road in the event that dam construction proceeds in the Dry Creek portion of the project area. Potential adverse impacts related to a new road, presumably at a higher elevation along the western side of the valley, cannot be assessed with the information presently available.

Indirect impacts on historic properties may result due to increased accessibility of certain sites, with a concomitant increase in potential for destruction through vandalism and looting. Indirect effects cannot be discussed in detail because a specific project design has not been formulated. It is our experience that any historic property made more accessible is likely to suffer damage, whether as a consequence of constructing a new access road nearby, or by permitting boating on a reservoir.

Table 4 lists affects to historic properties which would occur as a result of each of the eleven flood control/reservoir alternatives. Also included in this listing are potential impacts to ethnographic sites (DCE-1 through -4), and to the seven prehistoric properties identified by UCLA crews during the Lake Kaweah Intensive Cultural Resources Survey (cf. Meighan et al. 1988). Historic properties at elevations less than 10 feet above the proposed spillway elevations are included within the list of sites impacted due to the imprecision in recording exact site elevations. This impact assessment considers only adverse effects related to inundation because information regarding quarry areas for dam fill, haul roads, lay-down and storage areas, and other construction activities has not been developed.

EVALUATION OF CULTURAL RESOURCES

An integral part of cultural resource management studies is the evaluation of significance of identified historic properties. Such evaluation is made vis-a-vis the eligibility criteria for inclusion in the NRHP, as set forth in the Secretary of the Interior's Standards and Guidelines for Evaluation (36 CFR 60.4). Following the identification of pertinent historical themes or patterns, four basic criteria for significance evaluation are applied. "Criteria A, B, C, and D identify properties significant for their ability to characterize, illustrate, reveal, or recall specific persons, events, lifeways, patterns of development, or architectural types recognized by the public or the professional and scientific community as important in our understanding of the prehistory and history of the nation" (National Park Service 1982). Also essential in the evaluation process is an analysis of the integrity of each property within a defined context. It is emphasized that any discussion of site significance and potential eligibility for nomination to the NRHP is preliminary, and based strictly on survey level data.

In the following discussion we address the research themes (domains) germane to investigations of the cultural resources in the study area, thus establishing a context in which the cultural resources may be evaluated. There are two basic perspectives, archeological and ethnographic, and both subsume issues of historical significance. Although the two defined perspectives are not mutually exclusive (especially as regards topics which fall in the realm of ethnoarcheology or ethnohistory), the latter perspective incorporates the perceptions and commentary offered by contemporary Native Americans.

Archeological Research Domains and Evaluation

The research focus for the Kaweah River basin cultural resources inventory has been the discovery and assessment of sites, locales, and other resources in the project's APE which may possess either scientific research potential or those of concern to present-day Native American communities in the project vicinity. The

Table 4: Alternative Spillway Elevations and Potentially Inundated Historic Properties.

Lake Kaweah - Existing (694 feet)

No additional historic properties inundated

Lake Kaweah - 10 foot increase (704 feet)
Lake Kaweah - 15 foot increase (709 feet)
Lake Kaweah - 21 foot increase (715 feet)

TUL-1042, -1044, -1046

Limekiln Lake (694 feet)*

TUL-93, -111, -341, -836, -1045H, -1446, -1447, -1448, -1449, -1450, -1451, -1452, -1453, -1454, -1455, -1456, -1457, -1458, -1459, -1460, -1461, -1463, -1464, -1466, -1469, -1470H, DCE 1, DCE 3

Dry Creek - 19,200 AF (617 feet)

TUL-111, -1446, -1447, -1448, -1453, -1454, -1455, -1456, -1457, -1459, - 1460, -1469, -1470H

Dry Creek - 26,700 AF (630 feet)

TUL-111, -1446, -1447, -1448, -1453, -1454, -1455, -1456, -1457, -1459, - 1460, -1466, -1469, -1470H

Dry Creek - 33,000 AF (640 feet)

TUL-111, -1446, -1447, -1448, -1453, -1454, -1455, -1456, -1457, -1459, - 1460, -1466, -1469, -1470H

Dry Creek - 70,000 AF (684 feet)**

TUL-111, -1042, -1044, -1046, -1446, -1447, -1448, -1453, -1454, -1455, -1456, -1457, -1459, -1460, -1461, -1464, -1466, -1469, -1470H

Dry Creek - 80,000 AF (694 feet)**

TUL-111, -1042, -1044, -1046, -1446, -1447, -1448, -1453, -1454, -1455, -1456, -1457, -1459, -1460, -1461, -1464, -1466, -1469, -1470H

Dry Creek - 95,000 AF (708 feet)**

TUL-111, -1042, -1044, -1046, -1446, -1447, -1448, -1453, -1454, -1455, -1456, -1457, -1459, -1460, -1461, -1464, -1466, -1469, -1470H

* CA-TUL-27 is in the immediate vicinity of the proposed dam site and probably would be adversely affected.

** This alternative is coupled with a tunnel to Lake Kaweah plus the 21-foot increase to Lake Kaweah.

geographical focus for this consideration is the Dry Creek drainage because the Lake Kaweah area resources have been addressed previously and eligibility recommendations made in Meighan et al. (1988). The Dry Creek and Lake Kaweah areas do not exist in isolation, however, and archeological research concerns for the Kaweah River basin are basically synonymous with those defined in the *Cultural Resources Overview of the Southern Sierra Nevada* (TCR and ACRS 1984:157-174, 221-228). Given the extensive discussion of the research domains in that document, we only briefly summarize them for this discussion.

Research domains appropriate to the archeological resources of the project APE include:

1. Chronology - the methods and techniques for the estimation of absolute and relative ages of archeological materials, and the temporal ordering of cultural units in specific geographical settings;

2. Cultural Descriptions - describing the artifacts, assemblages, sites, and other patterns and associations of material culture which characterize these archeological units;

3. Paleoenvironment - determining the prehistoric fluctuations in climate as they affected the environment to which prehistoric populations sought to adapt and in which cultural systems evolved;

4. Subsistence Practices - deducing how aboriginal populations procured their basic sustenance and how such efforts are reflected in the archeological record;

5. Settlement Patterns - mapping and explaining the characteristics and positioning of prehistoric settlements, camps, stations, and other remains on the landscape as a means to understanding how prehistoric peoples exploited and adapted to their physical and social environment;

6. Procurement and Exchange - identifying where economic resources originated and how they were distributed over the prehistoric landscape via trade or exchange systems;

7. Population Movements and Ethnic Identifications - identifying evidence of discrete cultural populations in the archeological record and tracing their movements (migration) across the landscape; and, establishing material culture correlates of ethnic groups.

Another research domain emerging in archeology and recently applied in studies of the prehistory of the southern Sierra Nevada relates to engendered labor organization in prehistoric societies. The argument is that a basic element of human social organization is engendered tasks and activities, and that these have material culture analogs in the archeological record (Conkey and Spector 1984; Jackson 1990). As Jackson (1990) has sought to demonstrate, for example, the distribution and characteristics of bedrock milling facilities on the landscape reflect women's production activities, which are interpreted as fundamental structuring elements in the allocation of labor, organization of intra-site social space, and structuring of settlement systems.

A final research topic is "rock art," that is, attempts to comprehend pictographs and petroglyphs as a system of communication. Petroglyphs and pictographs are deliberately created, and we assume that they had some meaning within the cultural system. By comparing rock art elements, mapping their distribution, and describing their environmental and cultural settings, it is hoped that some sense of their meaning may be achieved.

We can arbitrarily assign the prehistoric archeological sites in the Dry Creek valley to either of two types: (1) complex sites with some combination of a cultural deposit (lithic scatter, midden), pictographs and/or petroglyphs, and bedrock milling features; or, (2) sites apparently comprised only of bedrock milling features. In the case of the latter category, none of these sites has been subject to test excavation to confirm whether any cultural deposit is present. Site descriptions have been provided in Section 3.0 and are summarized in Table 5.

We presume that no single site will contain information relevant to all of the research issues outlined, but the more complex sites have the potential to provide data relevant to more of the research questions. Complex sites in the Dry Creek valley, including CA-TUL-111, -341-, -836, -1442, -1445, -1453, -1454, -1455, and -1457 can potentially yield information relevant to all of the research domains, except rock art studies, which are appropriate only to the complex sites with rock art (CA-TUL-111, -341, -1453, and -1455).

The less complex sites are somewhat more problematic, although their probable contributions to research lie in the areas of subsistence practices, settlement patterns, and engendered production. It is important to bear in mind that none of these sites exists in cultural isolation, and that even the simplest of the milling sites represents an element in a comprehensive cultural system reflected by all other contemporaneous sites in the area.

Sites CA-TUL-1443H and -1444H may be evaluated in the context of early historic homesteading in the region and with regard to their possible association with

Table 5. Historical Properties within the APE.

Trinomial	Site Type*	Elevation	NRHP Status**
Dry Creek Drainage:			
TUL-1442	Pre,BRM,M,L	800-880'	eligible (Dist)
TUL-1443H	Hist,SF	760'	eligible (Dist)
TUL-1444H	Hist,homestead	750'	eligible (Dist)
TUL-1445	Pre,BRM,C,M,L,HP	740'	eligible (Dist)
TUL-1446	Pre,BRM	620'	eligible (Dist)
TUL-1447	Pre,BRM,C	560-620'	eligible (Dist)
TUL-1448	Pre,BRM	620'	eligible (Dist)
TUL-1449	Pre,BRM	690-780'	eligible (Dist)
TUL-1450	Pre,BRM	590'	eligible (Dist)
TUL-1451	Pre,BRM	560'	eligible (Dist)
TUL-1452	Pre,BRM	580	eligible (Dist)
TUL-1453	Pre,BRM,C,M,L,Cr,S,Pi	580-600'	eligible (Dist)
TUL-1454	Pre,BRM,M	600'	eligible (Dist)
TUL-1455	Pre,BRM,C,Pi	620'	eligible (Dist)
TUL-1456	Pre,BRM	600'	eligible (Dist)
TUL-1457	Pre,BRM,C,M,L,B	600-640'	eligible (Dist)
TUL-1458	Pre,BRM	700'	eligible (Dist)
TUL-1459	Pre,BRM,C	560'	eligible (Dist)
TUL-1460	Pre,BRM,C,SF	600'	eligible (Dist)
TUL-1461	Pre,BRM	670'	eligible (Dist)
TUL-1462	Pre,BRM	720'	eligible (Dist)
TUL-1463	Pre,BRM	700'	eligible (Dist)
TUL-1464	Pre,BRM,HD	680'	eligible (Dist)
TUL-1465	Pre,BRM	720'	eligible (Dist)
TUL-1466	Pre,BRM	635'	eligible (Dist)
TUL-1467	Pre,BRM,C	760'	eligible (Dist)
TUL-1468	Pre,BRM	740'	eligible (Dist)
TUL-1469	Pre,BRM	600'	eligible (Dist)
TUL-1470H	Hist,FP	560'	not eligible
TUL-93	Pre,Pi	550'	eligible (Dist)
TUL-111	Pre,BRM,C,M,L,SF,Pi,F	620-660'	eligible (Dist)
TUL-341	Pre,BRM,C,M,Pi,Pe,HP,St	600-650'	eligible (Dist)
TUL-836	Pre,BRM,M,L,HP	600'	eligible (Dist)
Lake Kaweah:* **			
TUL-1040	Pre,BRM,C	760'	eligible (C/D)
TUL-1041	Pre,BRM	750'	not eligible
TUL-1042	Pre,BRM,	700'	not eligible
TUL-1043	Pre,BRM,M	800'	eligible (D)
TUL-1044	Pre,BRM,C,M,L,F,HP,Pi	720'	eligible (C/D)
TUL-1045H	Hist,LQ&K,RR	500'	not eligible
TUL-1046	Pre,BRM	720'	not eligible

* Abbreviations for Site Type: Pre, prehistoric; Hist, historic; BRM, bedrock milling features; C, "cupules" or acorn-anvil depressions; M, midden; L, lithics; SF, stone features; HP, housepits; Cr, ceramics; S, shell; Pi, pictographs; Pe, petroglyphs; B, human burials; HS, historic debris; FP, fireplace; F, faunal; St, steatite; LQ&K, limestone quarry and kilns; RR, railroad.

** NRHP proposed eligibility status; Dist, district nomination; C, Criterion C; D, Criterion D.

*** Site descriptions and eligibility determinations for archeological sites on Lake Kaweah taken from Meighan et al. (1988) preliminary report.

attempts to establish a government sanctioned rancheria. As such these sites transcend studies in archeology, history, and ethnography and are likely to yield information concerning Native American and Euro-American relations in the region.

One site, CA-TUL-1470, a portion of a standing fireplace, with other apparently disassociated historic debris nearby, is not considered significant. Examination of historic records, including land patents, grant deeds, and various historic maps and atlases did not reveal information regarding the ownership or origin of the structure which presumably housed the fireplace. Without contextual information it is not likely the site (as an archeological feature) would provide information useful to any research domains and the site is considered ineligible for nomination to the NRHP.

As noted in Chapter 3, the ranch complex currently known as the Homer Ranch requires additional architectural, archeological, and historic documentation in order to evaluate its potential significance in terms of potential National Register eligibility. The ranch complex and associated subsurface features (if present) can potentially yield information useful in the study of early Euro-American settlement and land use of the Dry Creek area.

Some of the archeological sites have been adversely affected by road construction, grading, cattle grazing, and/or erosion. We would argue, however, that all sites retain integrity insofar as significant data are likely to be present to address the appropriate research questions outlined above.

Ethnographic Research Domains and Evaluation

Basic ethnographic research domains have been discussed previously in Section 3.0. These include issues relating to Native American subsistence technology, ethnobotany, and ethnohistoric reconstruction.

Current research in the area of subsistence technology and its interpretive significance has focused on reconstructing traditional plant foods processing using technology represented by bedrock mortars, grinding or milling slicks, and portable mortars (McCarthy et al. 1986). McCarthy et al. were able to demonstrate that mortar size and shape is related to mortar function for the North Fork Mono. A model of mortar function may be used to determine activities that occurred at a given site locality, and such knowledge can contribute to a more sophisticated assessment of the natural resource base exploited by prehistoric and historic-period Native American groups, along with questions regarding division of labor and social relationships.

It became apparent during the recording of bedrock mortar features for the present study that certain patterns of mortar size and placement are recurrent. For

example, a large mortar in excess of 22 cm diameter and 22 cm depth would often have two smaller (6-8 cm diameter, 1-4 cm deep) mortar cups along it's rim. In addition, several bedrock mortar features also contained boulders with small cupules, possibly acorn anvil depressions, generally 4-6 cm in diameter and 1-2 cm deep. This pattern of mortar placement and size contrasts with that observed by McCarthy et al. (1985) for the North Fork Mono.

Specific data requirements which are needed to address questions relating to mortar function and size, as per the research outlined above, are stationary milling features with milling surfaces. All of the prehistoric archeological sites identified in the Dry Creek drainage contain such features. At several archeological sites localities, it was apparent that mortar depressions had been "made" on extant grinding slicks. The possibility exists, therefore, that changes in milling processes may be derived through study of changes in use over time of stationary milling features. Conversely, these features may also represent different activities employed concurrently.

Ethnographic research and consultation for this study initially focused on Native American interpretation of archeological sites discovered during the course of field inventory; however, an additional productive avenue of research involved consultants memories of the recent occupation of the drainage. Of particular importance, in relation to archeological remains identified within the APE, was the indication that "an elderly white man" had attempted to develop a government-recognized rancheria in the northernmost portion of the APE, somewhere in the immediate vicinity of CA-TUL-1443H and -1444H. In addition to this locale, several post-contact Native American residences and sites of internment were also indicated within the APE. The historic-period Native American residential sites in the Dry Creek drainage span an important period of cultural change for the the Wukchumni Yokuts, a period for which there is little written documentation. Important research domains which are related to ethnohistoric reconstruction include Indian/non-Indian relationships, acculturation, and accommodation to pressures exerted by the surrounding non-Indian society.

Recommended NRHP Eligibility Status for Cultural Resources

Following our specified areas of research and the nature of the historic properties identified during the course of fieldwork, it is perhaps most useful to approach the evaluation of significance of these historical properties on a district level. For purposes of significance evaluations, a district is an historic environment that conveys a sense of time and place through the survival of many different kinds of features and the survival of the relationships among these features (NPS 1982:22). Due to the integration of archeological data with ethnographically-derived information in the study of culture process, for example in the study of mortar size

and function, it is recommended that the proposed archeological district encompass all historic properties identified, in addition to the ethnographic localities. The proposed historic district is a distinguishable entity within the lower Dry Creek drainage incorporating a suite of cultural components, the relationships among which provide for the study of changing patterns of subsistence and food processing, natural resource use, gender studies, environmental adaptations, population movements and ethnicity, rock art, and historic cultural changes occurring in Native American communities under the pressures of the surrounding non-Indian society.

In the Lake Kaweah area we concur with the eligibility recommendations made by Meighan et al. (1988) and summarized in Table 5. CA-TUL-1040, -1043, and -1044 are considered eligible under criteria 'C' and 'D'. Sites CA-TUL-1041, -1042, -1045H, and -1046 apparently do not meet any eligibility criteria.

NATIVE AMERICAN HERITAGE CONCERNS: ANALYSIS AND RECOMMENDATIONS

A major focus of the ethnographic research has been to describe the Wukchumni community's concerns about the impacts of the proposed project alternatives. To this end researchers worked closely with the Wukchumni Council of Visalia, a group which represents Wukchumni descendants from the Kaweah River area. Representatives of the Tule Reservation were also contacted, although most discussions concerning impacts and mitigation recommendation were held with the Council.

The Wukchumni Council was established in 1985 for the express purpose of preserving traditional social, religious and subsistence knowledge. Since its establishment, the Council has taken an active role in the preservation of traditional Wukchumni sites and locales, an effort which has included the Dry Creek drainage. The following recommendations are based on lengthy discussions with Council representatives, although in some instances an interpretation of the concerns of the Council has been made by the researchers. The recommendations are arranged by topic.

Archeological Sites (Cemeteries, Burial Sites, and Rock Art)

Wukchumni Council representatives are very concerned about the disposition of traditional sites. Two leaders of the group stated that they had been taught that the sanctity of a place, that is, the power invested in it at creation or through subsequent ceremonies and religious activities, takes precedence over the material objects at a site. With this precept in mind, Council representatives recommended that sites be left undisturbed and that the Dry Creek reservoir alternative be abandoned. The Council cited the importance of visiting these sites, particularly

at the present time as they are engaged in the twin efforts of heritage preservation and Wukchumni identity restoration and maintenance.

Should the reservoir be constructed (or any other activity undertaken which would result in disturbance to sites), the Council made the following recommendations:

1. Monitors should be present at all sites during archeological testing or data recovery. These monitors would have the responsibility of communicating directly with Council representatives and other Wukchumni leaders concerning the progress of the field research.

2. Human remains should be left in place, even if they are subject to inundation. This recommendation is based in part on the traditional belief that: (a) the original location of a burial is sacred; (b) all associated "grave goods" or burial associated artifacts might not be recovered if a burial were removed and relocated; and, (c) spirits of displaced burials may become restless. There is a possibility that gravel extraction or other project-related subsurface disturbances may impact areas where human remains have been identified or are likely to occur. In this case, removal and relocation of human burials and associated burials artifacts may be appropriate. If human remains are encountered during project-related activities, work in the immediate vicinity of the identified burials should cease, and the appropriate individuals should be contacted and their recommendations followed prior to resuming construction activities.

3. Rock art sites are considered to be transient in nature and elaborate attempts at preservation (e.g., moving rock art panels or detailed recording) would be of no benefit to community members. Two leaders stated that some community members would feel comfortable covering or painting the existing panels, should they feel moved to do so. Further they stated that the loss of the panels through natural processes resulting from exposure has been acceptable, although they do not favor the accelerated destruction which would follow inundation.

4. Finally, the Wukchumni Council wishes to be closely involved in all future stages of planning for the Kaweah River Basin projects. This participation should include representation at the time archeological testing or data recovery are planned as well as feel participation in the work itself. The Council also wishes to coordinate the participation of other concerned Wukchumni individuals or families from the Tule Reservation, Lemoore Rancheria or other areas.

5.0 REFERENCES CITED

Baker, P. Y.
1876 Map of Tulare County, California. Map on file, Shields Library, University of California, Davis.

Bannister, A.
1883 Map of Tulare County. Map on file, Shields Library, University of California, Davis.

Barnes, E. K.
1985 Sierra Sub-Glacial Potholes: Their Sigificance in California Geology, with a Note on Archaeology. Unpublished ms. in author's possession.

Basgall, M. E.
1987 Resource Intensification among Hunter-Gatherers: Acorn Economies in Prehistoric California. Research in Economic Anthropology 9:21-52.

Berryman, L. E., and A. B. Elsasser
1966 Terminus Reservoir: Geology, Paleontology, Flora and Fauna, Archaeology, History. United States Army Corps of Engineers, Sacrmento District.

Bettinger, R. L.
1987 Archaeological Approaches to Hunter-Gatherers. Annual Review of Anthropology 16:121-142.

Conkey, M. W., and J. D. Spector
1984 Archaeology and the Study of Gender. In, Advances in Archaeological Method and Theory, Vol. 7, edited by M.B. Schiffer, pp. 1-38. Academic Press, New York.

County of Tulare, Recorders Office
1855-1892 Land Patents and Grant Deed records. Tulare County Recorder's Office, Visalia.

Edw. Denny Map Co.
1911 Map of Tulare County, California. Map on file, Shields Library, University of California, Davis.

Fee, D. J.
1980 An Archeological Assessment of Sequoia-Kings Canyon National Parks, California. Ms. on file, Western Archeological Center, National Park Service, Tuscon.

Fenenga, F.
1952 The Archaeology of the Slick Rock Village, Tulare County, California. American Antiquity 4:339-347.

Gayton, A. H
1930a The Ghost Dance of 1870 in South-Central California. University of California Publications in American Archaeology and Ethnology 28:57-82.

1930b Yokuts-Mono Chiefs and Shamans. University of California Publications in American Archaeology and Ethnology 24:361-420.

1945 Yokuts and Western Mono Social Organization. American Anthropologist 47:409-426.

1946 Culture-Environment Integration: External References in Yokuts Life. Southwest Journal of Anthropology 2:252-268.

1948 Yokuts and Western Mono Ethnography. University of California Anthropological Records 10(1).

Gorden, M. A.
1988 Archeological Site Description: Ca-Tul-341 (Draft). Unpublished ms. in author's possession. Copy on file, BioSystems Analysis, Inc., Santa Cruz, CA.

Holland, R. F.
1986 Preliminary Descriptions of the Terrestrial Natural Communities of California. Department of Fish and Game, Sacramento, CA.

Jackson, T. L.
1990 Pounding Acorn: Women's Production as Social and Economic Focus. In, Women and Production in Prehistory, edited by M. Conkey and J. Gero. Basil Blackwell, Cambridge, MA.

Latta, F. F.
1977 Handbook of Yokuts Indians. Second Edition, Bear State Books, Santa Cruz.

McCarthy, H., R. A. Hicks, and C. M. Blount
1985 A Functional Analysis of Bedrock Mortars: Western Mono Food Processing in the Southern Sierra Nevada. In, Cultural Resources of the Crane Valley Hydroelectric Project Area, volume 1. Submitted by INFOTEC Research, Inc, and Theodoratus Cultural Research, Inc., to Pacific Gas and Electric Company, San Francisco.

Meighan, C. W., B. D. Dillon, D. V. Armstrong, P. Farnsworth, D. S. Whitley, E. A. Gehr, L. Conton, and R. H. Dillon
1988 Lake Kaweah Intensive Cultural Resources Survey. Submitted by the Institute of Archaeology, University of California, Los Angeles, to the U.S. Army Corps of Engineers, Contract No. DACW05-83-C-0107.

Menefee, E. L., and F. A. Dodge
1913 History of Tulare and Kings Counties, California. Historic Record Company, Los Angeles.

Mitchell, A.
1972 Land of the Tules. Valley Publishers, Fresno, CA.

1976 The Way It Was. Valley Publishers, Fresno, CA.

Moratto, M. J.
1972 A Study of Prehistory in the Southern Sierra Nevada Foothills, California. Ph.D. dissertation, University of Oregon. University Microfilms, Ann Arbor.

1984 California Archaeology. Academic Press, Orlando, Florida.

Moye
1920 Map of Tulare County, California. Map on file, Shields Library, University of California, Davis.

Pendergast, D. W. and C. W. Meighan
1959 The Greasy Creek Site, Tulare County, California. Annual Reports of the University of California Archaeological Survey 1:10, Los Angeles.

Pogue, G. C.
1971 Within the Magic Circle. Woodlake.

Smith, A. McC. (editor)
1974 A Modern History of Tulare County. Limited Editions of Visalia, Inc.

Smith, S.
1901 Official Map of Tulare County, California. Map on file, Shields Library, University of California, Davis.

1909 Official Map of Tulare County, California. Map on file, Shields Library, University of California, Davis.

Theodoratus Cultural Research, Inc., and Archaeological Consulting and Research Services, Inc. (TCR/ACRS)
1984 Cultural Resources Overview of the Southern Sierra Nevada: An Ethnographic, Linguistic, Archaeological, and Historical Study of the Sierra National Forest, Sequoia National Forest, and Bakersfield District of the Bureau of Land Management. Report submitted to the U.S. Forest Service.

Thompson, T. H.
1892 Official Historical Atlas Map of Tulare County. On file, Tulare County Library, Visalia.

Varner, D. M., and R. Bernal
1976 Archaeological Investigations at Kerckhoff Reservoir, Madera County. Report submitted to Pacific Gas and Electric Company, San Francisco, CA.

6.0 GLOSSARY

Acculturation	The adoption of a trait or traits by one culture from another; the influence of one culture on another.
Anthropology	The study of humankind, extant and extinct, from an all-encompassing holistic approach.
Archeology	The study of the human past as revealed through the study of their material remains.
Area of potential effects	The geographic area or areas within which an undertaking may cause changes in the character or use of historic properties, if any such properties exist.
Assemblage	The totality of artifacts found in any one component or single locality.
Auger	An instrument used to bore into the soil to determine the depth or distribution of cultural materials, or to collect soil samples.
Batholith	An intrusive mass of rock (usually granitic), which extends over an area larger than 100 square kilometers.
Bedrock mortar (BRM)	A cup-shaped depression in a bedrock outcrop generally used for processing plant foods (such as acorns); usually used with a pestle.
Cultural Resource Management	The conservation and carefully planned investigation of archeological, ethnographic, or historical materials; generally refers to efforts to safeguard remains of the past through legislation and applied archeology, ethnography, or history.
Cupule	A small cup-shaped depression approximately 5 cm diameter by 1 cm deep; usually found in groups on granite boulders.

Debitage	Lithic debris produced during flaked stone tool manufacture.
Ethnogeography	The comparative study of the spatial distribution of cultures.
Ethnography	A primarily descriptive study of contemporary or modern cultures.
Feature	A large, complex artifact (usually immobile) or part of a cultural site (e.g., hearth, rock alignment, bedrock mortar).
Flake	A fragment from the manufacture of a knapped stone tool which has been removed by the application of force; the flake exhibits a characteristic platform and bulb of force at the proximal end.
Historic property	Any prehistoric or historic district, site, building, structure, or object included, or eligible for inclusion in the National Register. This term includes, for the purposes of these regulations, artifacts, records, and remains that are related to and located within such properties. The term "eligible for inclusion in the National Register" includes both properties formally determined as such by the Secretary of the Interior and all other properties that meet National Register listing criteria.
Homestead Act of 1862	The United States Congressional act which allowed a claimant to occupy up to 160 acres of public land and, upon completion of certain improvements and a period of residence, allowed the claimant to take possession of the land.
Integrity	A wholeness or completeness. As part of the National Register criteria, a property must have "integrity of location, design, setting, materials, workmanship, feeling and association."
Isolate	The location and artifact assemblage of less than three associated artifacts which are at least 45 years of age.

Lithic	Pertaining to stone. In archeological terms, it refers to the material (e.g., obsidian, chert, basalt) used by prehistoric people to manufacture certain types of tools.
Midden	A localized deposit containing such materials as discarded artifacts, bone and shell food refuse, charcoal, ash, rock, and structural remnants, and produced as a byproduct of human occupation.
Mitigation	Minimization. As related to Cultural Resource Management, it refers to actions designed to reduce adverse effects to the resources by avoidance, data collection, or other means to preserve potential data.
National Historic Landmark	A historic property that the Secretary of the Interior has designated a National Historic Landmark.
National Register	The National Register of Historic Places maintained by the Secretary of the Interior.
Obsidian hydration dating	The technique of dating obsidian artifacts by measuring the thickness of a microscopic layer of water saturated obsidian on an artifact.
Pestle	An elongate, often cylindrical or triangular, stone or wooden artifact used to pound food products; usually used with a mortar (see bedrock mortar).
Petroglyph	An engraved rendering, usually made by pecking shallow grooves into a stone surface, which represents a form of nonverbal communication.
pH	A numerical measure of the acidity or alkalinity level of a soluble medium. The numerical scale ranges from 1.0 (acidic) to 14.0 (basic) with 7.0 indicating a neutral condition.
Phase	An archeological construct possessing traits sufficiently characteristic to distinguish it from other units similarly conceived; spatially limited to roughly a locality or region and chronologically limited to a relatively brief interval of time.

Pictograph	A painted rendering, often found on the walls of caves or cliffs, that represents a form of nonverbal communication.
Rancheria	An area of land set aside by the state or federal government for the exclusive habitation of Native Americans; generally refers to any area of land inhabited by a group of Native Americans.
Significance	Of important consequence or relativity. As related to Cultural Resource Management, the significance of a potential historic property is assessed in relation to a defined frame of reference such as scientific, historical, ethnic, or legal.
Site	The location of associated artifacts and features, regardless of temporal placement or complexity which meet the following two criteria: (1) it consists of at least three associated artifacts or a single feature; and, it must be at least 45 years of age.
Shovel scrape	An excavation unit approximately 1x1 m and 5 cm deep, used to evaluate the distribution of cultural materials on the soil surface.
Steatite	Talc (hydrous magnesium silicate) or soapstone--a very soft and easily carved metamorphic rock used as a raw material for bowls, beads, cooking vessels, etc.
Traditional resources	Those resources which possess a role in the traditional and continuing lifeways of a society. For example, a location associated with the traditional beliefs of a Native American group about its origins, its cultural history, or the nature of the world.

APPENDIX E

LAND USE

STUDY

KAWEAH RIVER BASIN
INVESTIGATION
DRAFT EIS/EIR

CONTENTS

Topic		Page
1.0	Introduction	872
2.0	Proposed Project	872
3.0	Existing Conditions	873
	3.1 Methodology	873
	3.2 Kaweah Reservoir	874
	3.3 Downstream Area	875
	3.4 Tulare Lakebed	880
4.0	Land Use Trends (No-Action Alternative)	880
	4.1 Overview/Methodology	880
	4.2 Flood Protection	883
	4.2.1 Kaweah Reservoir	884
	4.2.2 Downstream Area	884
	4.2.3 Tulare Lakebed	885
	4.3 Water Supply	885
	4.3.1 Kaweah Reservoir	886
	4.3.2 Downstream Area	886
	4.3.3 Tulare Lakebed	887
	4.4 Cropping Patterns	887
	4.4.1 Kaweah Reservoir	888
	4.4.2 Downstream Area	888
	4.4.3 Tulare Lakebed	889
5.0	Future Projections (Selected Plan)	890
	5.1 Overview/Methodology	890
	5.2 Flood Protection	892
	5.2.1 Kaweah Reservoir	893
	5.2.2 Downstream Area	893
	5.2.3 Tulare Lakebed	894
	5.3 Water Supply	895
	5.3.1 Kaweah Reservoir	896
	5.3.2 Downstream Area	896
	5.3.3 Tulare Lakebed	896
	5.4 Cropping Patterns	897
	5.4.1 Kaweah Reservoir	897
	5.4.2 Downstream Area	897
	5.4.3 Tulare Lakebed	898
6.0	Conclusions	898
7.0	References	900
8.0	Personal Communications	901

Tables

Number		Page
1	Existing Land Use	874
2	Future Land Use With and Without Project	883
3	Land Use in Existing and Post-Project 100-Year Floodplains	891
4	Future Conditions	899

Figures

1	Native Vegetation and Other Potential Wildlife Habitat	876
2	Kaweah River Development Corridor	882
3	Existing 100 and Post 100-Year Flood Plains	892

Appendixes

A	Regulation on Hacienda Ranch Property	902
B	Individual Comments on Future Land Use	920

KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA

LAND USE APPENDIX

August 1995

1.0 INTRODUCTION

This report provides a detailed analysis of land use changes that could potentially result from changes in reservoir operation and seasonal water supply due to the proposed project alternatives. The analysis includes existing land uses and those projected over the next 100 years under with- and without-project conditions. The study area encompasses 639,126 acres and includes the reservoir area above the dam, the Kaweah Delta Water Conservation District (KDWCD) service area, the 100-year flood plain below Terminus Dam, and the Tulare lakebed.

The purpose of this analysis is to provide a basis for determining effects on land use due to the project alternatives. Land uses for the study area have been delineated and quantified according to land use type under existing, future with-, and future without-project conditions.

Major factors affecting land use discussed in this report include land use trends and development plans, along with urban, agricultural, open space, and wildlife habitat conversion and the factors encouraging or inhibiting such conversions. Such factors include historical patterns of development, county and city general plans and zoning, impacts of flooding on land use, and agricultural limitations including water supply and soil type.

2.0 PROPOSED PROJECT

The existing Terminus Dam forms a reservoir on the Kaweah River of 143,000 acre-feet at gross pool. The project was constructed for 150,000 acre-feet of storage, with 142,000 acre-feet for flood control space and 8,000 acre-feet for sedimentation. Since construction in 1962, the sedimentation space has been reduced to 1,000 acre-feet through inflow of sediment in magnitudes greater than anticipated. Terminus Dam was authorized for flood protection and water supply. Recreation was developed at Lake Kaweah under Section 710, and hydropower was recently retrofitted by the Kaweah Power Authority.

The project alternatives include raising and widening the spillway at Terminus Dam. The elevation of the spillway would be raised by 21 feet from 694 to 715 feet, mean sea level (m.s.l.). This would raise the gross pool by 21 feet and add 42,600 acre-feet of flood storage space in Lake Kaweah. As a result, the total flood storage capacity in the lake would increase from 143,000 acre-feet to 185,600 acre-feet.

The spillway would be widened from the existing 307 feet to 455 feet. An ungated concrete ogee section would be placed over the existing concrete broad-crested sill. Rock excavation would be required at the right and left abutments, with most of the excavation taking place on the left abutment.

No new access roads would be required, and no existing access roads would be relocated. The existing bridge over the spillway would be lengthened by 140 feet to accommodate the widening of the spillway. This lengthening would involve adding two 70-foot concrete spans to the bridge.

To accommodate the rise in gross pool elevation, the existing State Highway 198 bridge over Horse Creek would be raised by 7 feet. Currently, the lowest elevation on the bridge is 711.5 feet, m.s.l., and this would be reconstructed at the new height of 718.5 feet. The highway leading into and out of the bridge would be raised and reconstructed for about 1,500 feet on each side. The structural design would be the same as the existing highway. The location of the bridge and highway would be slightly offset.

The total land required for the project alternatives would be approximately 820 acres of mitigation land and approximately 618 acres of land acquired by flowage easement and fee simple rights in the reservoir area.

3.0 EXISTING CONDITIONS

The study area is composed of three distinct geographic areas: the area surrounding Lake Kaweah (called Kaweah Reservoir), the area between the dam and the Tulare lakebed (called the downstream area), and the Tulare lakebed. Each is addressed separately throughout the remainder of this appendix.

3.1 Methodology

Land use data have been derived from historic records maintained by the Department of Water Resources (DWR), records provided by the KDWCD, the Tulare Lake Basin Water Storage District, the County of Tulare, and the City of Visalia. Aerial photos were reviewed, and field investigations were conducted. In addition, numerous individuals having extensive knowledge of the area were interviewed. Information was also provided by the U.S. Corps of Engineers' economics branch.

Land use was determined using DWR 1993 land use maps for Tulare and Kings Counties. DWR conducts detailed land use surveys for use in determining urban and agricultural water needs. Aerial 35-millimeter color slides, taken immediately before the survey, are used as the main reference for field boundaries, and in some instances, to help identify crop types. The transfer of information from the slide to the quad is done by photo-interpretation. Delineation made on the quads are all verified in the field, and then the information is digitized. Land

use types were summarized in categories of native vegetation, agricultural, and urban/commercial. Existing land use acreages are shown in Table 1.

TABLE 1
Existing Land Use

	Existing		
Land Use (Acres)	Kaweah Reservoir	Downstream Area	Tulare Lakebed
Riparian	72	6,672	0
Grassland	145	7,030	0
Oak Savanna/woodland	228	10,107	0
Other/fallow (disturbed/flooded)	36	3,682	46,345
Row crops/pasture	0	230,078	50,267
Orchards	0	42,165	0
Cotton	0	102,644	88,333
Urban/commercial	27	65,469	10
Total	508	467,847	184,945[1]

[1] Source: Tulare Lakebed Water Storage District

Areas of native vegetation were identified and planimetered off U.S. Geological Survey 7.5-minute quadrangles with a Leitz electronic planimeter. Aerial photographs scaled 1 inch = 400 feet assisted in land use interpretations as well as site visits.

3.2 Kaweah Reservoir

The investigation covers approximately 589 acres of land around the lake, including 243 acres of shoreline between the existing gross pool elevation of 694 feet to 715 feet, m.s.l. Plant communities of the Lake Kaweah area are typical of the western slope of the Sierra Nevada range. The area is characterized by oak-savanna interspersed with oak woodland which supports extensive grazing. Three picnic areas, one campground, one boat launching ramp, and one marina/ramp combination facility are located on the south shore of the lake for public recreation. The community of Three Rivers, which has approximately 3,500 people, is situated along the Kaweah River near where the river enters the lake. Three Rivers is primarily a retirement community and a tourist stop for visitors on their way to and from Kings Canyon and Sequoia National Parks. Several single-family homes and motels are located along the Kaweah River as it enters the reservoir.

Approximately 3,100 acres of land have been acquired by the Corps for Terminus Dam and Lake Kaweah. Of this total, 300 acres are in flowage easements and are not available for public use. All of the remaining 2,800 acres

owned by the Corps are available for public use except for a small area near the dam which is restricted to the public for safety reasons. Land uses by the Corps for Terminus Dam/Lake Kaweah are allocated into the following categories: project operations, intensive recreation, low-density recreation, and wildlife management.

3.3 Downstream Area

Land use downstream of Terminus Dam is closely tied to agriculture, especially as the land flattens and opens onto the San Joaquin Valley floor. Generally, much of the relatively narrow zone of agricultural land between Terminus Dam and Visalia is planted in citrus and deciduous fruit orchards, interspersed with mixed vegetable crops.

Land use within the channels of the Kaweah River is open space and supports a variety of native and non-native riparian vegetation. The native vegetation consists of willow, grasses, forbs, scattered oaks, and cottonwood trees. The non-native, weedy giant reed has become naturalized in sections of many downstream channels, choking out much of the native vegetation. Riparian vegetation was historically distributed along both the main waterways and the secondary, smaller overflow channels. Agricultural, urban, and industrial encroachment have eliminated the riparian vegetation along most of the smaller channels and reduced the remaining vegetation to a narrow band along the edge of the waterways.

Large and small patches of native vegetation are scattered throughout the land downstream of Terminus Dam. This area supports significant remnants of Great Valley oak riparian forest. This plant community is found only in California's Central Valley and is in serious decline. It is second only to southern California's Engelman oak riparian forest in its threatened status. A prime example of the valley oak riparian forest community is found on the Kaweah Oaks Preserve. The 340-acre preserve is located on a distributary of the lower Kaweah River and is owned and managed by The Nature Conservancy.

Locations of native vegetation and urban areas are shown in Figures 1A through 1D. Types of native vegetation tabulated include riparian (stream and open wetland), previously agriculture now developed, previously agricultural now grassland, previously agricultural now intermittent flood basin, agricultural, open water/ponding basin/evaporation pond, undisturbed grassland which includes oak savanna woodland, disturbed grassland, and riparian/grassland miscellaneous.

Land within the city limits of the scattered municipalities such as Visalia, Lemon Cove, Exeter, Farmersville, and Tulare has been either developed for commercial uses or supports high- and low-density residential housing. Any remaining open space within the city limits has been significantly disturbed by the surrounding community. The communities of Visalia, Tulare, and Hanford are

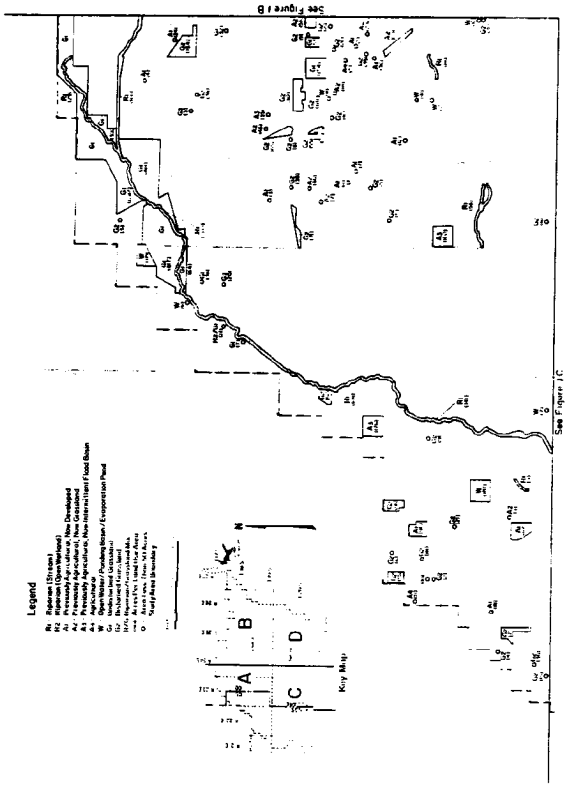


Figure 1A. Kaweah River Basin Investigation--Project Area
Native Vegetation and Other Potential Wildlife Habitat

California Department of Water Resources
San Joaquin District
Fresno, California

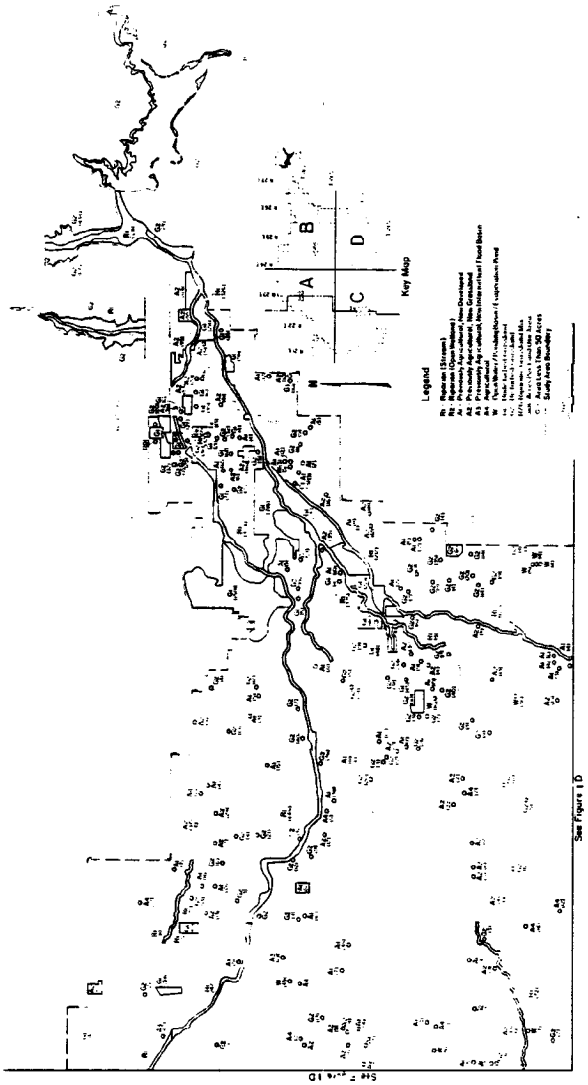


Figure 1B. Kaweah River Basin Investigation--Project Area
Native Vegetation and Other Potential Wildlife Habitat

California Department of Water Resources
San Joaquin District
Fresno, California
June 1989

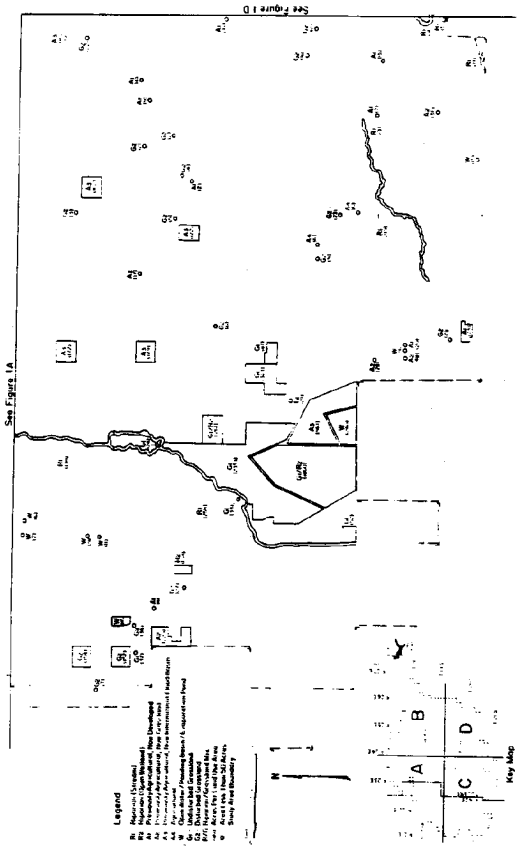


Figure 1C. Kaweah River Basin Investigation--Project Area
Native Vegetation and Other Potential Wildlife Habitat

California Department of Water Resources
San Joaquin District
Fresno, California
June 1989

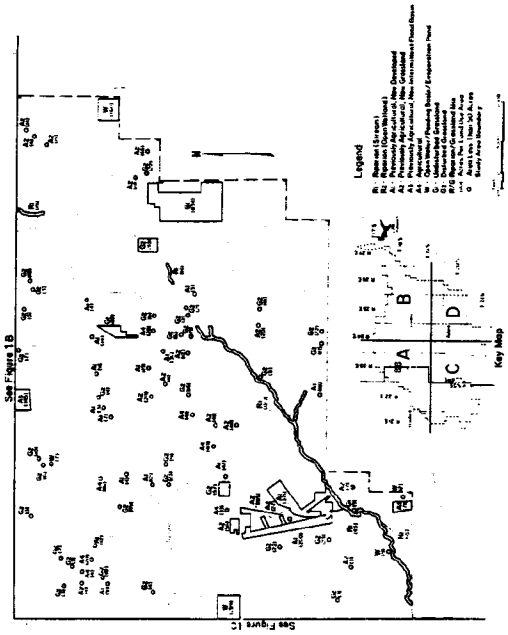


Figure 1D. Kaweah River Basin Investigation--Project Area
Native Vegetation and Other Potential Wildlife Habitat

California Department of Water Resources
San Joaquin District
Fresno, California
June 1980

rapidly expanding their boundaries into the outlying agricultural areas. However, Tulare County has a strong land use plan that supports agriculture as the primary land use for elevations under 600 feet. Urban development boundaries are strictly enforced.

3.4 Tulare Lakebed

Tulare lakebed is located within the Kaweah River flood plain. The majority of the land is developed for agriculture. The main crop is cotton, including lint and seed cotton. Safflower, seed alfalfa, wheat, and barley are also grown in the lakebed. There is no significant riparian vegetation or native habitat. Flooding in the lakebed can occur from the Kings, Kaweah, Tule, and Kern Rivers plus local runoff – individually or at the same time.

Two areas near the lakebed have been purchased, improved, and reserved for storing irrigation and floodwaters. These areas have been farmed in the past but did not prove productive. They are South Wilbur and Hacienda Ranch Tracts. The purchase of Hacienda Ranch included State water rights. In 1981, DWR was petitioned for permission to relocate the State water rights that were attached to Hacienda Ranch to a more productive area within the lakebed. The resulting agreement prohibits any application of surface water or well water to the Hacienda Ranch property. Permission to sell must be obtained from DWR before any sale of Hacienda Ranch property can occur. If it is sold, the same stipulation will hold that no surface water irrigation or well water can be applied (Appendix A).

4.0 LAND USE TRENDS (NO-ACTION ALTERNATIVE)

This section of the appendix discusses expected future land uses in the study area to the year 2099 under the no-action alternative.

4.1 Overview/Methodology

Future land uses were determined by reviewing numerous planning documents, including county general plan, a growth management plan, and a rural valley lands plan. In addition, knowledgeable individuals were contacted and asked about predicted growth in the study area.

The potential project area and its zone of influence from Lake Kaweah to the Tulare-Kings County line fall within the planning authority of the Tulare County General Plan. The remaining western portion of the project area falls within the planning authority of the Kings County General Plan. These plans regulate how land can be used. Any proposed changes must go through a public review process.

The Tulare County General Plan contains several smaller planning elements that address specific regions of the County. The two elements that apply to this

project are the Foothill Growth Management Plan (FGMP), which extends westward from Lake Kaweah to the toe of the Sierras, and the Rural Valley Lands Plan, which extends from the toe of the Sierras to the Tulare-Kings County line. These two planning documents contain the planning goals of the two regions.

The objectives of Tulare County's FGMP are to (1) rationally direct urban/suburban growth into specific areas of the foothills in order to protect the fragile environment; (2) maintain the agricultural viability of the foothills by identifying areas to be maintained or encouraged for intensive and extensive agricultural uses; and (3) accommodate urban/rural growth in the areas serviceable by State and/or county agencies in a manner which is cost-efficient and consistent with the environmental constraints.

The FGMP, adopted in 1981, identifies foothill areas, referred to as development corridors, that are suitable for development based on the following considerations:

Physical – topography, soils, flooding potential
Biological – wildlife habitat, threatened and endangered species
Access – emergency vehicle response time
Cultural – land use, archeological sites
Governmental – jurisdiction, as preserves

The Kaweah River Development Corridor is shown in Figure 2. The FGMP's development standards prohibit improvements near riparian woodlands and the development of residences within the 100-year flood plain. The standards also prohibit the removal of native trees in open space areas. Lands outside of the development corridor have an intensive agriculture land use designation and a foothill-agriculture zoning, which requires a minimum parcel size of 160 acres. The primary activity in these zones is cattle grazing.

Native vegetation does not receive any special protection in the county general plans except for native trees with diameters greater than 6 inches, measured at 3 feet above ground surface, under the Planned Development - Foothill Combining - Special Mobile Home Zone (PD-F-M). These trees should be mapped on final site plans and should not be removed or graded around unless it is determined necessary due to circulation alignments or infrastructure requirements. Also any portion of a development site which is adjacent to a water course area, is within the 100-year floodplain, contains undeveloped slopes of 30 percent or more, or exhibits environmental, archeological, or historical sensitive areas shall remain in open space.

The Tulare and Kings County General Plans were investigated in order to determine the existing zoning for land uses. The California Department of Finance, Demographic Research Unit, was contacted for the population projections for Tulare and Kings Counties to determine future projected growth in the area.

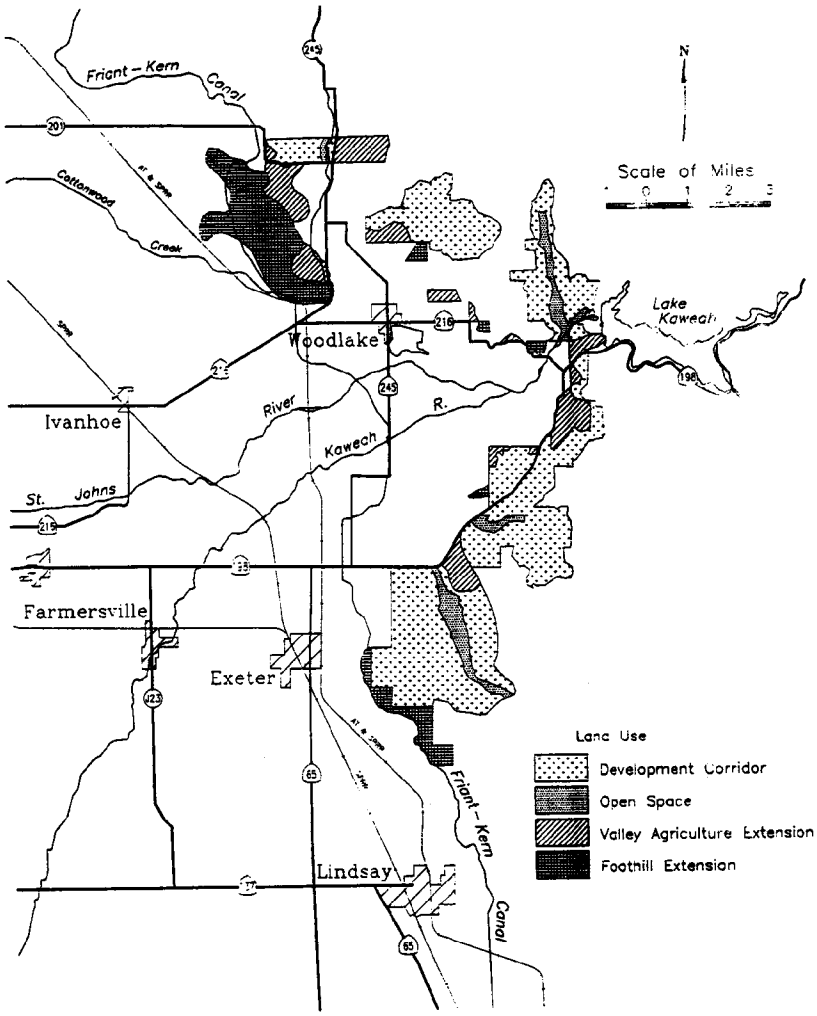


Figure 2. Kaweah River Development Corridor
Source: Foothill Growth Management Plan

Several knowledgeable people familiar with the project or the area were contacted to obtain their professional opinions about land use changes in the future for both with- and without-project conditions. Their opinions, provided in Appendix B, were taken into account when making future projections.

After reviewing county and local plans, factors that can affect future land use changes were identified. They are increased availability of water, elimination of flooding, changes in cropping patterns, water delivery systems, and lands going out of production due to ground-water overdraft.

Acreages of future land use with and without the project are shown in Table 2.

TABLE 2
Future Land Use With and Without Project
(acres)

	Future with Project			Future Without Project		
Land Use	Kaweah Reservoir	Downstream Area	Tulare Lakebed	Kaweah Reservoir	Downstream Area	Tulare Lakebed
Riparian	2	6,672	0	72	6,672	0
Grassland	66	7,030	0	145	7,030	0
Oak savanna/ woodland	92	10,107	0	228	10,107	0
Other/fallow (disturbed/ flooded)	6	3,682	46,345	36	3,682	46,345
Row crops/ pasture	0	228,597	50,267	0	228,597	50,267
Orchards	0	42,165	0	0	42,165	0
Cotton	0	102,644	88,333	0	102,644	88,333
Urban/ commercial	21	66,950	10	27	66,950	10
Total	187	467,847	184,945[1]	508	467,847	184,945[1]

[1]Source: Tulare Lakebed Water Storage District

4.2 Flood Protection

The Kaweah River Basin is known to have a long history of flooding, and many large rain floods and snowmelt floods have been documented. The largest and most destructive rain flood to occur since the turn of the century and prior to

the completion of Terminus Dam occurred in December 1955. A peak flow of 87,000 cubic feet per second (cfs) was estimated at McKays Point.

Intense rainfall occurred over the Kaweah River Basin during January 1969, and without Terminus Dam the peak flow at McKays Point would have reached 40,000 cfs. However, Terminus Dam reduced Lake Kaweah outflow to nearly zero.

Tulare County has participated in the Federal Emergency Management Agency's (FEMA) National Flood Insurance Program since July 1983. FEMA maps were developed that display 100-year and 500-year flood plains for the County. Owners of developed property located in the 100-year flood plain prior to 1983 have the option to purchase FEMA's flood insurance. If developed property located within the 100-year flood plain is refinanced or sold, terms of the new mortgage will require that the property be covered by flood insurance.

4.2.1 Kaweah Reservoir

The existing dam and reservoir are operated by the Corps for the primary purpose of flood control. The Corps has historically coordinated closely with downstream water users to ensure that the reservoir is operated according to Federal requirements, contractual water rights, and local needs. This coordination will continue with or without the project. Flooding will continue as it does now in the Three Rivers area.

4.2.2 Downstream Area

Existing conditions do not prevent development in the flood plain. Flooding depth in much of the area is 1 foot or less. A structure can be elevated above this level with a basic foundation or slab. For a developer building a subdivision in the flood plain or floodway, the cost of satisfying all of the conditions to develop in the floodway is not significant when prorated over several homes. However, this cost may be significant enough to deter an individual from building a single structure.

In order to develop land located within FEMA's 100-year floodway, the following three conditions have to be met: (1) the structure must be elevated above the water surface of the 100-year flood, (2) if fill material is used to elevate the structure, the fill must come from within the floodway (in order not to reduce the conveyance capacity of the floodway), and (3) an HEC II run or the equivalent, prepared by a certified professional engineer, must be submitted to attest that the conveyance capacity of the floodway will not be diminished by the proposed development. The results of the HEC II run and the proposed development would have to be approved by FEMA.

FEMA distinguishes between the flood plain and the floodway. A floodway is used as a tool to assist local communities in balancing the economic gain from

flood plain development against the resulting increase in flood hazard. The area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent land area required to pass the 100-year flood discharge without cumulatively increasing the water-surface elevation at any point more than 1 foot above the pre-floodway condition. Construction requirements within the floodway fringe are less strict than for construction within the narrower floodway. In order to construct in the floodway fringe, only criterion (1) above needs to be met.

4.2.3 Tulare Lakebed

Floodwaters are conveyed from Lake Kaweah to the Tulare lakebed via two principal distribution systems. From the north, floodwaters flow from the St. Johns River into Cross Creek, and then into the Tulare lakebed. Floodflows are also conveyed through the lower Kaweah River to Elk Bayou and then through the Tule River into Tulare lakebed. Once in the lakebed, floodwaters are pumped into the south flood areas through the Gates-Jones or Wilbur Canal. The south area flood storage cells are composed of the Wilbur, East Hacienda, Mid-Hacienda, and West Hacienda cells. These cells encompass 20,000 acres with an aggregate storage capacity of approximately 100,000 acre-feet. Floodwater stored in these cells is later used for crop irrigation.

After the south flood areas are full, floodwaters are directed onto agricultural land in the Tulare lakebed. Flooding of agricultural land affects how much land will be out of production and how long the land will be out of production. Flooding also relates to how much and how long ponded floodwater will be available for wildlife habitat.

The non-damaging frequency of flooding to Tulare lakebed from the Kaweah River is 5 years. These floodwaters can be stored in the Wilbur and Hacienda areas and do not affect farming operations. This flooding is associated with snowmelt flood releases that occur primarily from April through June.

4.3 WATER SUPPLY

Land use is greatly influenced by water supply. The study area is technically defined as a desert, meaning that evaporation is greater than rainfall. The area is totally dependent upon surface and ground-water supplies, both of which are limited. Typically, lands that have not been irrigated historically do not have surface water rights, water contracts, available ground water, or conditions that make it suitable for development.

In the past, average annual supplies were generally adequate to meet average net water demands for agriculture in this region. However, during the recent drought, present supplies have been insufficient to meet present demands. Without an additional water management program or additional surface supplies,

drought year annual shortages are expected to be about 1.1 million acre-feet by 2020.

Historically, lands were developed for irrigated agriculture using ground water and unregulated flows of the Kaweah River. The coming of the Friant-Kern Canal water supply helped offset and slow the rate of ground-water overdraft. Water conservation provided by Terminus Dam helped control the Kaweah River and further slowed the rate of ground-water overdraft. In spite of these measures, ground-water overdraft continues to exist in the service area.

When Terminus Dam went into operation in 1961, few new lands were put into agriculture production. The primary purposes of Terminus Dam are flood control and water supply. The water storage space behind Terminus Dam has helped in the timing of water delivery for agricultural uses.

4.3.1 Kaweah Reservoir

In many foothill areas, local surface water connections are not available. Ground water is limited to small pockets of water formed by runoff trickling into fissures in the rock strata. During drought years, the ground water in the fissures is scarcely replenished, and water supplies in foothill areas are often exhausted.

Upstream of Terminus Dam in the Three Rivers area, canals or ditches were built beginning in 1858 to facilitate the diversion of water from the Kaweah River and its tributary forks to irrigate valley pastures, groves, and orchards. Several of these ditches are still in use. However, these canals are unreliable for irrigation during hot, dry months because of erratic and low flows of the North and South Forks of the Kaweah River during the summer. Therefore, water supply would be a limiting factor for future land use changes in the reservoir area.

4.3.2 Downstream Area

The service area supplied by the Kaweah River is about 130,000 acre-feet deficient in meeting its annual water demand. The diversion of unregulated flows into 31 canals and channels before the existence of the dam and into percolation ponds and fields for ground-water recharge kept water from leaving the service area except during major flooding events. Currently, excess floodflows leave the service area on the average of 1 year in 5.

In addition to affecting water supplies, ground-water overdraft can potentially cause subsidence, which will compact the sediments and lower infiltration capabilities of a ground-water aquifer.

All the water from the Kaweah River is fully subscribed under water rights. All these rights pre-date Terminus Dam. Rights may be sold or transferred within the KDWCD service area but are not allowed to be transferred outside of KDWCD.

There are two types of water delivery arrangements associated with Kaweah River water. There are water right holders who do not have storage space in Lake Kaweah and those who do have storage space. The first type includes the riparian right holders and some ditch companies. The members of the Kaweah and St. John's Rivers own the water supply space behind Terminus Dam.

Based on water right schedules, agreed upon by all Kaweah water right holders at and below the dam, the flow of the Kaweah River is allocated at the dam to each of the respective water right holders. This allocation is determined by diversion and storage right schedules. Allocation of the Kaweah River water is based on inflow, as computed by the Corps. Historically, those users that were located at the upper limits of the river, closest below the damsite, were served first. In order for a user to receive water, the inflow had to be great enough for the water to have traveled to their location without being lost upstream to other water users or evaporation and infiltration.

Without the proposed project, increasingly high costs for water and the reliability of water supplies will likely result in lands going out of production.

4.3.3 Tulare Lakebed

Tulare Lake Basin Water Storage District, which generally corresponds with the geographic boundaries of the Tulare lakebed, receives water from three sources. Approximately one-third comes from the California Aqueduct system on the west side of the San Joaquin Valley. This amounts to a maximum annual entitlement of 118,500 acre-feet. Approximately one-third comes from wells located around the fringe of the lakebed, and one-third comes from the Kings and Tule Rivers. Occasionally, floodflows from the Kaweah and Kern Rivers reach the lakebed. In years when excess water is available, Friant-Kern Canal water can be used. Tulare lakebed has no irrigation rights to Kaweah River water.

4.4 CROPPING PATTERNS

Agricultural acreages are projected to decrease in the future according to information provided by Tulare County. A primary consideration in projections of decreased agricultural acreage is the continued conversion of irrigated agricultural lands to urban use. In most cases, the conversion of agricultural lands to urban areas does not reduce water demands. Often prime agricultural lands are also prime lands for urban development as cities surrounding agriculture continue to grow. Currently, agriculture moves onto less desirable lands as urban acreage expands.

The California Department of Conservation has estimated the conversion of prime farmlands to urban uses since 1984. The department's most recent report identifies nearly 32,000 acres of prime land in the Tulare Lake Basin converted to

urban use since 1984. This trend is likely to continue because the region's population is projected to double in the next 30 years.

Putting land into agricultural production is a function of one or more of the following: holding water rights; having a contract for someone else's water rights; having available ground water for pumping; having acceptable ground-water quality; land being suitable for production, that is, appropriate soil components and slope; and being located close enough to a water source to make transport of water economically feasible. Based on these criteria, all of the agricultural land in the KDWCD service area has been developed to the maximum point economically feasible.

Various supply and demand factors influence cropping patterns. These factors include water quality, urban encroachment, future crop yields, access to world markets, government farm programs, regulation of farm chemicals and availability of affordable alternatives, availability of an affordable water supply, emergence of agricultural export capability in other countries, labor and overhead, and species protection.

4.4.1 Kaweah Reservoir

Lake Kaweah and its surrounding land lie within a development corridor identified in the Tulare County's Foothill Growth Management Plan. Ninety percent of the land around Lake Kaweah and the Kaweah River, within the scope of the Foothill Growth Management Plan, is zoned for agricultural uses. The land is almost exclusively grassland that supports grazing. Limited parcels upstream of the dam are zoned general commercial.

The area immediately adjacent to the gross pool of Lake Kaweah is Federally owned and is protected from private development. All lands within the Terminus Dam/Lake Kaweah area are zoned to protect public use of the lake's recreation areas.

The principal land uses in the vicinity outside the Corps area are grazing, agriculture, and rural-residential. Recreation and second-home construction would be the only industries expected to increase and change current land use in the future without the project.

4.4.2 Downstream Area

Existing and potential land uses on the valley floor to the western edge of the project's zone of influence are addressed in the Tulare County's Rural Valley Lands Plan. The primary objective of the plan is to preserve the agricultural viability of rural lands outside of areas zoned for urban expansion. Tulare County planning documents strongly support agriculture as the primary land use in the

County. Agricultural land use is protected whenever possible, and urban boundaries are strictly enforced.

Rural land on the San Joaquin Valley floor, within the project's zone of influence, has been intensively cultivated with a wide variety of crops including cotton, alfalfa, vegetables, vineyards, grains, and orchards. The land has been cultivated up to the edge of the Kaweah River's natural distributaries and tributaries, leaving little or no margin between the cultivated land and the instream riparian vegetation. The pattern of cropping often depends on the underlying soil type and the amount of water available for cultivation.

Periodic flooding in the past did not prevent development of agricultural land in the current flood plain. The extent of development was more determined by its inherent suitability to sustained profitable crop production (fertility and drainage) than dictated by flooding, which occurred infrequently or before the planting of summer crops.

If land in the flood plain is not currently in agricultural production, it is due to its location, slope, poor soil type, or value in its native state. This land would generally only be suitable for annual field and grain crops which have marginal profit margins under good conditions. Due to the poor fertility of the soil and capital expenditures necessary to develop land, in addition to the risks involved in the development and reclamation of land, little incentive exists for expansion of agricultural production into these areas. Therefore, agricultural land use changes without the project are expected to occur based on supply and demand factors. Periodic flooding has not been a limiting factor in the past and is not expected to be in the future.

Open space area (parcels of land or any water body which is essentially unimproved) downstream of Terminus Dam are primarily zoned as exclusively agriculture. Undeveloped areas comprise about 20,500 acres. Land consisting primarily of undisturbed grasslands comprises about 7,000 acres. The area also contains some designated preserves. Open space consisting of agricultural land amounts to about 375,000 acres and is given no special protection from development.

Large and small patches of native vegetation are scattered throughout the land downstream of Terminus Dam. The term "native vegetation" is used to identify any parcel of land not committed to some kind of developed use. Approximately 27,500 acres of native vegetation were identified within the project area downstream of Terminus Dam.

Without the project, agricultural supply and demand factors may affect land uses in open space or unimproved land in the downstream area. However, these changes are difficult to quantify.

4.4.3 Tulare Lakebed

The Tulare lakebed is used primarily for agriculture. The main crop is cotton, including lint and seed cotton. Safflower, seed alfalfa, wheat, and barley are also grown in the lakebed. Cropping patterns will change in the future without the project based on the market value of the crops and other factors discussed previously.

Two areas near the lakebed, the south flood areas, have been purchased, improved, and reserved for storing floodwaters. These areas have been farmed in the past but did not prove productive. These areas will continue to be regulated for flood control or agricultural drainage without the project. The water rights associated with the Wilbur Tract have been permanently relocated to more productive lands in the lakebed.

5.0 FUTURE PROJECTIONS (Alternatives 2 and 3)

This section discusses future land use to the year 2099 under Alternatives 2 and 3. Flood protection to downstream areas would increase and add additional water storage space in the reservoir. Therefore, potential land use changes due to reduced flooding and additional water storage space associated with the project alternatives were analyzed.

5.1 Overview/Methodology

Future with-project land use conditions were estimated using maps, reports, hydrologic data, conversations with knowledgeable individuals, and site visits.

Land use changes from a reducing the 100-year flood plain were calculated graphically using flood plain maps developed and provided by the Corps. Land use in the existing 100-year and the post-project 100-year flood plains were identified, digitized, and tabulated. The existing and post-project 100-year flood plains are shown in Figure 3 and summarized in Table 3. Acres of land removed from the flood plain are those lands that would no longer be subject to inundation by 100-year events under project conditions.

Potential land use changes resulting from additional water storage facilities were determined by a literature review, which included the 1993 California Water Plan Update for the Tulare Lake Region, and through discussions with knowledgeable individuals.

Land use changes resulting from inundation of land around the lake were calculated using aerial photos (scale 1:24,000; flight 87125) taken in June 1987. The photos were fitted with acetate overlays on which the various plant community types were delineated. Stereo pairs were used to delineate community boundaries. Verifications of the community types were conducted by field

personnel in January 1989. A Bausch and Lomb Stereo Zoom Transfer Scope (Model MII) was then used to transfer the delineated areas to acetate overlays on 1:24,000 7.5-minute U.S. Geological Survey quadrangle maps. In order to provide detailed descriptions and more accurate acreage calculations, these delineated communities were transferred for a second time onto large-scale maps. These maps, supplied by the Corps, were on a scale of 1 inch equals 200 feet.

Acreages of the plant communities were calculated using a Tamaya digital planimeter (Model Planiz 5). All acreages were calculated from the existing maximum pool level of 694 feet to the 715-foot proposed inundation level.

TABLE 3
Land Use in Existing and Post-Project 100-Year Flood Plains
(acres)

Land Use	Downstream Area			Tulare Lakebed		
	A	B	A-B=C	D	E	D-E=F
	Existing 100-Year Floodplain	Post-Project 100-Year Floodplain	Acres Removed	Existing 100-Year Floodplain	Post-Project 100-Year Floodplain	Acres Removed
Riparian	2,288	2,216	72	0	0	0
Grassland	1,797	1,136	661	0	0	0
Oak savanna/ woodland	5,899	5,281	618	0	0	0
Other (disturbed/ flooded)	528	210	318	*	*	1,412[1]
Row crops/ pasture	35,204	20,148	15,056	0	0	0
Orchards/ vines	33,703	20,239	13,464	0	0	0
Cotton	20,540	9,868	10,672	0	0	0
Urban/ commercial	19,255	13,298	5,957	10	10	0
Total	119,214	72,396	46,818	*	*	1,412[1]

*the existing 100-year floodplain contains 15,949 acres inundatedfor about 71 days, the post-project 100-year floodplain contains 14,360 acres inundated for about 65 days.
[1]1,412 acres represents the acres removed from flooding in the lakebed on an average annual basis from smaller more frequent flood events.

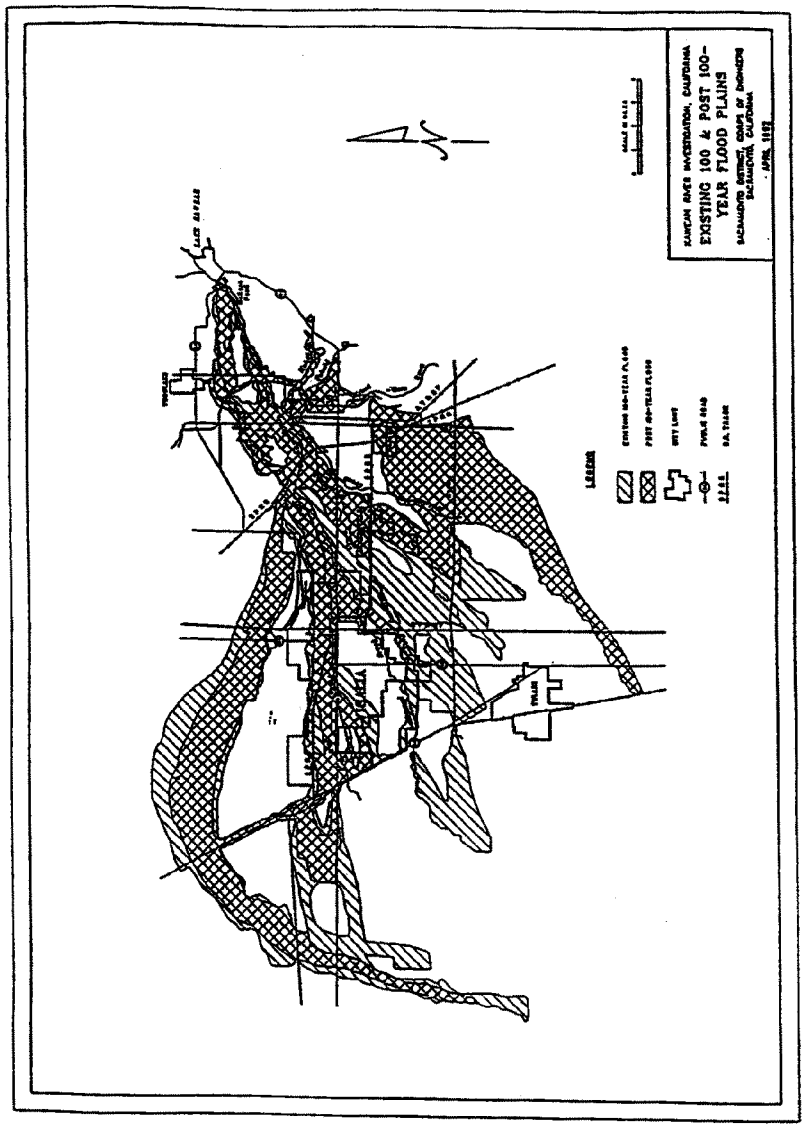

KANTAN RIVER INVESTIGATION, CALIFORNIA
EXISTING 100 & POST 100-YEAR FLOOD PLAINS
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
APRIL 1982
LEGEND

Figure 3

5.2 Flood Protection

Terminus Dam currently provides about a 46-year level of flood protection to Visalia from flooding by the Kaweah River. The selected plan would increase the level of flood protection from the Kaweah River to about the 70-year level. However, Visalia would still be subject to frequent flooding from the Dry Creek Basin, estimated to be about the 15-year event.

The project alternatives would reduce flood damages up to the 400-year event. However, for events larger than the 400-year, the plan would increase downstream flood damages by releasing more water through the wider spillway.

Implementation of Alternatives 2 or 3 would not change the basic operation of the project. Timing of releases would remain the same. Flood control space in the reservoir would be provided starting by mid-November. Conditional storage of irrigation water would begin February 1 and reach maximum storage by May 1.

The proposed alternatives would have minimal impact on releasing floodwater into the California Aqueduct system. Kaweah River water has been pumped into the Friant-Kern Canal in the past under severe flooding conditions. However, pumping into the canal is only an option if there is space available in it to transport the excess water. An increase in flood protection of 42,600 acre-feet is too small an increment to have a significant impact on the decision to release water to the aqueduct system when there is a major flood in excess of 1 million acre-feet.

5.2.1 Kaweah Reservoir

The proposed project would adversely affect land use around the reservoir by inundating approximately 370 acres of shoreline around Lake Kaweah. Six residences, one motel, and some recreation facilities would be inundated. The residences and relocations would be acquired and the owners compensated.

5.2.2 Downstream Area

Operation of the dam and reservoir under the project alternatives would decrease flows in the downstream distributaries during the spring snowmelt season.

The proposed project would provide protection to the urban area of Visalia to approximately the 70-year event. With-project conditions would probably not significantly increase subdivision development in the previous flood plain. However, elimination of the floodway in some areas might increase development by individuals because of the removal of the expense of satisfying FEMA requirements. Any development is subject to strict development guidelines and is constrained within designated urban boundaries.

Some of the alfalfa and mixed grassland may be converted to poultry farms, dairies, or feedlots where flood protection is provided. Under current regulations, they are prevented from being located in the 100-year flood plain unless they are elevated above the 100-year flood level.

Approximately 14 percent of the lands within the water service area are urban, commercial and industrial, farmsteads and feedlots, and roads, channels, and canals. Tulare County is one of the California counties that is demonstrating growth. This growth would continue both with and without the project. Development is not prohibited in the flood plain, but it is restricted. Residential properties must be elevated above the 100-year base flood elevation. Nonresidential structures may be either elevated above the 100-year base flood elevation or floodproofed.

Under post-project conditions, some of the plots of native vegetation would be removed from the existing 100-year flood plain. Currently, all of these vegetation types occur both inside and outside of the existing 100-year flood plain. This situation will continue with the post-project flood plain.

Several local people were contacted by telephone to obtain their projections for the future of the study area based on increased water storage at Lake Kaweah and reduction in the 100-year flood plain. In general, the comments indicated that urban expansion was already going on in the existing 100-year flood plain and that reduction of the flood plain would have no significant impact on that development. In the rural area, there would probably be some conversion of pasture land to dairies or poultry farms in the areas eliminated from the flood plain.

Based on information from the city and county general plans, professional judgment, and estimated reasonable projections, there would be no significant adverse growth-inducing impacts due to the project alternatives.

5.2.3 Tulare Lakebed

The project alternatives would reduce the volume and duration of flooding in the Tulare lakebed, mostly from snowmelt flooding. The flooded area would decrease by 1,412 acres on an average annual basis from smaller more frequent flood events, and the duration of flooding would also decrease. The lakebed would continue to receive floodwater from other major streams, including the Kings, Tule, and Kern Rivers, as well as local drainage.

Flooding affects land use in the Tulare lakebed in terms of how much land would be out of production due to flooding and how long it would be out of production. Flooding is also related to how much and how long ponded floodwater would be available for wildlife habitat. Ponding time in the lakebed would be reduced under the with-project conditions as a result of the increase in storage capacity upstream. This ponding time is a function of surface area coverage,

depth of water, and duration. Reduction in size and duration of ponding would be most noticeable when there is a low-volume flooding event.

Raising the spillway on Terminus Dam by 21 feet would minimally decrease the frequency of flooding from the Kaweah River on the Tulare lakebed. Flooding of the Tulare lakebed from the Kaweah River, which does not damage agricultural land under both with- and without-project conditions, occurs approximately every 5 years. Flooding of the lakebed from the Kings, Tule, and Kern Rivers and local drainages would not be changed with the proposed project. The frequency of major flooding would remain the same; consequently, there would be no incentive to convert limited riparian habitat or grasslands to agricultural lands in the lakebed due to a reduction in flooding. At this time all lands in the lakebed that are suitable for agricultural conversion have been converted.

Changes in the surface area flooded in the Tulare lakebed were calculated for the 5-, 10-, and 100-year floods. This flooding is associated with snowmelt flood releases that occur primarily from April through June. Flooding to the lakebed associated with this project would not be eliminated, but the volume of water and the surface acres flooded would be attenuated for the 5-, 10-, and 100-year events based on the increased storage capacity in Lake Kaweah.

A historical analysis shows the reduction in flooding that would have occurred from 1904 to 1989 as a result of the project. There was water in the lakebed from the Kaweah River 36 out of 86 years. The project alternatives would have reduced flooding to the lakebed in 35 of those years and would have eliminated flows to the lakebed in 4 of those years.

Therefore the proposed project would not affect land use in the Tulare lakebed.

5.3 WATER SUPPLY

The project alternatives would not create any new water for the Kaweah River Basin. However, the increased storage capacity in the reservoir could be used to store additional water for irrigation during the nonflood season. Under existing conditions, this additional water could eventually be floodwater to the Tulare lakebed. As a result, the enlarged reservoir would reduce downstream flooding and allow increased storage of water. Proper timing and regulation of releases would convert this additional potential floodwater into an irrigation supply.

With the project alternatives, there is an opportunity to store 42,600 additional acre-feet of water in the reservoir. However, the average annual yield has been calculated at 8,400 acre-feet per year. The members of the Kaweah and St. John's Rivers Association would hold all the master contracts with the Federal Government for the new water conservation storage space.

Implementation of the the project alternatives would not change the basic operation of the existing water storage project. From May through September, the reservoir would be operated to optimize irrigation water supply. The additional storage space allow greater storage of snowmelt during the spring and summer months, which would allow irrigation water releases for a longer period during the irrigation season.

The flow of the Kaweah River would continue to be allocated at the dam to each of the water right holders based on diversion, storage, and water right schedules agreed upon by all water right holders. Allocation of irrigation supply would be based on inflow, as computed by the Corps and measured at the dam.

The additional storage provided in Lake Kaweah would increase the capacity to meet water demands by surface delivery. This would decrease the need to pump ground water and thereby reduce pumping costs. At the same time it would reduce the draw on the ground-water system. However, water supply benefits from the proposed project would not contribute to agricultural or urban growth.

5.3.1 Kaweah Reservoir

The primary source of water around the Kaweah Reservoir is ground water. This source is not expected to change with the proposed project. Therefore, no increased growth is expected to occur with the project.

5.3.2 Downstream Area

The additional water storage space provided by the project alternatives would allow better timing of water deliveries. Surface water could then be used instead of pumping ground water. Ground-water overdraft cannot be considered a long-term source of supply; instead, it is an indicator of a chronic water shortage. The additional availability of surface water would help prevent lands from going out of production due to ground-water overdraft or the high cost of pumping.

Only about 1 percent of the land in the service area is designated as idle land. Under without-project conditions, this category might increase as a result of lands going out of production due to ground-water overdraft.

Conveyance systems in the service area are not used to full capacity under existing conditions. There are no plans to construct new conveyance systems or enlarge existing systems within the study area, either with or without the project. The project would allow for more efficient use of existing facilities and help offset ground-water pumping costs.

Therefore, the rate of lands going out of production would be slowed as a result of the project.

5.3.3 Tulare Lakebed

The project would affect only floodwater reaching the lakebed from the Kaweah River. It would not affect water supply to the lakebed.

The Kaweah River is a source of water supply to the lakebed only in times of flooding. Lakebed interests have a system in place to store floodwater; however, excess floodwater must be stored on productive land.

Tulare lakebed receives water from three locations. Approximately one-third comes from the California Aqueduct system on the west side of the San Joaquin Valley. This amounts to an annual entitlement of a maximum of 118,500 acre-feet. Approximately one-third comes from wells located around the fringe of the lakebed and one-third from the Kings and Tule Rivers. Occasionally, floodflows from the Kaweah and Kern Rivers reach the lakebed. Tulare lakebed has no irrigation rights to Kaweah River water. Therefore, no water supply benefits to the lakebed would result from the project alternatives.

5.4 CROPPING PATTERNS

The California Farm Extension Service's concern is that without the project, valuable agricultural lands may go out of production due to the continuous overdraft problem in the area and the associated increase in pumping costs. The additional storage would allow for more efficient use of irrigation water, reducing ground-water pumping by providing surface water longer in the growing season.

5.4.1 Kaweah Reservoir

The area immediately adjacent to the existing gross pool of Lake Kaweah is Federally owned and is protected from private development. All lands within the Terminus Dam/Lake Kaweah area are zoned to protect the public use of the lake's recreation areas. This zoning would also be the same with the proposed project in place. Because there is no incentive to change, cropping patterns around the reservoir would not be affected by the project alternatives.

Some existing riparian oak woodland and grassland areas would be inundated by the proposed project, changing these land uses to grasslands that are periodically inundated. Mitigation for these habitats is part of the proposed project.

5.4.2 Downstream Area

The most significant land use type in the Kaweah River water service area is field crops. These include cotton, milo corn, and miscellaneous field, truck, and grain crops. There is no projected change in cropping patterns either with or without the project for grain crops, orchards, or vineyards. Local agricultural

groups such as Tulare County Farm Bureau and the University of California Farm Extension Service do not project a change in cropping patterns with or without the project.

The projected growth rate for Tulare County is 2.26 percent per year for the next 20 years. The growth rate of 2.26 per year is the same for with- or without-project conditions since the project is not expected to influence growth projections. The population of the City of Visalia has increased about 52 percent from the 1980 figure of 49,729. The Visalia 2020 General Plan, March 1990, projects a population of 165,000 people in Visalia by the year 2020. This growth is projected for both with- and without-project conditions according to local planners. It is expected that under both conditions this growth will result in the conversion of some agricultural and grazing lands to urban development in the study area.

Changes in natural lands composed of riparian habitat, woodlands, and non-grazed native grasslands are not projected to occur as a result of the proposed project. These lands have generally not been developed because of their location, slope, lack of water supply or conveyance system, poor soil type, or value in their native state. The proposed project would not change these factors; therefore, natural lands are expected to remain the same with the project.

5.4.3 Tulare Lakebed

The Tulare lakebed is used almost exclusively for agriculture and will likely remain the same with or without the project. The cropping pattern is determined by many factors beyond flooding or water supply, as discussed in Section 4.4.

6.0 CONCLUSIONS

The conclusion of this report is that there would be minimal land use changes as a result of raising and widening the spillway of Terminus Dam. Future with- and without-project conditions discussed in this report are outlined in Table 4.

With the project, flood protection would improve for the downstream area and for the Tulare lakebed. Development in the flood plain is currently allowed if specific conditions are met, and this situation is not likely to change with the proposed project.

Water supply conditions would improve for the downstream area. The amount of newly stored water on an average annual basis was not considered to be significant or dependable enough to generate conversion of undeveloped lands into production or induce any significant changes in cropping patterns. This water supply would be used to offset ground-water pumping and prevent lands from going out of production due to ground-water overdraft. Reduction in ground-water use would reduce ground-water overdraft. Therefore, the net effect of improved

surface water deliveries would be to reduce long-term ground-water overdraft as well as reduce shortages.

No changes in cropping patterns are expected in any of the three study areas. No adverse flood protection or water supply effects would result from the project alternatives.

TABLE 4
Future Conditions

Subject	Area	With-Project Conditions	Without-Project Conditions
Flood protection	Kaweah Reservoir	No change	No change
	Downstream area	70-year protection from Kaweah River.	No change
	Tulare lakebed	Reduced flooding from Kaweah River. Will continue to flood from Kings, Kern, and Tule River waters.	No change
Water supply	Kaweah Reservoir	No change	No change
	Downstream area	Better timing of release of 8,400 acre-feet.	Continued ground water overdraft.
	Tulare lakebed	No change	No change
Cropping patterns	Kaweah Reservoir	No change	No change
	Downstream area	No change	No change
	Tulare lakebed	No change	No change

7.0 REFERENCES

California Department of Finance, Demographic Research Unit. 1991. Interim Population Projections for California State and Counties, 1990-2005. Report 91 P-1, Official State Projections.

California Department of Water Resources. 1993. California Water Plan Update. Bulletin 160-93.

____. 1987. California Water: Looking to the Future. Bulletin 160-87.

____. 1987. Tulare County Land Use Study. Study No. 87-54.

EIP Associates. January 1990. Kaweah River Rock Mining and Reclamation Project.

Federal Emergency Management Agency. August 4, 1988. Flood Insurance Study, Kings County Unincorporated Areas.

Kaweah River Power Authority. December 1984. Application for License, Major Project, Existing Dam.

Kings County. 1994. Agricultural Crop Report.

____. 1965. General Plan, as modified.

Tulare County. General Plan. 1988.
Rural Valley Lands Plan. 1988. GPA 75-1D. GPS 86-09.
Foothill Growth Management Plan. February 1981. GPA 84-03.

U.S Army Corps of Engineers. July 1987. Kaweah River Basin Investigation, California, Reconnaissance Report.

____. Revised November 1971. Reservoir Regulation Manual, Terminus Dam (Lake Kaweah), Kaweah River, California.

U.S. Bureau of Reclamation. March 1989. Report on Refuge Water Supply Investigation, Central Valley Hydrologic Basin, California.

Visalia, City of. March 1990. Visalia 2020 General Plan.

8.0 PERSONAL COMMUNICATIONS

Bertelsen, Brian	Pearson Reality
Brady, Roberto	Tulare County Planning and Development
Bricker, Walter	Tulare Lake Basin Water Storage District
Crook, James	Kaweah Delta Water Conservation District
Dooley, Dan	Farmer, Attorney
Ericksen, Carolyn	City of Visalia Planning Department
Finney, George	Tulare County Planning and Development
Johnson, Laurena	Tulare County Farm Bureau
Keller, Dennis	Hydrologic Engineer
Knierim, Herb	Kaweah Delta Water Conservation District
Lorenzo, Maria	Department of Water Resources (Federal Emergency Management Agency representative)
Neufeld, Marge	Tulare County Planning and Development
Sullins, Rob	University of California Farm Extension Service
Hansen, Rob	Creighton Ranch and Kaweah Oaks Preserve
Wiley, Ken	The Nature Conservancy
Zumwalt, Bill	Kings County Regional Planning Commission

APPENDIX A

REGULATIONS ON HACIENDA RANCH PROPERTY

STATE OF CALIFORNIA—THE RESOURCES AGENCY

GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 445-9248

December 7, 1987

Mr. Edward C. Giermann
Corporate Counsel
J. G. Boswell Company
4600 Security Pacific Plaza
333 South Hope Street
Los Angeles, CA 90071

Dear Mr. Giermann:

Tulare Lake Representatives; J. G. Boswell Co. & Salver American

As requested in your December 2, 1987, letter to Director David Kennedy, I am returning the letter to you with the executed consent to transfer of lands.

If we can be of additional assistance, please let me know at (916) 445-8207.

Sincerely,

for Susan Weber
Chief Counsel

Enclosure

cc: Thomas R. Hurlbutt
J. G. Boswell Co.
P. O. Box 877
Corcoran, CA 93212

J. G. BOSWELL COMPANY
4600 SECURITY PACIFIC PLAZA
333 SOUTH HOPE STREET
LOS ANGELES, CALIFORNIA 90071
(213) 485-1717

December 2, 1987

Mr. David N. Kennedy
Director
Department of Water Resources
P. O. Box 942836
Sacramento, CA 94236-0001

Re: Tulare Lake Representatives; J. G. Boswell Co. & Salyer American

Dear Dave:

In March, 1978, J. G. Boswell Company, Salyer Land Company and other Tulare Lake area landowners formed Tulare Lake Representatives ["TLR"], an entity organized to:

[i] purchase and thereafter retire from production Hacienda Water District ["HWD"] farm lands,

[ii] transfer HWD's State Water Project water entitlement to Tulare Lake Basin Water Storage District, and

[iii] use the HWD lands for drainage and floodwater disposal.

The Department of Water Resources ["Department"] agreed to the transfer of HWD's water entitlement with the proviso the HWD lands not be farmed with controlled surface water supplies or groundwater.

In March 1980, the Boswell and Salyer companies became TLR's sole joint venturers. On February 11, 1981 the Boswell and Salyer companies, as separate corporate entities and as joint venturers doing business as TLR, entered into an agreement with the Department. The agreement [a copy is enclosed for your reference] established, among other matters, that the limitations on the use of the former HWD lands were covenants running with the land and that any conveyance of the former HWD lands by TLR required the Department's prior written approval [see paragraph 8 of the agreement]. The agreement also required the Department to approve any such conveyance provided the grantee agreed to be bound by the terms of the agreement

Several weeks ago our company agreed to acquire Salyer Land Company's interest in TLR. Consequently, TLR, i.e., the Boswell and Salyer companies, will be conveying the former HWD lands to Boswell. We are writing to request your written approval of the conveyance. The Boswell Company is now bound by and, as noted in the attached agreement, will continue to be bound by the terms of the February 11, 1981 agreement.

Inasmuch as the escrow relative to our acquisition of the former HWD lands is scheduled to close on or about December 15, 1987, we would sincerely appreciate the Department's timely action on our request. For your convenience, we have prepared a consent statement and included same hereinbelow.

Very truly yours,

Edward C. Giermann
Corporate Counsel

CC w/encl: Mr. Norman Hill, Esq.
CC w/o/encl: Mr. T. R. Hurlbutt

CONSENT TO TRANSFER OF LANDS

The Department of Water Resources of the State of California, by and through the undersigned, hereby approves and consents to the conveyance of lands described in that certain "Agreement [Covenants Running With The Land, Civil Code 1468]" dated February 11, 1981, which agreement was recorded in book 1195 at page 277 of the official records of Kings County, California, from Tulare Lake Representatives to J. G. Boswell Company.

Dated 12-7-87

Department of Water Resources

By
Its Director

Approved as to legal form and sufficiency:

for
Chief Counsel, Department of Water Resources

DEPARTMENT OF WATER RESOURCES
STATE OF CALIFORNIA

In The Matter of the Transfer of Certain Lands of Tulare Lake Representatives to J. G. Boswell Company	AGREEMENT OF J. G. BOSWELL COMPANY

The undersigned, duly elected officers of J. G. Boswell Company, hereby represent and warrant to the Department of Water Resources, pursuant to that certain "Agreement [Covenants Running With The Land, Civil Code 1468]" dated February 11, 1981 [hereinafter "Agreement", a copy of which is attached hereto and incorporated herein by reference], that upon the conveyance of certain real property described in the Agreement from Tulare Lake Representatives to J. G. Boswell Company, that J. G. Boswell Company shall be bound by the terms, conditions and covenants thereof, particularly those terms, conditions and covenants in Exhibit B of that certain letter agreement dated February 16, 1979 contained in and made part of the Agreement.

Executed on December 3, 1987 at Los Angeles, California

John C. Sterling
Secretary

Edward C. Giermann
Assistant Secretary

2771 1195

RECORDED IN OFFICIAL RECORDS OF KINGS COUNTY, CALIFORNIA AT 51 MIN PAST 10 M
MAR 10 1981
JOAN L. BULLOCK County Clerk and Recorder FEE 26

AGREEMENT
(COVENANTS RUNNING WITH THE LAND, CIVIL CODE 1468)

THIS AGREEMENT made this 11th day of February, 1981, by and between J. G. BOSWELL COMPANY, a corporation, hereinafter sometimes referred to as "BOSWELL", and SALYER LAND COMPANY, a corporation, hereinafter sometimes referred to as "SALYER", doing business as TULARE LAKE REPRESENTATIVES under an Amended Statement of Partnership (Joint Venture) of Tulare Lake Representatives, effective March 1, 1980, herein termed TLR-II; J. G. BOSWELL COMPANY and SALYER LAND COMPANY as separate corporate entities; and the DEPARTMENT OF WATER RESOURCES (DWR), an agency of the State of California. BOSWELL, SALYER and TLR-II make this agreement for themselves and their respective successors and assigns.

W I T N E S S E T H:

WHEREAS, the said J. G. BOSWELL COMPANY, the said SALYER LAND COMPANY, and WESTLAKE FARMS, INC., a corporation; PRODUCERS COTTON OIL COMPANY, a corporation, as owner of all

of the issued and outstanding capital stock of South Lake Farms, a corporation; NEWTON BROS., a partnership; GILKEY FARMS, INC., a corporation; and JAMES B. HANSEN and JESS V. HANSEN, individuals, entered into a MEMORANDUM OF JOINT VENTURE AGREEMENT, effective March 28, 1978, (herein TLR-I);

WHEREAS, BOSWELL and SALYER purchased all of the partnership interests of the other Tulare Lake Representatives in TLR-I and are now the sole joint venturers in TLR-II;

WHEREAS, Tulare Lake Drainage District (TLDD), Tulare Lake Basin Water Storage District (TLBWSD), Hacienda Water District (HWD) and TLR-I entered into a letter agreement dated February 16, 1979, with the Department of Water Resources (DWR), which reads as follows:

STATE OF CALIFORNIA—RESOURCES AGENCY EDMUND G. BROWN JR., G.
DEPARTMENT OF WATER RESOURCES
P.O. BOX 388
SACRAMENTO
95802
(916) 445-9248

FEB 16 1979

Tulare Lake Drainage District
P. O. Box 985
Corcoran, CA 93212

Tulare Lake Basin Water Storage District
1109 Whitley Avenue
Corcoran, CA 93212

Hacienda Water District
P. O. BIN 9448
Bakersfield, CA 93309

Tulare Lake Representatives
P. O. Box 877
Corcoran, CA 93212

Gentlemen:

By letter dated February 14, 1978 to the Department, Mr. Stanley M. Barnes, President, Tulare Lake Drainage District, outlined a proposed program for drainage disposal and transfer of water supplies involving Hacienda Ranch properties, Hacienda Water District (HWD), Tulare Lake Drainage District (TLDD), and Tulare Lake Basin Water Storage District (TLBWSD) and requested the Department's preliminary views before proceeding. The proposal was reviewed by the Department, and by letter dated June 13, 1978, the Department indicated willingness to have water under the HWD State Water Project water supply contract (contract) used on lands within TLBWSD and for the Table A values of the TLBWSD and HWD contracts to be combined substantially as proposed.

Subsequent to the exchange of correspondence, certain actions have been taken. Tulare Lake Representatives (TLR), a joint venture, has purchased and now owns the Hacienda Ranch properties with the intention of selling the lands to TLDD. Also some minor changes have been made in the original proposal which have no significant effects on the proposed program.

The following commitments may be combined in one or more documents as may be deemed mutually desirable.

Based on the correspondence referred to above and subsequent discussions, the following actions are to be taken:

1. Execution of an agreement between HWD and the Department to assign the HWD contract to TLBWSD, subject to execution of the agreement called for in item 2 below and to the final transfer of lands provided for in item 3 below.

2. Execution of an agreement between TLBWSD and the Department to assign all the rights and obligations of HWD's contract to TLBWSD, subject to (a) the exclusion from TLBWSD of approximately 3,200 acres of land, currently located within HWD, (b) the execution of the agreement called for in item 1 above, and (c) the final transfer of lands provided for in item 3 below.

3. Initiation by TLDD of Project No. 2, and upon adoption thereof by the electorate and the sale of bonds pursuant to such adoption and acquisition from TLR of the Hacienda Ranch lands now owned or subsequently acquired by TLR within the area outlined on Exhibit A attached hereto. The commitments herein express are subject to (a) the affirmative action of the electorate of TLBWSD on the adoption of TLBWSD Project No. 5, and (b) the affirmative action of the electorate on the Project No. 5 bond election and sale of bonds pursuant thereto. The area designated on Exhibit A includes approximately 16,800 acres, of which approximately 15,700 acres are currently owned by TLR, and in addition TLR has arranged to acquire 300 acres by purchase from other owners and/or trades for outlying lands. This would leave approximately 800 acres within the designated area which TLR and/or TLDD propose to acquire when economically available. Restrictions to be included in the deed or deeds for transfer of title to TLDD are set forth in Exhibit B attached hereto.

4. Execution of the following interim operation agreements:

   a. Agreement among HWD, TLBWSD, TLR and the Department for interim delivery of HWD's state water supply to TLBWSD.

   b. Agreement between TLR and the Department to incorporate the land restrictions set forth in Exhibit B on lands described in Exhibit A to run with the agreement called for in item 4a above.

If you agree with the above outlined actions to be taken by the respective participants, please sign below and return.

Sincerely,

Ronald B. Robie
Director

Attachments

AGREED:

TULARE LAKE DRAINAGE DISTRICT

By _____
Title President
Date February 6, 1979

TULARE LAKE BASIN WATER STORAGE DISTRICT

By _____
Title Vice President
Date February 6, 1979

HACIENDA WATER DISTRICT

By _____
Title Vice President
Date February 6, 1979

TULARE LAKE REPRESENTATIVES

By _____
Title Authorized Representative
Date February 6, 1979

" EXHIBIT A

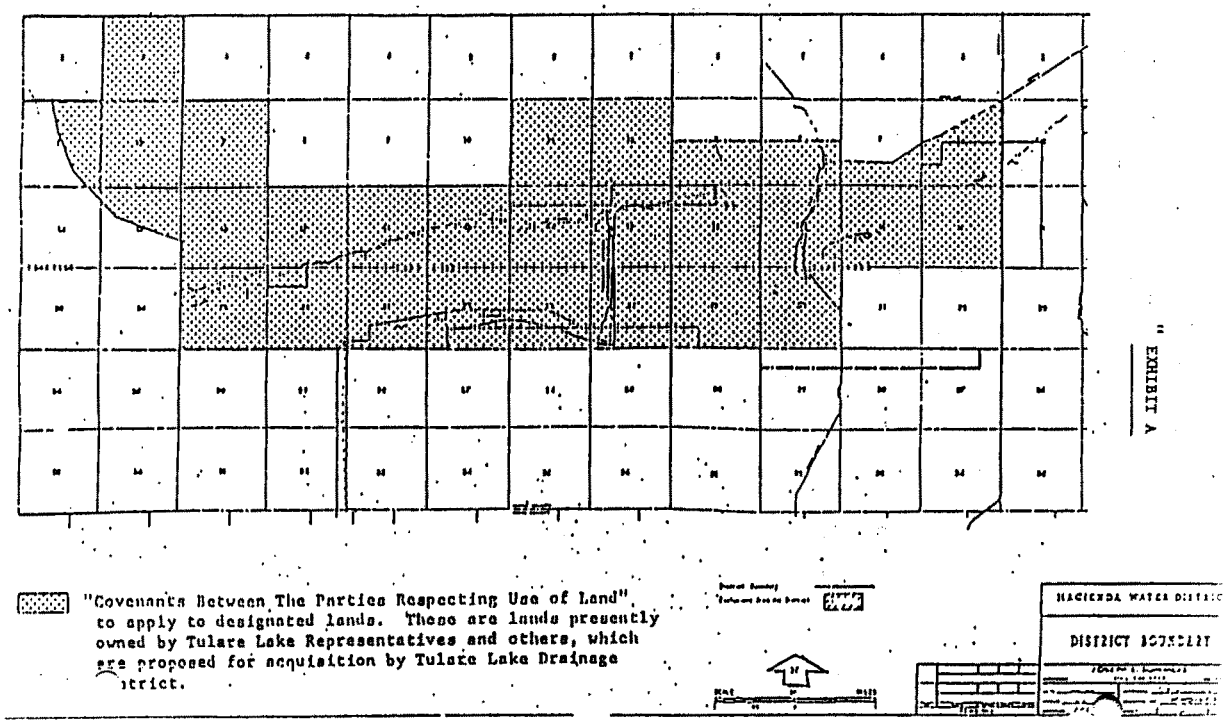

"Covenants Between The Parties Respecting Use of Land"
to apply to designated lands. These are lands presently
owned by Tulare Lake Representatives and others, which
are proposed for acquisition by Tulare Lake Drainage
District.
HACIENDA WATER DISTRICT
DISTRICT BOUNDARY

EXHIBIT B

COVENANTS BETWEEN THE PARTIES RESPECTING USE OF LAND

Tulare Lake Representatives (TLR), for themselves and their respective successors, assigns, heirs and representatives, and Tulare Lake Drainage District (TLDD), a public district organized and existing under the Drainage District Act of 1903, covenant with each other, with each of the other parties and all thereof as follows:

(a) That the lands designated on Exhibit A shall be used primarily for drainage disposal and for storage of excess floodwater flows and shall not be used for the growing of crops including forage crops and grasses irrigated from controlled surface water supplies; it being expressly understood and agreed that uncontrolled water inundating such lands either in whole, or in part, and floodwaters stored on such lands are not within the scope of this covenant. It is further expressly understood and agreed that no wells shall be drilled or otherwise placed on such lands for the production of irrigation water from underground water supplies for crop production including forage crops and grasses, nor shall any existing wells on such lands be utilized therefor; nor shall ground water supplies produced from wells on other lands be used on the lands designated on Exhibit A for any purpose.

"(b) That the aforesaid covenants are for the benefit of the lands designated on Exhibit A. Tulare Lake Drainage District, on acquisition of any of such lands, will hold such lands in trust for, and such lands will be dedicated and set apart for the uses and purposes set forth herein.

(c) That the aforesaid covenants shall run with the land designated on Exhibit A but no owner is to be responsible except for its or his acts or defaults. This entire agreement shall continue in effect and shall be coexistent with the duration of the right of Tulare Lake Basin Water Storage District to enjoy the use of water formerly supplied Hacienda Water District and specified in the Water Supply Contract, as amended, between the State of California, Department of Water Resources and Hacienda Water District dated December 20, 1963.

(d) That the aforesaid covenants will be included in any deed of such lands, either in whole or in part, from the TLR to TLDD, executed and delivered to TLDD, under approved and adopted Tulare Lake Drainage District Project No. 1 Amended and Tulare Lake Drainage District Project No. 2, if, as, and when said Project No. 2 is approved and adopted by Tulare Lake Drainage District.

(e) The State of California Department of Water Resources is a third party beneficiary to this covenant."

WHEREAS, approximately 6,700 acres of land originally designated as included in the land to be transferred to TLDD in accordance with the letter agreement and exhibits above quoted, remain in the ownership of TLR-II (herein termed TLR-II land);

WHEREAS, approximately 800 acres of land within the area designated to be covered by the covenants, although sought by TLDD and TLR-II for their respective drainage and flood control activities, is currently owned by a number of private landowners other than TLDD and TLR-II;

WHEREAS, the covenants set forth in Exhibit B of said letter agreement are for the benefit of DWR in addition to TLDD, Boswell, Salyer and TLR-II, and the parties are desirous of incorporating the same in an agreement which runs with the TLR-II land and is enforceable by DWR, as well as Boswell, Salyer and TLR-II.

NOW, THEREFORE, IT IS AGREED EACH WITH EACH AND ALL WITH EACH AS FOLLOWS:

1. It is expressly understood and agreed that TLR-II is the owner of lands (herein termed TLR-II lands), described in Exhibit A attached hereto and made a part hereof.

2. It is expressly understood and agreed that TLR-II lands shall be used primarily for drainage disposal, and for storage of excess floodwater flows and shall not be used for the growing of crops including forage crops and grasses irrigated from controlled surface water supplies; it being expressly understood and agreed that uncontrolled water inundating such lands either in whole, or in part, and floodwaters stored on such lands are not within the scope of this covenant. It is further expressly understood and agreed that no wells shall be drilled or otherwise placed on such lands for the production of irrigation water from underground water supplies for crop production including forage crops and grasses, nor shall any existing wells on such lands be utilized therefor; nor shall ground water supplies produced from wells on other lands be used on the above-described TLR-II lands.

3. It is expressly understood and agreed that other lands of Boswell and Salyer are benefitted by these covenants and will be afforded flood protection by the use of TLR-II lands as aforesaid. Said lands of Boswell so benefitted are particularly

described as follows:

	APN	Section	Acreage
J. G. Boswell Company	42-050-10	10,22/20	640
	42-060-08	22,22/20	640

Said lands of Salyer so benefitted are particularly described as follows:

	APN	Section	Acreage
Salyer Land Company	36-100-06	16,21/20	616
	44-240-22	32,22/21	560

4. It is expressly understood and agreed that, in partial consideration of the foregoing covenants and in reliance thereon, DWR is approving assignment of the HWD Water Supply Contract to TLBWSD by separate document and has an interest in these covenants derived from Boswell, Salyer and TLR-II, and that without these covenants, DWR will not approve said assignment.

5. It is expressly understood and agreed that successive owners of the above-described TLR-II land are bound by these covenants for the benefit of the lands owned by Boswell and Salyer, heretofore described.

6. It is expressly understood and agreed that these covenants relate to the use of the above-described TLR-II land, and no other land, and Boswell, Salyer and TLR-II will suspend the right of

partition, or sale in lieu of partition of said TLR-II land, during the period of time that this agreement continues in effect as hereinafter specified.

7. It is expressly understood and agreed that the aforesaid covenants shall run with the land but no owner is to be responsible except for its or his acts or defaults. This entire agreement shall continue in effect and shall be coexistent with the duration of the right of Tulare Lake Basin Water Storage District to enjoy the use of water formerly supplied Hacienda Water District and specified in the Water Supply Contract, as amended, between the State of California, Department of Water Resources and Hacienda Water District dated December 20, 1963.

8. That no lands originally designated in Exhibit A to the Letter Agreement dated February 16, 1979, heretofore set forth in full, shall be conveyed by TLR-II, its successors or assigns, without the prior written approval of the California Department of Water Resources and any such attempted conveyance without the Department's prior written approval shall be null and void. The Department will grant its prior written approval for the conveyance of any lands originally designated in said Exhibit A providing the Grantee agrees to be personally bound

by the terms, conditions and covenants of Exhibit B to said Letter Agreement.

9. Upon the execution hereof, the signatures of the representatives of the parties so executing, shall be acknowledged before a Notary Public and the agreement will be forthwith recorded in the Official Records of Kings County, California, wherein all of the land is situate, all in accordance with Section 1468(d) of the Civil Code of the State of California.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement on the day and year first above written.

TULARE LAKE REPRESENTATIVES (TLR-II), a Joint Venture,

By: J. G. BOSWELL COMPANY, a corporation,

By: [illegible] x [illegible]

Title: Vice President Secretary

By: SALYER LAND COMPANY, a corporation,

By: [illegible]

Title: [illegible]

J. G. BOSWELL COMPANY AND SALYER LAND COMPANY
AS SEPARATE ENTITIES

By: J. G. BOSWELL COMPANY, a corporation,
a separate entity,

By: [signature]

Title: Vice President & Secretary

By: SALYER LAND COMPANY, a corporation,
a separate entity,

By: [signature]

Title: Pres. & Secretary

Approved as to legal
form and sufficiency:

[signature]
Chief Counsel
Department of Water Resources

DEPARTMENT OF WATER RESOURCES

By: Sheila M. Lagi

Title: Director of Water Resources

APPENDIX B

INDIVIDUAL COMMENTS ON FUTURE LAND USE

Tim Batten (209) 733-6257
Tulare County Planning and Development
May 1995

Mr. Batten stated that the unincorporated areas in the project area are presently agricultural lands. He sees no change in development as a result of the proposed project. The land is already fully developed in irrigated agriculture and the city governments control urban development.

John Bergman (209) 732-8301
Tulare County Farm Bureau
May 1995

The market dictates which crops will be planted. Water costs and water availability are part of the equation. Population pressures are greater than agricultural pressures on development in the local area. Water is a limiting factor to urban and rural growth. He predicts no changes in cropping as a result of the proposed project.

Brian Bertelsen (209) 897-8000
AgWest Realty Group
May 1995

Mr. Bertelsen predicts that the proposed project will not change cropping patterns. He stated, however, that some desert areas or marginal agricultural lands might be converted to cattle feedlots or poultry farms. Presently these operations are excluded from the 100-year floodplain unless the property is raised above the 100-year base flood elevation. Bertelsen added that poultry farms are not water intensive.

Dan Dooley (209) 738-8418
Farmer - Attorney
May 1995

Mr. Dooley does not project any changes in land use or cropping patterns as a result of the proposed project. On the Kaweah River the service area is almost fully developed. The floodplain is already developing just by raising the elevation above the base flood level. There might be some additional dairies along the St. Johns River if the floodplain changes, but that would be decided by political and institutional issues rather than floodplain issues.

Mr. Hansen stated that his experience has shown that land which is vulnerable to flooding may be subject to low-intensity use such as grazing. However, when the flood threat is diminished, the land often becomes cultivated agriculture. Hansen cited lands along Cross Creek from the St. Johns River downstream to the Corcoran Irrigation District reservoir as an example. In addition, Hansen stated that he has concerns regarding the water supply to Creighton Ranch. The ranch receives Kaweah River water in extremely wet years such as 1969 and 1983. There are plant communities on the ranch that are dependent upon periodic flooding. Three specific plant communities in the area that depend on periodic flooding are fresh water marsh, riparian along the Tule River and iodine bush.

Dennis Keller (209) 732-7938
Hydrologic Engineer
May 1995

Mr. Keller stated that people are already building in the floodplain. There is a new legislative move to preserve land above ground water recharge areas. This move will help preserve agricultural land as well as recharge land. The Rocky Hill area is being developed. An overdraft situation currently exists in the area and he does not foresee any increase in agricultural conversion of native habitat. The increase in surface water availability would offset pumping. Assembly Bill 3030 relates to management of ground water. Presently irrigation water is 60 to 70 percent surface water and 30 to 40 percent ground water. Both urban and agricultural lands would be removed from the 100-year floodplain with the proposed project.

Marge Neufeld (209) 733-6227
Tulare County Planning and Development
May 1995

Ms. Neufeld stated that removing lands from floodplains might allow for nominal increases in development. She does not feel that the increase would be significant because people are already developing in the floodplain. Lands outside of the communities are devoted to agriculture. She does not see any new lands being put into production as a result of the proposed project, but she said there may be a possibility of some cropping changes.

Jim Sullins (209) 733-6363
University of California Farm Extension Service
May 1995

Mr. Sullins said that there is overdraft in a normal year, let alone a dry year. The proposed project would not increase cropping at all. The area is currently in a position of fending off lands going out of production.

APPENDIX F

RECREATION

STUDY

KAWEAH RIVER BASIN
INVESTIGATION
DRAFT EIS/EIR

APPENDIX F

Kaweah River Basin Investigation
Evaluation of the Recreation Benefits and Costs

Purpose. This appendix describes the methodology used to determine the recreation benefits and costs of the project alternatives. Since the project alternatives would have no significant effects to recreation in the downstream area or Tulare lakebed, the analysis includes only the Kaweah Reservoir area. The discussion of effects is included in Section 4.4 of this EIR/EIS.

Lost Visitation.

Alternative 2: A Federal water resources project may both create and displace recreational opportunities. Net recreation benefits are defined as the difference between the value of the recreational opportunities gained and the value of the recreational opportunities displaced, and may therefore be positive or negative. The addition of up to 216 surface acres of water would incrementally increase the value of recreation at Lake Kaweah with the relocation of inundated facilities. However, since no non-Federal sponsor was initially willing to cost share in a recreation plan to relocate all existing facilities, there would be no gain in recreation benefits. Net recreation benefits would equal recreation benefits lost with this alternative.

Determining displaced recreational opportunities requires gathering information regarding visitation and value. Visitation records have been kept for Lake Kaweah since 1962 when 116,000 recreation days were recorded. Annual visitation has fluctuated considerably, influenced by lake levels, weather patterns, and population shifts. The three most current years' visitation statistics available are shown on Table 1, listing the number of visits at each recreation area by month. An average of approximately 576,000 visits per year at Lake Kaweah has been recorded (see Table 2).

As the water surface level is raised from the current gross pool of 694 feet, m.s.l., to 700 feet (and 715 feet), m.s.l., existing recreation facilities will become inundated, and normal recreation use will decrease. Recreation use is expected to decrease by 75 percent at the Kaweah, Horse Creek and Slick Rock areas. Table 2 shows what the estimated visitation would be with the condition of inundation at each recreation area by month. For example, normal visitation at Kaweah during July is 30,964 visits. When the water surface level reaches at least 700 feet, m.s.l., visitation is expected to decrease by 75 percent to 7,741 visits, for a monthly loss of 23,323 visits.

Only recreation during the months of May through August would be significantly affected by implementation of the project alternatives. Lost recreation visits due to inundation, by month, are shown below:

Month	Kaweah	Horse Creek	Slick Rock	TOTAL
May	24,156	7,875	14,357	46,388
June	23,598	6,546	10,397	40,541
July	23,223	6,882	15,025	45,130
August	15,899	5,296	12,232	33,427

Based on historic monthly elevation data between 1966 and 1992 (Attachment A-1), Lake Kaweah would have reached 700 feet, m.s.l., under the selected plan conditions often during May through August. The public recreation use lost during inundation periods should return to normal after the water is drawn down below the existing gross pool level and the recreation facilities are rehabilitated. During the span of 27 years, the percentages of months reaching at least 700 feet, m.s.l., would be as follows:

Month	Occurrences	Percentage (%)
May	9	33
June	14	52
July	12	44
August	5	18

Implementation of the NED plan would not change the basic operation of Lake Kaweah. Thus, over a 100-year life of the project, one may assume that a water surface level of 700 feet, m.s.l., would be reached during May a total of 33 times. With 46,388 lost visits during May every 33 years out of 100, this would translate to 1,530,804 lost visits during May over the life of the project. Averaged over 100 years, approximately 15,308 visits per May would be lost. Using this same mathematical calculation, lost annual visits can be determined. (For the month of June, the frequency of inundation was changed slightly from 52 percent to 50 percent for greater ease in calculating the total.)

Month	Calculation			TOTAL
May	46,388 X .33	=		15,308
June	40,541 X .50	=		20,270
July	45,130 X .44	=		19,857
August	33,427 X .18	=		6,016
				61,451

Thus, an average of 61,451 visits per year would be lost due to inundation of recreation facilities at Lake Kaweah.

Alternative 3: Alternative 3 would have similar impacts as Alternative 2. Only recreation during the months of May through August would be significantly affected by implementation of the locally preferred plan. Based on historic monthly elevation data between 1966 and 1992 (Attachment A-2), Lake Kaweah would have reached 700 feet, m.s.l., under the selected plan conditions often during May through August. The public recreation use lost during inundation periods should return to normal after the water is drawn down below the existing gross pool level and the recreation facilities are rehabilitated.

Determination of Benefits Lost.

Screening of Methods. Various methods have been developed and tested to assign monetary values to recreation use. Most of these methods are related to combinations of real and abstract values based on the users' willingness to pay. At Lake Kaweah, some fees are collected for recreational use. Total willingness of users to pay is the sum of two components: the actual entrance fees and user charges for the right to use the site, plus any excess amount which users would be willing to pay but do not have to pay. Determining values is difficult since citizens throughout the world have historically considered use of public parks and gathering spaces a right that should be free, having already paid for by their taxes.

Notwithstanding, the Corps' Principles and Guidelines sets forth three basic methods to determine recreation benefits.

The three procedures available for evaluating the recreation benefits of any water project are the (1) Travel Cost Method, (2) Contingent Valuation Method, and (3) Unit Day Value Method. The Unit Day Method is acceptable under limited situations. Assuming a regional model is not available, the unit day method is acceptable if expected annual visitation is less than 750,000 visitor days and if either (a) recreation costs do not exceed 25 percent of the total project costs, or (b) specific annual Federal recreation costs do not exceed $1 million per year. Since no regional model was available, uses affected do not involve specialized recreation activities, annual visits affected are estimated below 750,000, recreation costs do not exceed 25 percent of the total project costs, and specific annual Federal recreation costs do not exceed $1 million per year for the Lake Kaweah project, the Unit Day Method was used.

The Unit Day Value Method relies on expert or informed opinion and judgement to approximate the average willingness-to-pay of users of Federal or Federally assisted recreation resources. Analysis determined that the Lake Kaweah study involved General Recreation Activities as defined in ER 1105-2-400.

Determination of Unit Day Values. Table 6-29 (Attachment B) from the Corps' Principles and Guidelines outlines the criteria and judgement factors to be used in assigning points for general recreation activities, thus determining values for calculating recreation benefits.

Points were assigned for general recreation activities along Lake Kaweah as shown in Table 3. The points (42) were then converted to dollar values ($4.69) by the use of Revised Table 6-28 (FY 96) (see Attachment C). Dollar values were interpolated when necessary.

Table 3
Point Tabulation for General Recreation for Lake Kaweah

Criteria	Points
Recreation Experience (30 points maximum)	10
Availability (18 points maximum)	9
Carrying Capacity (14 points maximum)	5
Accessibility (18 points maximum)	13
Environmental Quality (20 points maximum)	5
Total	42 = $4.69

Estimated Annual Benefits Lost. Benefits foregone are derived by multiplying the decrease in estimated annual use by the determined unit value. The point value derived in Table 3 was 42. After escalating the dollar values from Principles and Guidelines to the 1996 Consumer Price Index as directed in ER 1105-2-100, this point value converts to a unit value of $4.69 per user. This value seems reasonable and consistent with the costs of providing recreation facilities in the Central Valley area of California.

The projected lost recreation visitation numbers were annualized using a life of 100 years. The visitation values for the project were then multiplied by the above mentioned dollar values to give an average annual recreation benefit lost of approximately $288,000 (see Table 4) for Alternative 2 or Alternative 3. Additionally, marina concessionaires would sustain an economic loss, and there would also be a significant decrease in the amount of user fees collected at Lake Kaweah by the Corps.

Table 4
Average Annual Recreation Benefits Lost

Visitation (MPU)*	Lost Visits	Dollar Value	Average Annual Benefits Lost
Alternative 2			
700,000	61,451	$4.69	$288,205
Alternative 3			
700,000	61,451	$4.69	$288,205

*MPU - Maximum Practical Use

Operation and Maintenance Costs. The periodic maintenance of the completed project would be described in an Operation and Maintenance (O&M) Manual to be prepared by the Corps. Generally, all O&M activities are to be paid for and completed by the non-Federal sponsor. The selected plan would modify the existing Terminus Dam project that the Corps currently operates. As a result, an arrangement may be made whereby the non-Federal sponsor would pay the Corps the additional annual costs of operating and maintaining the new increment to the existing project. Recreational facilities and activities at Lake Kaweah would continue to be operated and maintained by the Corps.

Since facilities were designed to accommodate the design day load, or average weekend day use during the peak month of use, some overcrowding and overuse of non-inundated facilities could occur. This overuse can lead to further degradation of the facilities and increased overall replacement costs.

In 1978, the Corps prepared an Environmental Assessment for a project that would temporarily raise the spillway of Terminus Dam by 8 feet. This project would result in inundation of recreational facilities up to 704 feet, m.s.l. Repair and rehabilitation of recreation facilities damaged by this action was estimated to cost $105,000. Adjusting this repair amount to current prices, as based on Survey of Current Businesses, Engineering News Record Construction Costs, a cost of approximately $194,000 is necessary per inundation event.

Table 1
Visitation Statistics at Lake Kaweah, 1991-1993

1991	LEMON HILL	KAWEAH	HORSE CREEK	SLICK ROCK	OTHER	TOTAL
JAN	5833	9124	1258	3700	1319	21032
FEB	7170	13413	1833	4308	1788	28510
MAR	10728	20033	4122	10574	3055	48510
APR	11273	22242	7497	18681	3361	61034
MAY	14901	28733	10328	19798	4319	78077
JUNE	18252	36295	8404	20609	4904	89454
JULY	15043	32802	9273	21393	4542	92853
AUG	15927	24231	5474	15027	3507	64168
SEP	13078	17899	3205	10012	2547	46739
OCT	9092	10350	1818	4805	1690	28755
NOV	7507	12847	1567	3394	1696	27011
DEC	5483	10235	1228	3110	1339	21395
TOTALS	133083	237994	57005	133397	34067	595538

1992	LEMON HILL	KAWEAH	HORSE CREEK	SLICK ROCK	OTHER	TOTAL
JAN	5512	8248	1272	3078	1218	18324
FEB	9073	14102	1678	4838	1888	31677
MAR	10481	18130	2825	5817	2482	39545
APR	14904	27681	7315	17367	3898	71168
MAY	18418	35781	11823	20698	4958	89672
JUNE	14598	28938	6703	15742	4048	73025
JULY	17832	28581	6888	17201	4227	76549
AUG	18688	24288	11124	18248	4058	72405
SEP	13287	15851	14880	9038	3232	55188
OCT	9087	2117	1429	3888	1150	17871
NOV	7281	10358	1842	2775	1518	23885
DEC	13330	8787	895	2552	1741	27315
TOTALS	148295	222980	73584	118040	34524	597403

1993	LEMON HILL	KAWEAH	HORSE CREEK	SLICK ROCK	OTHER	TOTAL
JAN	8033	9244	1325	3216	1473	23281
FEB	10158	10557	1318	5057	1821	28910
MAR	10232	16718	2968	8424	2575	40938
APR	12151	22305	6818	14673	3268	58305
MAY	17259	32108	8348	18937	4415	80068
JUNE	15854	28188	7078	5237	3858	60792
JULY	17503	31698	8358	21508	4654	84718
AUG	15781	15077	4585	17854	3290	56387
SEP	12482	13838	3888	8643	2115	38724
OCT	7651	7714	1813	4580	1479	23237
NOV	8518	8879	1223	3877	1504	23798
DEC	5183	8811	870	2324	989	15757
TOTALS	140541	203720	50281	110130	31237	535908

Table 2
Average With and Without Project Visitation Estimates

AVERAGE VISITATION WITHOUT PROJECT

	LEMON HILL	KAWEAH	HORSE CREEK	SLICK ROCK	OTHER	TOTAL
JAN	6383	8871	1284	3331	1337	21216
FEB	8800	12691	1610	4734	1865	29699
MAR	10480	18294	3312	8205	2707	42998
APR	12776	24076	7241	16234	3509	63835
MAY	16192	32208	10500	19143	4563	82606
JUNE	16167	31464	8728	13863	4202	74424
JULY	16726	30964	9176	20034	4474	81374
AUG	16125	21199	7061	16310	3618	64313
SEP	12942	15898	7177	8231	2631	46877
OCT	8277	6727	1687	4424	1440	22554
NOV	7771	10628	1577	3349	1573	24898
DEC	7992	8548	931	2662	1356	21489
TOTALS	140640	221565	60283	120519	33276	576283

ESTIMATED AVERAGE VISITATION, WITH INUNDATION

	LEMON HILL	KAWEAH	HORSE CREEK	SLICK ROCK	OTHER	TOTAL
JAN	6383	8871	1284	3331	1337	21216
FEB	8800	12691	1610	4734	1865	29699
MAR	10480	18294	3312	8205	2707	42998
APR	12776	24076	7241	16234	3509	63835
MAY	16192	8052	2625	19143	4563	50575
JUNE	16167	7866	2182	13863	4202	44290
JULY	16726	7741	2294	20034	4474	51269
AUG	16125	5300	1765	16310	3618	43118
SEP	12942	15898	7177	8231	2631	46877
OCT	8277	6727	1687	4424	1440	22554
NOV	7771	10628	1577	3349	1573	24898
DEC	7992	8548	931	2662	1356	21489
TOTALS	140640	134699	33695	120519	33276	462809

ELEVATION PROJECT NED PLAN (with parameter, 0 AF Min Pool) 2050 CONDITIONS

WATER YEAR		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1966	MAX	567.68	579.42	575.96	573.25	572.82	615.08	661.90	682.94	681.22	635.77	548.86	557.91
1967	MAX	563.60	580.02	704.36	643.24	632.86	584.80	592.62	653.11	701.70	714.95	712.43	649.27
1968	MAX	615.89	572.62	572.16	572.33	577.06	612.01	644.85	663.63	663.52	610.08	551.52	560.18
1969	MAX	565.42	573.92	573.42	690.56	680.21	656.26	609.47	670.00	707.81	714.95	713.40	650.83
1970	MAX	612.23	575.47	576.88	621.29	618.05	621.60	653.71	694.75	697.20	675.44	605.99	563.86
1971	MAX	563.90	575.36	571.66	570.30	576.34	615.30	649.03	674.00	673.86	662.30	571.80	563.89
1972	MAX	564.03	572.50	574.08	571.41	572.72	616.58	638.09	648.74	643.03	523.62	540.56	560.57
1973	MAX	564.07	572.77	570.41	604.91	595.16	609.72	635.12	705.24	714.95	714.35	681.28	623.73
1974	MAX	565.35	578.51	572.71	586.53	574.02	623.09	669.12	712.33	714.95	707.15	666.38	613.42
1975	MAX	565.70	573.49	573.39	572.08	574.80	621.52	645.52	701.43	714.95	707.29	666.11	610.67
1976	MAX	567.78	576.95	571.58	571.39	571.98	598.33	621.50	636.32	627.10	528.74	549.81	571.97
1977	MAX	566.80	571.03	571.21	571.51	571.69	573.41	600.26	601.63	577.68	520.00	541.66	546.06
1978	MAX	553.30	564.98	583.54	592.93	623.85	640.05	648.32	679.86	711.02	713.17	704.36	645.70
1979	MAX	624.01	573.83	572.03	578.04	574.91	623.64	668.97	714.95	714.95	701.29	656.90	609.18
1980	MAX	566.49	574.09	572.77	665.09	665.06	649.69	667.81	685.30	708.48	712.28	704.14	639.42
1981	MAX	590.53	571.74	573.29	575.78	574.50	612.87	655.65	682.16	682.69	650.10	554.60	563.06
1982	MAX	565.26	578.84	576.31	591.61	571.11	566.22	689.65	714.32	713.93	710.09	694.86	636.26
1983	MAX	622.99	623.81	650.54	654.80	650.17	653.43	648.42	625.67	705.65	714.95	714.95	675.23
1984	MAX	639.12	620.17	642.99	646.25	641.00	636.33	671.03	713.21	713.92	694.19	649.61	607.90
1985	MAX	565.99	577.19	568.45	573.12	577.89	617.24	673.47	706.22	706.08	683.39	618.20	564.95
1986	MAX	564.92	573.06	577.57	590.26	656.70	656.72	675.91	709.20	714.46	712.39	685.23	627.42
1987	MAX	565.98	571.57	571.41	571.60	580.69	603.43	646.27	663.62	658.53	583.11	541.29	551.09
1988	MAX	563.36	573.98	573.74	579.75	573.32	607.96	638.84	652.08	649.47	526.28	545.14	557.39
1989	MAX	563.55	571.38	571.99	571.40	574.14	617.96	665.43	680.32	677.97	631.93	542.49	560.61
1990	MAX	564.72	571.30	571.38	571.86	571.40	602.25	634.39	643.16	638.47	520.00	543.24	550.97
1991	MAX	556.80	563.72	563.76	571.38	569.02	630.29	664.15	703.98	714.95	710.05	673.08	617.30
1992	MAX	566.57	571.48	571.38	571.44	572.88	598.15	640.98	653.86	645.54	528.21	543.30	548.04
MEAN		576.15	577.16	583.30	594.60	596.09	617.18	648.54	676.74	684.23	648.19	619.30	593.59
MAX		639.12	623.81	704.36	690.56	680.21	656.72	689.65	714.95	714.95	714.95	714.95	675.23
MIN		553.30	563.72	563.76	570.30	569.02	566.22	592.62	601.63	577.68	520.00	540.56	546.06

ELEVATION PROJECT LOCAL PLAN (with parameter, 0 AF Min Pool) 2050 CONDITIONS

WATER YEAR		OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
1966	MAX	581.71	590.44	586.43	584.11	593.68	624.55	668.99	687.33	685.62	642.55	548.86	567.1
1967	MAX	564.10	585.20	705.72	646.77	636.84	593.19	592.51	652.78	701.09	714.95	712.43	649.6
1968	MAX	619.23	584.57	584.44	587.90	594.94	621.77	651.47	669.10	669.00	620.42	551.52	560.18
1969	MAX	567.18	584.19	586.28	692.65	682.46	658.62	614.49	670.40	707.85	714.95	713.40	650.83
1970	MAX	615.79	585.27	590.75	625.16	621.91	623.94	655.13	695.77	698.21	676.65	609.12	564.99
1971	MAX	565.11	581.27	579.42	582.39	595.29	625.07	655.64	679.43	679.29	668.20	594.15	565.68
1972	MAX	565.60	579.92	586.88	583.16	596.57	626.14	645.45	655.24	649.89	523.62	540.56	560.57
1973	MAX	565.58	577.28	578.89	610.17	601.07	614.13	636.76	705.54	714.95	714.35	681.28	627.45
1974	MAX	568.27	585.53	581.91	594.11	590.25	624.94	668.76	712.23	714.95	707.15	666.38	617.86
1975	MAX	568.04	582.14	585.27	590.51	591.41	617.94	643.83	700.81	714.95	707.29	666.11	615.08
1976	MAX	571.80	585.28	585.27	587.85	596.32	611.20	630.29	643.50	634.87	528.74	549.81	574.85
1977	MAX	571.45	571.88	572.06	577.10	583.12	585.50	607.16	608.55	589.77	520.00	541.66	546.06
1978	MAX	553.30	565.19	591.46	598.27	623.85	640.05	648.03	679.43	710.95	713.12	704.31	648.84
1979	MAX	628.39	585.27	58[illegible].90	591.49	592.05	622.48	668.07	714.95	714.95	701.29	656.90	614.92
1980	MAX	570.60	585.27	586.65	668.20	668.14	653.30	669.72	686.18	708.57	712.38	704.24	643.00
1981	MAX	597.34	578.92	585.27	592.09	592.09	622.03	661.40	686.83	687.38	656.03	554.60	563.08
1982	MAX	568.15	584.72	590.0[illegible]	597.51	577.76	566.17	689.55	714.29	713.90	716.08	694.86	640.20
1983	MAX	627.81	624.05	653.38	658.40	653.84	656.88	652.36	625.63	705.35	714.95	714.95	675.23
1984	MAX	641.97	616.20	639.85	643.40	637.76	633.09	668.67	711.52	712.25	692.20	649.31	612.04
1985	MAX	569.69	583.67	579.91	588.31	595.05	621.65	675.07	707.48	707.34	684.91	621.09	567.75
1986	MAX	567.99	581.72	586.52	596.01	658.38	660.32	676.62	709.42	714.60	712.43	685.27	631.52
1987	MAX	573.13	580.16	585.28	590.51	597.98	615.23	652.44	668.77	664.10	599.07	541.29	551.09
1988	MAX	563.36	579.05	583.49	588.22	596.33	619.23	646.08	658.24	655.87	576.46	545.14	557.39
1989	MAX	563.67	575.86	581.05	579.97	594.49	623.61	668.35	682.97	680.71	635.94	542.49	560.6
1990	MAX	566.86	572.81	573.90	582.84	591.83	614.37	641.45	649.36	645.13	520.00	543.24	550.97
1991	MAX	556.80	563.98	564.74	576.65	574.61	630.28	663.67	703.83	714.95	710.05	673.06	620.61
1992	MAX	568.22	579.94	582.77	587.45	591.12	610.31	647.24	659.36	651.64	523.21	543.30	548.04
MEAN		579.30	583.33	592.35	603.75	608.49	622.81	651.75	679.22	686.97	651.89	620.35	595.43
MAX		641.97	624.05	705.72	692.65	682.46	660.32	689.55	714.95	714.95	714.95	714.95	675.23
MIN		553.30	563.98	564.74	576.65	574.61	566.17	592.51	608.55	589.77	520.00	540.56	546.06

from ER 1105-2-100
dated 28 Dec 90

Table 6-29
Guidelines for Assigning Points for General Recreation

Criteria	Judgement Factors				
(a) Recreation Experience[1]	Two general activities[2]	Several general activities	Several general activities; one high[3] quality value activity	Several general activites; more than one high quality activity	Numerous high quality activites; some general activites
Total Points: 30	0-4	5-10	11-16	17-23	24-30
(b) Availability of opportunity[4]	Several within 1 hr. travel time; a few within 30 min. travel time	Several within 1 hr. travel time; none within 30 min. travel time	One or two within 1 hr. time; none within 45 min. travel time	None within 1 hr. travel time	None within 2 hr. travel time
Total Points: 18	0-3	4-6	7-10	11-14	15-18
(c) Carrying capacity[5]	Minimum facility for development for public health and safety	Basic facility to conduct activity(ies)	Adequate facilities to conduct without deterioration of the resource or activity experience	Optimum facilities to conduct activity at site potential	Ultimate facilities to achieve intent of selected alternative
Total Points: 14	0-2	3-5	6-8	9-11	12-14
(d) Accessibility	Limited access by any means to site or within site	Fair access, poor quality roads to site; limited access within site	Fair access, fair road to site; fair access; good roads within site	Good access, good roads to site; fair access, good roads within site	Good access, high standard road to site; good access within site
Total Points: 18	0-3	4-6	7-10	11-14	15-18
(e) Environment	Low esthetic[6] factors that significantly lower quality[7]	Average esthetic quality; factors exist that lower quality to minor degree	Above average esthetic quality; any limiting factors can be reasonably rectified	High esthetic quality; no factors exist that lower quality	Outstanding esthetic quality; no factors exist that lower quality
Total Points: 20	0-2	3-6	7-10	11-15	16-20

1 Value for water-oriented activities should be adjusted if significant seasonal water level changes occur.
2 General activities include those that are common to the region and that are usually of normal quality.
This includes picnicking, camping, hiking, riding, cycling, and fishing and hunting of normal quality.
3 High quality value activities include those that are not common to the region (and/or Nation) and that are usually of high quality.
4 Likelihood of success at fishing and hunting.
5 Value should be adjusted for overuse.
6 Major esthetic qualities to be considered include geology and topography, water, and vegetation.
7 Factors to be considered to lowering quality include air and water pollution, pests, poor climate, and unsightly adjacent areas.

REVISED TABLE 6-28 (FY 96)
Conversion of Points to Dollar Values
(See ER 1105-2-100, Chapter 6,
Section VIII, for Table 6-29 and 6-30)

Point Values	General Recreation Values (1)	General Fishing& Hunting Values (1)	Specialized Fishing & Hunting Values (2)	Specialized Recreation Values Other Than Fishing & Hunting (2)
0	2.50	3.67	17.55	10.04
10	2.92	4.07	17.99	10.88
20	3.37	4.45	18.44	11.70
30	3.93	4.84	18.91	12.54
40	4.52	5.34	19.35	13.38
50	5.38	5.87.	21.13	15.07
60	5.80	6.39	22.93	16.97
70	6.25	6.88	24.74	20.08
80	6.67	7.16	26.54	23.42
90	7.11	7.42	28.31	26.77
100	7.53	7.49	30.12	30.12

(1) Points from Table 6-29
(2) Points from Table 6-30

FINAL ENVIRONMENTAL IMPACT STATEMENT/ ENVIRONMENTAL IMPACT REPORT APPENDIX G

COMMENTS AND RESPONSES

TABLE OF CONTENTS

CONGRESSMEN 936
1. Letter from State Senator Jim Costa dated July 23, 1996. 936
2. Oral comments from U.S. Representative Cal Dooley at public hearing. 937
3. Statement from U.S. Representative George Radanovich dated July 23, 1996. 937
4. Statement from U.S. Representative Bill Thomas dated July 23, 1996. 938

FEDERAL AGENCIES 939
5. Letter from Department of the Interior dated August 27, 1996. 939
6. Letter and attached comments from Environmental Protection Agency dated August 21, 1996. 940

STATE AGENCIES 944
7. Letter from California Water Commission dated July 8, 1996. 944
8. Letter from Department of Fish and Game dated August 26, 1996. 944
9. Letter from Department of Forestry and Fire Protection dated August 12, 1996. 951
10. Letter from Department of Water Resources dated July 23, 1996. 952

CITIES AND COUNTIES 953
11. Letter from Kings County Department of Agricultural Commissioner dated August 26, 1996 953
12. Oral comments from Kings County at public hearing. 953
13. Letter from Tulare County dated August 12, 1996. 953
13. Oral comments from Tulare County at public hearing. 954
14. Oral comments from City of Visalia at public hearing. 954

LOCAL 955
15. Oral comments from Kaweah Delta Water Conservation District at public hearing (comments endorsed by Kaweah and Saint Johns River Water Association). 955
16. Oral comments from Kings County Water District at public hearing. 955
17. Oral comments from Tulare County Flood Control District at public hearing. 956
18. Letter from Tulare Lake Basin Water Storage District dated August 1, 1996. 956

19. Letter from Tulare Lake Drainage District dated August 26, 1996. 956

ORGANIZATIONS 957
20. Letter from American Whitewater Affiliation dated August 26, 1996. 957
21. Letter from California Native Plant Society dated August 26, 1996. 958
22. Oral comments from Central Valley Bass Masters at public hearing. 959
23. Letter from Environmental Defense Fund dated August 26, 1996. 960
24. Oral comments from Etco Marine at public hearing. 960
25. Statement from Kaweah Lake Preservation Group dated July 23, 1996. 961
26. Letters from Kaweah Marina dated July 23 and August 12, 1996. 961
27. Letter from Lakeside Ditch Company dated July 11, 1996. 963
28. Letter from Law Offices of Richard L. Harriman dated August 27, 1996. 964
29. Oral comments from San Joaquin Paddling Club at public hearing. 965
30. Oral comments from Three Rivers - Lemon Cove Business Association at public hearing. 966
31. Letter from Tyrrell Management Company dated August 20, 1996. 966

INDIVIDUALS 967
32. Letter from Keith Beck, M.D., dated July 20, 1996. 967
33. Letter from Lowell E. Brown, Jr., dated July 15, 1996. 968
34. Letter from Betty Douglas dated July 22, 1996. 970
35. Letter from Bill Douglas dated July 25, 1996. 970
36. Oral comments from Darrel Hall at public hearing. 970
37. Letter from Margaret Austin Hall dated July 14, 1996. 971
38. Oral comments from Brad Howard at public hearing. 972
39. Oral comments from John Kirkpatrick at public hearing. 972
40. Letter from Kyle Knight dated July 21, 1996. 973
41. Letter from Robert Krase dated August 19, 1996. 973
42. Letter from Micheal Latendresse dated August 22, 1996. 974
43. Letter from Robert Lawson dated July 29, 1996. 975
44. Letter from Karla Little dated August 21, 1996. 975
45. Letter from Bard McAllister dated July 25, 1996. 976
46. Letter from Marilyn Messa dated August 27, 1996. 977
47. Letter from William Pooley dated August 26, 1996. 977
48. Letter from Rick Mitchell dated August 23, 1996. 978
49. Letter from Stanley Stephens dated August 26, 1996. 979
50. Oral comments from Del Strange at public hearing. 1001
51. Letter from William S. Tuthill dated July 24, 1996 1002
52. Letter from Peter van Gilluwe dated July 22, 1996. 1002
53. Letter from Mrs. W. Woods received July 1, 1996. 1002

COMMENT LETTERS/STATEMENTS 1003

The draft Kaweah 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 June 1996. This appendix contains the comments that were received during the review period, which ended August 27, 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 formal public hearing was held in Visalia in July. Oral and written comments were received at the hearing. Six of the 23 commentors also submitted or mailed written comments. The oral comments of the other 17 commentors and Corps responses are included with the written comments. A copy of the transcript from the hearing follows the copies of the original correspondence.

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.

CONGRESSMEN

1. Letter from State Senator Jim Costa dated July 23, 1996.

a. Comment: "As the state Senator representing lands in the Kaweah drainage, I want you to know I fully endorse the district's [Kaweah Delta Water Conservation District] recommendations [support of the Locally Preferred Plan over the National Economic Development plan]."

Response: Planning of water resource projects in the Corps is based on the Water Resources Council's Planning Principles and Guidelines. The Corps interpretation of those guidelines (in its administrative regulations, guidance, and policy) calls for the recommendation of a particular water resource alternative over another based primarily on a national economic development analysis. Under this concept the Federal government strives to recommend water resource plans which maximize economic benefits to the nation. While the Corps may recommend a plan which deviates from the NED plan, such a decision is evaluated on a case-by-case basis. In general, a deviation from the NED plan may be approved if the locally preferred plan provides greater economic outputs which may be significant regionally or environmentally, but from a national economic development analysis perspective it is not deemed an optimal investment.

The National Economic Development Plan (NED) identified in the Kaweah River Basin Investigation maximizes flood control benefits. The Locally Preferred Plan (LPP) maximizes water supply benefits while providing additional security to the existing recreation operations. The LPP also provides additional protection to warm water fishery resources within the lake. These unquantified benefits associated with recreation and the warm water fishery benefits did not influence the conclusions of the national economic development analysis. The existing recreation facilities were never intended to be operated and maintained at Federal expense. While current policy does recognize recreation benefits as legitimate national economic development benefits, policy requires that a non-Federal sponsor cost share in the construction and operation and maintenance of any recreation plan. Because no non-Federal sponsor was identified for recreation facilities, existing recreation benefits of the project and current recreation OMRR&R costs are not considered in the evaluation of this project in relation to the final recommendation. Consequently, the NED plan was recommended by the Corps.

b. Comment: "It is my hope that preconstruction engineering design will begin this fiscal year. . . . I would like to encourage the Corps of Engineers to expedite the project to increase flood control capabilities and irrigation benefits for the Kaweah River Basin."

Response: The preconstruction, engineering, and design phase will begin in Fiscal Year 1996.

2. Oral comments from U.S. Representative Cal Dooley at public hearing.

a. Comment: "I strongly support the project to increase the flood control and water storage capability of Lake Kaweah by raising the spillway of Terminus Dam by 21 feet. . . . I support the Locally Preferred Plan for operating the project because it will provide the greatest benefits for the largest number of parties."

Response: Same response as Costa a.

b. Comment: "I urge the Corps to stay on schedule so this project can get under way. It also is important that the Corps begin preconstruction engineering and design of the project during the current fiscal year."

Response: Same response as Costa b.

3. Statement from U.S. Representative George Radanovich dated July 23, 1996.

a. Comment: "First, I wish to express my strong support for the Lake Kaweah Enlargement Project . . . Alternative 1 (No Action) is clearly unacceptable. The Corps, as well as the local sponsors, have demonstrated a need for action and substantial taxpayer and sponsor funds have been expended. . . . I give my support and recommendation for operation under the Locally Preferred Plan. Structurally identical to the NED Plan, the LPP provides similar flood control and irrigation benefits while providing substantially greater fishery, recreation and other environmental benefits. This plan was developed by consensus and has the support of the local sponsors. . . ."

Response: Same response as Costa a.

b. Comment: ". . . I emphasize that it is imperative that the Chief's Report stay on course to be completed in 1996 in order to meet the criterion for conditional authorization in the 1996 Water Resources Development Act. Failure to meet this deadline would result in greatly increased costs to the local sponsors and the federal taxpayers and could jeopardize the future of this important project.

Response: Same response as Costa b.

4. Statement from U.S. Representative Bill Thomas dated July 23, 1996.

a. Comment: "I believe the local sponsors have developed an option that could create a win-win situation for everyone. Their 'Locally Preferred Plan' would increase conditional water storage capacity to 12,000 acre-feet and enhance fisheries and recreational opportunities at the lake."

Response: Same response as Costa a.

b. Comment: "I urge the Corps to examine this proposal and to begin action on its engineering design before this coming October."

Response: Same response as Costa b.

FEDERAL AGENCIES

5. Letter from Department of the Interior dated August 27, 1996.

a. Comment: "The Bureau of Reclamation (BOR) has projects which this proposed action could affect. One is the Friant-Kern Canal siphon where it passes under the Kaweah River."

Response: The proposed improvements at Terminus Dam should not adversely affect the Friant-Kern Canal siphon. The frequency and peak flows of floodwaters passing over the siphon should reduce the exposure of the siphon to flood damages. The additional water supply developed through the proposed action may improve the flexibility of water deliveries throughout some areas of the region.

b. Comment: "Reclamation also funds the Kaweah River Delta Corridor Enhancement Study managed by Kaweah Delta Water Conservation District.

Work on the Kaweah River Delta Corridor Enhancement Study (DEIS 5-4) is in process, so the information presented here is out of date. One of the three benefits of the project is stormwater protection rather than emergency flood control."

Response: The funding, correct benefit, and current status of the study are noted.

c. Comment: "On DEIS 4-68, . . . in relocating populations of Kaweah Brodiacea . . . and Spiny-sepaled Coyote-thistle . . . care must be taken as these plants may be exacting in their requirements."

Response: Existing populations of the two plants would be relocated if inundated by the increased level of the reservoir. Care would be taken to ensure that the plants are salvaged and relocated in a manner that would ensure their survival. During preconstruction engineering and design a detailed topographic survey of the reservoir area would be made. If necessary, experts on this species would be consulted. The relocated plants would be protected from disturbance such as construction and firebreaks.

d. Comment: "On DEIS 4-69, it would seem more prudent to have a tentative plan in place to avoid any impacts to southwestern pond turtle rather than possibly delaying construction in the Horse Creek area."

Response: Previous studies, surveys, and the State's Natural Diversity Data Base did not indicate the occurrence of this Federal candidate species in the study area although lake personnel have reported seeing a few turtles. Since the occurrence of this species at specific construction sites seems unlikely, a detailed avoidance plan would not be needed unless indicated by a biologist during advanced studies.

e. Comment: "You may wish to reconsider the value of putting blue oak on Lower San Joaquin Irrigation District (LSID) sites. . . . they are not found down onto the valley floor. There appear to be no alternatives to using the LSID sites and no mention about what arrangements for these have been made."

Response: Since blue oaks are not found on the valley floor, the Habitat Evaluation Procedure team agreed to a trade-off of blue and interior live oak woodlands for valley oak woodland at the LSID site. Page 4-1 states mitigation sites may change in PED due to availability or suitability.

f. Comment: "The issue's [effects on recreation] dismissal on the basis that 'no non-Federal sponsor was initially willing to cost share in a recreation plan to relocate' the facilities seems abrupt."

Response: The recreational needs in the study area are identified under "Recreation" in Chapter 3 of the FR. In addition, the EIS/EIR describes the recreational resources, potential impacts of the alternatives on these resources, and benefits and costs in Section 3.3.3, Section 4.4, and Appendix F, respectively. Since recreation is not an authorized purpose of the Terminus Dam project, Corps policy requires that a non-Federal sponsor be willing to cost share in a recreation plan to relocate any facilities beyond those required by public health regulations. If such a non-Federal sponsor is identified, the Corps would cooperate fully in the development and evaluation of a recreation plan.

6. Letter and attached comments from Environmental Protection Agency dated August 21, 1996.

a. Comment: "We urge the Crops to address the long-term sedimentation issue, the underlying cause of the lost storage space, instead of focusing only on a short-term fix to the problem."

Response: Same response as McCallister c.

b. Comment: ". . . we remain concerned because of the debatable success of replacement/recreated habitat."

Response: The Corps and non-Federal sponsor would be jointly responsible for ensuring the success of the mitigation plan. Riparian and oak woodland/savannah plantings would be monitored for 3 years, and there would be a plant survival success criterion of not more than 30 percent mortality in the first 2 years. Wetland plantings would be monitored for 6 years. After the mitigation monitoring is completed, the non-Federal sponsor would be responsible for maintaining and documenting the status of the mitigation sites.

c. Comment: ". . . proposed mitigation does not address the potential adverse effects to recreation and fisheries."

Response: Same responses as Kaweah Marina a and b.

d. Comment: "Thus, if other more comprehensive alternatives are not proposed, we recommend the LPP plan be the selected plan."

Response: Same response as Costa a.

e. Comment: EPA does "not believe the DEIS totally complies with the intent of NEPA" because only three alternatives are evaluated. "We strongly urge the Corps and project sponsors to evaluate, in detail, additional options to increase flood protection and water supply."

Response: During plan formulation, a variety of preliminary alternatives were evaluated to provide flood control and increase water supply. These alternatives included other storage sites, detention basins, levee and channel work, pumping into Friant-Kern Canal, removing sediment from Lake Kaweah, ground-water recharge, and nonstructural methods. However, engineering, economic, and environmental analyses of the preliminary alternatives indicated that none of these plans were feasible either because they could not provide adequate flood control or water supply or they were economically infeasible (benefit-to-cost ratios less than 1.0). As a result, these plans were not considered further. Additional discussions of the preliminary alternatives are included under "Measures" in Chapter 5 of the FR and Section 2.3 of the EIS/EIR.

f. Comment: "The DEIS clearly states that the liquefaction susceptibility of the alluvium foundation of Terminus Dam is still unknown (pg. 4-12). Thus, a significant unresolved question regarding the safety of the dam remains. . . . "We

strongly recommend the Corps conclusively resolve the dam safety issue prior to a decision on raising the spillway or increasing the size of the gross pool."

Response: Preliminary seismic studies have identified potential liquefaction problems at Terminus Dam whether the proposed spillway project occurs or not. Dam safety studies are being done concurrently with preconstruction, engineering, and design studies for the proposed spillway raise.

g. Comment: "The confirmatory environmental site assessment for hazardous waste sites done by the California Department of Water Resources (Appendix G, Feasibility Report) describes several sites which could delay implementation of the proposed action because of remediation requirements. . . . We urge the Corps and local sponsor to conduct the detailed site assessment studies and remedial plan development prior to the final decision on the proposed action in order to minimize the loss of sunk costs."

Response: In accordance with Federal policy regarding cost-shared studies, the non-Federal sponsor is responsible for evaluation and any required remediation of hazardous waste associated with a proposed project. Detailed site assessment studies would be conducted early in the preconstruction engineering and design phase of the project to identify any potential hazardous waste problems. If necessary, plans would then be developed to remediate the contamination. The schedule for the studies and plans (if necessary) would be developed to minimize any sunk costs.

h. Comment: The Environmental Protection Agency is concerned that potential soil and groundwater contamination on the Lindsay Strathmore Irrigation District site may make it unusable as a mitigation site. ". . . we recommend the FEIS include an additional evaluation of the feasibility of the Lindsay site as a mitigation site. . . . include possible fallback options . . . ."

Response: The non-Federal sponsor would be responsible for evaluation and any required remediation of and hazardous waste sites on mitigation lands. Detailed site assessment studies would be conducted early in the preconstruction engineering and design phase of the project to identify any potential hazardous waste problems on the Lindsay Strathmore Irrigation District site. If necessary, plans would then be developed to remediate any contamination, modify project designs to avoid the contamination, or use another site.

The "Kaweah River Corridor Study," a two-part study done in 1993 for the city of Visalia and the Kaweah River Delta Water Conservation District evaluated the environmental restoration potential of 14 sites along the Kaweah And St. John's Rivers downstream of Terminus Dam. The U.S. Fish and Wildlife Service

further evaluated four of these sites and stated in their Coordination Act Report that "significant riparian corridor expansion and oak tree regeneration opportunities are available at each site."

i. **Comment:** The Environmental Protection Agency urges the Corps and project sponsors to demonstrate leadership on a San Joaquin Valley basin-wide plan to address water management effects in the area. ". . . especially appropriate given the new restoration mission of the Corps and the critical regional issues of groundwater overdraft, water supply, and cumulative impacts from multiple water supply and flood protection actions."

Response: The Corps actively supports effective water management in California. The Corps continues to cooperative with other Federal, State, and local agencies to evaluate, develop, and protect water resources in the San Joaquin Valley. Existing Corps projects are operated and maintained in cooperation with other existing projects in the valley, especially during flood events. To fulfill its new environmental restoration mission, the Corps and various non-Federal sponsors are currently evaluating environmental restoration opportunities at several existing and potential Corps projects.

j. **Comment:** "A detailed Section 404(b)(1) alternatives analysis was not included in the DEIS. . . . such as evaluation was not pursued due to the lack of impacts to wetlands. . . . The FEIS should clearly show that wetlands are not adversely affected by the proposed project."

Response: A sentence has been added to Section 3.3.9 in the final EIS/EIR to indicate that there are no jurisdictional wetlands around the reservoir or in the reservoir area.

STATE AGENCIES

7. Letter from California Water Commission dated July 8, 1996.

a. Comment: At its June 7 meeting, the Commission "voted to support the Locally Preferred Plan (LPP) and encourage expeditious completion of the necessary work to begin preconstruction engineering and design this fiscal year."

Response: Same response as Costa a and b.

8. Letter from Department of Fish and Game dated August 26, 1996.

a. Comment: "In general, . . . we support the Locally Preferred Alternative (LPA). . . . With minor improvements, it potentially provides improved protection for fishery resources and associated recreational use. It presents opportunities for impact avoidance and mitigation that far exceed those available under the NED alternative."

Response: Same as Costa a.

b. Comment: The Department is concerned about the effect of the loss of shoreline vegetation on fishery diversity in the reservoir.

Response: Section 4.11.2 of the EIS/EIR discusses the effects of the project on the fishery in the reservoir.

c. Comment: The Department is concerned about the effects of the project on riparian habitat around the reservoir. "Any such loss should be mitigated in-kind, and as near the impact site as is practicable."

The Department recommends that "local sportsmen be allowed to cable them [oak trees to be cut along the reservoir] in place as submergent fish habitat . . . and as wildlife brush-piles . . . ."

Response: Section 4.10 of the EIS/EIR discusses the effects of the project on riparian habitat around the reservoir. Sections 4.10.4 and 5.7 discuss mitigation in accordance with Corps policy and guidance. In-kind and on-site mitigation were considered in the development, evaluation, and selection of all mitigation plans.

Page 2-7 of the EIS/EIR states that the trees in the new inundation zone would not be removed [cut]. In conjunction with Corps lake personnel, local

sportsmen could cable the trees in place as fish habitat.

d. Comment: The Department argues that the NED plan would adversely affect the fishery in the reservoir and that any adverse effects should be mitigated.

The Department states that the draft FR and draft EIS/EIR "both erroneously state, under the NED alternative, that fisheries can alternatively be produced by artificial stocking." They then discuss several reasons why stocking would not be feasible.

". . . Federal projects are responsible to mitigate their impacts to fish and wildlife as a project cost, and that this burden is not averted simply by the lack of a separate non-federal recreation sponsor."

"The conditional pool flood control evacuation criteria need to be clearly defined, such that evacuation does in fact occur as infrequently as possible."

Response: The effects of the NED plan on the fishery in the reservoir are discussed in Section 4.11.2 of the EIS/EIR. Under the NED plan, conditions for fish resources in the reservoir are expected to be similar to without-project conditions. Although the NED plan does not significantly improve the fishery, the plan does not significantly worsen the long-term viability of the fishery in the reservoir. As a result, no mitigation was proposed.

The EIS/EIR does not state that the fishery in the reservoir could be produced by artificial stocking under the NED plan. Section 4.11 states: "The DFG or local interests could stock additional warmwater gamefish in the reservoir when adequate water conditions return. Due to financial constraints, restocking gamefish in Lake Kaweah is not guaranteed, especially if the lake is emptied frequently."

Mitigation plans for the Kaweah River Basin project have been developed in accordance with all applicable laws and policies. Corps guidance states that project-caused adverse impacts to fish and wildlife resources have been avoided or minimized to the extent practicable, and that unavoidable impacts have been compensated to the extent justified. In addition, the Water Resources Development Act of 1986 (Public Law 99-662) and subsequent Corps policy state that non-Federal cost sharing is required for the devlelopment of recreation facilities at Corps projects. Current recreation laws and policy are summarized in Section 5.8 of the EIS/EIR.

The timing of releases would be the same under the NED plan and the LPP as the without-project conditions. Detailed reservoir operation diagrams are

shown in the FR.

e. **Comment:** The Department argues that lost recreational facilities should "be addressed in the project EIS, and mitigated as features of the project."

Response: The recreational needs in the study area are identified under "Recreation" in Chapter 3 of the FR. In addition, the EIS/EIR describes the recreational resources, potential impacts of the alternatives on these resources, and benefits and costs in Section 3.3.3, Section 4.4, and Appendix F, respectively. The Water Resources Development Act of 1986 (Public Law 99-662) and subsequent Corps policy state that non-Federal cost sharing is required for the devlelopment of recreation facilities at Corps projects. Current recreation laws and policy are summarized in Section 5.8 of the EIS/EIR.

f. **Comment:** The Department is considered about minimum fishery protection at the reservoir. They would also like operation and evacuation criteria clarified for the conditional pool. "We recommend that the project EIS compare and display the differental flood event protection for the city of Visalia, and agricultural lands within Tulare Lake, with and without evacuation of the conditional pool".

Response: The project purpose for Terminus Dam is flood control and water supply. Therefore, there are no miminum fishery protection requirements for the operation of the reservoir. The reservoir could be emptied at any time for flood control purposes. Appendix A, attachment 2 of the FR contains the operating criteria for the conditional pool. The flood protection level in all areas downstream of the dam would be less if the conditional pool was not allowed to be evacuated for flood control purposes. The conditional storage space is not established for flood protection but improves water supply benefits and incidental recreation and fishery benefits. In any case, both the NED and LPP plans improve winter conditions for the fishery compared to the without-project conditions.

g. **Comment:** The Department is concerned about fishery effects that would occur if the reservoir is emptied for non-flood control purposes in context with other cumulative fishery impacts.

Response: Water supply releases under the proposed operating criteria would be similar to without-project conditions. When compared to without-project conditions, the proposed project would not contribute to any adverse cumulative impact of the reservoir fishery. The conditional space in the NED plan would be in the operating criteria for the life of the project. Without the project, there is no guarentee of conditional space in the reservoir.

h. **Comment:** The Department believes mitigation for fishery impacts should include purchase of water rights necessary to control the conditional pool, thus enabling them to provide the pool in perpituity.

Response: The proposed project provides conditional storage space in pertituity. This conditional storage space is not the same as a permanent miminum pool. Under the alternatives the Department identifies reservoir de-watering as an adverse impact. However, under without project conditions, this reservoir de-watering may also occur. Purchase of water rights to control the conditional pool is therefore not appropriate. Increased storage provided by the proposed alternatives may offer water supply operation flexability in coordinating with Centeral Valley Water Project facilities (Friant-Kern Canal).

i. **Comment:** Recreation impacts should be addressed in the EIS and mitigated as features of the project.

Response: Same as Kaweah Marina a.

j. **Comment:** "We recommend the Final EIS analyze sediment removal both as a governmental and contractual (i.e., privatized) operation."

Response: Same response as Beck a and McCallister c.

k. **Comment:** The Department argues that "the estimates of economic value associated with recreation at Kaweah Lake are underestimated in both the Draft EIS and Draft Feasibility Study."

"We believe the project must accept responsibility for mitigating . . . at least at levels needed to assure continuation of basic public service."

Response: Same response as Kaweah Marina c.

The proposed project includes replacement of basic minimum facilities for public health and safety. The facilities include vault toilets and lengthening the Kaweah Marina boat ramp.

l. **Comment:** What would be the long-term impacts to alder trees and valley riparian habitat if flooded is eliminated?

Response: Page 4-53 explains our assessment of downstream impacts. According to the simulations that were done for the project, the downstream flows are not expected to change singificantly from without projects conditons. the Kaweah River and other tributaries wold still receive flows from other sources

including local runoff. Flooding would not be eliminated downstream of Terminus Dam.

j. **Comment:** How will changes in flushing, sediment deposition, timing of water flow, etc., affect riparian vegetation and its associated wildlife?

Response: Operation of the resrvoir with the project is not expected to be significantly different from without project conditions. Less water would be released downstream during the spring reservoir filling period and water releases would increase in the summer during irrigation season. Flow changes downstream from the dam in the winter and spring are expected to be minor and not effect downstream vegetation and wildlife resources. Downstream tributarities would still receive flows from other sources including runoff. Irrigation releases woould also be made longer in the irrigation season than without the project. The project would also increase groundwater recharge capability and lessen the use of groundwater pumping during the irrigation season see page DEIS 1-7.

k. **Comment:** The analysis of potential off-site mitigation sites is inadequate.

Response: The analysis of mitigation sites included 7 sites and is discussed in section 4.10.4 and 5.7. Biological criteria was included on page 4-56. The management of the mitigation lands would be the non-Federal sponsor's responsibility. Mitigation lands are purchased in fee title and will be maintained in perpetuity. Section 5.7 outlines the framework for the final mitigation and monitoring plan that will be developed and finalized in PED and included in the operation and maintenance manual. Ultimately, however, the lands are turned over to the non-Federal sponsor to operate and maintain as specified in the operation and maintenance manual. The non-Federal sponsor could contract with the FWS or DFG to oversee the mitigation lands.

l. **Comment:** The Department does not necessarily agree that all livestock grazing should be removed from mitigaiton sites.

Response: Periodic grazing may be considered during PED as part of the mitigation and monitoring plan.

j. **Comment:** The Department is concerned about the site selection for mitigation at the Tulare Lakebed.

Response: The wetland mitigation site was selected with the FWS. The sites considered for wetland mitigation are included in section 4.10.4 and 5.7 and in Appendix 2. Elimination of mitigation sites was done according to Corps policy

on justifiable mitigation by performing an incremental analysis in Appx B.

The lakebed mitigation site was chosen for a variety of factors those factors are discussed on page 5-16 and include its location near KDWCD boundaries, existing water delivery system, proximity to the Corcoran Irrigation District ponds, and historical conditions. DFG field personnel (Tim Kroeker) was consulted and stated that the Corcoran ponds nearby get a lot of shorebird use and that an additional site would be a benefit.

The Corps believes that the selected mitigation site for wetlands is adequate. However, as discussed on page 4-1 mitigation sites may change due to availability, soils analysis etc. If alternate mitigation sites are selected, those sites would be evaluated in a supplemental environmental document.

k. Comment: The Department is concerned about potential impacts from the project to the Creighton Ranch area.

Response: Creighton Ranch would not be affected by the proposed project and was not included in the analysis for the EIS/EIR.

l. Comment: Who will be responsible for supplying the water for wetland mitigation?

Response: Each year the wetland mitigation area would be flooded with clear water from February to July. The non-Federal sponsor would be responsible for supplying the water.

j. Comment: The Department is concerned about the way the Corps used the analysis of mitigation sites in relation to the Kaweah Delta Water Conservation District's Kaweah River Delta Cooridor Enhancement Study.

Response: The Kaweah River Corridor Enhancement Study evaluated sites for among other things habitat enhancement. The Corps used these criteria to assist in the selection of potential mitigation sites. Availability of the sites was also considered.

k. Comment: The Department is concerned about the planting of blue oak at the downstream mitigaiton site and associated irrigation.

Response: Page 12. Page 37 of the CAR states that the LSID mitigation site is suitable for valley oak savannah and woodland. There is a trade-off of blue and interior live oak woodlands for valley oak woodlands at the mitigation site.

The water for irrigation would be supplied by the non-Federal sponsors as described in the detailed mitigation and monitoring plan developed in PED. This plan will be part of the operation and maintenance manual. As described on page 5-16 and in Appx 2, supplemental summer irrigation would be done to ensure the survival of the young plants.

l. **Comment:** The Department is concerned about the performance variables to measure mitigation success.

Response: Performance variables are tied directly to the variables in the HEP models which are contained in Appx A-1 of the CAR. This insures the success of the mitigation is related to the evaluation species chosen to represent those habitats. 1.25 is the number of trees/shrubs species identified for baseline conditions for the riparian scrub habitat. The numbers for the final success criteria relate to the baseline conditions measured for the affected habitats. The baseline information is in Appx A-II of the CAR. The success criteria for all habitats can only relate directly to the HEP models and baseline measurements for the project. The timing of the target of the final success criteria will be included in the final mitigation and monitoring plan and included in the operation and maintenance manual.

m. **Comment:** The Department would like to see rodent control at the mitigation sites and monitoring reports and remedial action plans.

Response: Rodent control could be added to the mitigation and monitoring plan. Biannual and annual reports would be prepared for mitigation monitoring. Annual monitoring reports would be prepared between years 3 and 6. Remedial action plans are included in the detailed mitigation and monitoring plan developed in PED.

n. **Comment:** The Department notes that the Kaweah brodiaea listing status by the State of California is endangered.

Response: Comment noted.

o. **Comment:** The Department had concerns over some of the information for the foothill yellow-legged frog and the red-legged frog. Additionally, they supported enhancement measures for the bald eagle.

Response: The survey report, Appendix B to the BDR states that the foothill yellow-legged frog is currently found only at high elevations in Sequoia National Park (Werner pers comm, 1995). Full citation of source is Werner, Harold. April 1995. Wildlife Biologist. Sequoia National Park. Telephone

conversation.

Red-legged frog - Comment noted on the change of status of the red-legged frog. The survey report, Appendix B to the BDR states the California red-legged frog is unlikely to occur in the project area (Hansen and Werner per comm, 1995). Full citation is Hansen, Robert B. May 1995. Biological Consultant. Visalia, California. Telephone conversation. Werner, Harold. April 1995. Wildlife Biologist. Sequoia National Park. Telephone conversation.

Bald Eagle - The BDR concludes that since the project would not remove mature trees and snags that constitute roosting and perching habitat for eagles therefore, no enhancement measures would be necessary

p. **Comment:** The Department is concerned about mitigating future cumulative impacts at the lakebed.

Response: The EIS/EIR states that the effects of the Kaweah project would be mitigated to a less than significant level and the proposed projects evaluated for cumulative effects are not expected to adversely affect flows to the lakebed. However, cumulative adverse effects to wildlife, wetland habitat, and endangered species may occur in the Tulare lakebed due to the collective effects of other future projects in the San Joaquin Valley. There is a great potential for basin-wide adverse environmental effects resulting from the many smaller proposals for localized water diversions. Further studies are needed to address water management effects in the San Joaquin Valley in a basin-w

9. Letter from Department of Forestry and Fire Protection dated August 12, 1996.

a. **Comment:** "The report does not address fire prevention engineering of equipment related fires during the construction process. The raising of Terminus Dam will involve the use of heavy equipment at the quarry site and at Horse Creek. Will the construction efforts occur during the fire season? Will fire patrols be provided and by whom?"

Response: Construction of the project would require two construction seasons. The first season would be limited to April through November and would involve the relocation and construction of the Horse Creek Bridge. The second season would begin the following March and continue through November and would involve raising Terminus Dam and enlarging the spillway. During all construction activities, best management practices would be used to minimize the possibility of construction-related fires. For example, water trucks would spray the area regularly, and spark arrestors would be used on heavy equipment. In addition, the Corps would coordinate the construction schedule with local fire

authorities to ensure public safety.

b. Comment: "Increase in the shore line will increase the area of contact by recreationists. . . . Any fire starts, during peak reservoir storage, will place the start higher on the hillside allowing for more rapid spread. The fires that currently occur along the shoreline are illegal campfires and occur on relatively mild slopes. Starting the fire on the steeper "mid-slope" will have an adverse affect on our ability to contain the fire before it reaches a larger size."

Response: Recreationists would continue to be reminded that campfires along the shoreline are not allowed. In addition, Corps rangers would continue to patrol the reservoir area. Any illegal campfires would be immediately extinguished, and recreationists who do not adhere to the regulations would be cited.

10. Letter from Department of Water Resources dated July 23, 1996.

a. Comment: The department noted the flood protection, fish and wildlife, and incidental recreational benefits
of the Locally Preferred Plan as well as the strong support for the plan from the local sponsors and the community. "For these reasons and based on our experience with the study, we recommend that the Corps actively pursue the LPP."

Response: Same response as Costa a and b.

CITIES AND COUNTIES

11. Letter from Kings County Department of Agricultural Commissioner dated August 26, 1996.

a. Comment: ". . . express my support for raising the spillway at Terminus Dam as suggested in the Locally Preferred Plan (LPP)."

Response: Same as Costa a.

b. Comment: ". . . hope that the selection of mitigation properties as found in the LPP for the purpose of wetland wildlife habitat development is flexible and objective."

Response: The proposed mitigation sites were selected with the intent of mitigation being implemented on those sites. However, as the project progresses, mitigation sites could change due to factors such as site suitability and availability. If different mitigation sites are selected, they would be evaluated in a supplemental environmental document for public review and comment.

12. Oral comments from Kings County at public hearing.

a. Comment: "No Action is simply not acceptable. . . . We believe that the Locally Preferred Plan and will afford the best of all proposals."

Response: Same response as Costa a.

b. Comment: "We would like to strongly recommend immediate completion of the feasibility and environmental documents in order that the preconstruction and engineering and design phases can begin in fiscal year 1996."

Response: Same response as Costa b.

13. Letter from Tulare County dated August 12, 1996.

a. Comment: "Figure 1 needs to be revised to include a map showing the extent of the new lake area resulting from the raising of the dam."

Response: Since the difference between the with- and without-project surface areas of the lake is small compared to the without-project surface area, the difference is nearly indistinguishable on an 8 1/2-inch by 11-inch (or 11-inch

by 17-inch) map such as Figure 1. Currently, the differences are shown on large topographic maps, which are available for viewing at the Sacramento District.

b. Comment: "Tulare County would like to be provided with the final report on the seismic safety foundation testing for the dam when it becomes available. We would also like to be provided with any further technical studies or monitoring reports on dam seepage."

Response: The Corps will keep Tulare County informed of the progress of seismic studies and associated studies.

c. Comment: "Was on-site mitigation for riparian habitat considered? Mitigation habitat could be re-established within the elevational range of the new maximum pool. This would significantly reduce the costs associated with the project, and provide mitigation for wildlife that are currently utilizing this site."

Response: In the selection of the mitigation sites for the project, the lands currently owned by the Corps (project lands) in the reservoir area were evaluated first. Unfortunately, the amount and quality of these acres were inadequate to satisfy mitigation requirements so off-site mitigation was considered. Additional details on the sites that were evaluated are included in Section 4.10.4 of the EIS/EIR.

d. Comment: "Was the increased evaporation rate of the additional 152 acres of reservoir surface area analyzed, showing net gains or losses?"

Response: The 21-foot spillway raise would increase the water surface area at gross pool by 241 acres. While the rate of evaporation would not change from existing conditions, more water would be lost to evaporation because of the larger surface area. However, increased losses are not expected to be significant since the increase in water surface area is small relative to the increased storage and the reservoir will not fill to the gross pool every year.

e. Comment: "As dredging was not considered as an option, please discuss why this sediment could not be utilized as a supply of aggregate."

Response: Same response as Beck a and McCallister c.

13. Oral comments from Tulare County at public hearing.

a. Comment: ". . . on behalf of the Tulare County Board of Supervisors, I would like to make a comment for the record that we are in favor of the Locally Preferred Plan. The No Action option is not an option for us . . . ."

Response: Same response as Costa a.

14. Oral comments from City of Visalia at public hearing.

a. Comment: "The City of Visalia supports the project, especially the Locally Preferred Plan. We do not support the No Project Alternative."

Response: Same response as Costa a.

LOCAL AGENCIES

15. Oral comments from Kaweah Delta Water Conservation District at public hearing (comments endorsed by Kaweah and Saint Johns River Water Association).

a. Comment: ". . . . the No Action Alternative is simply not acceptable. . . . we recommend that the enlarged Lake Kaweah be operated under the Locally Preferred Plan."

Response: Same response as Costa a.

b. Comment: ". . . proceed to a rapid and timely completion of the feasibility and environmental reports so that preconstruction engineering and design may be started in this fiscal year 1996."

Response: Same response Costa b.

c. Comment: "We request the development of a more reasonable NED plan, one which would allow for conditional space to be constant for the entire project life. . . . request [that the Corps] explore all opportunities to bring the flood control benefits under the Locally Preferred Plan to a similar level as the NED plan without disturbing the 12,000 acre feet of conditional space provided by the Locally Preferred Plan."

Response: Alternative operational scenarios were evaluated for both the NED plan and the LPP. Optimization of alternative operational scenarios from a flood control benefit perspective would conclude that operating the reservoir without any conditional storage space would optimize flood control benefits. However, this would eliminate substantial water supply benefits associated with the existing project. Elimination of the conditional storage space would also have significant impacts on fishery and other environmental resources. Such a plan would not be implementable. The formulation of the NED and LPP plans described in Chapters 5, 6, and 7 of the FR represents a reasonable formulation which balances economic optimization with environmental and implementability considerations.

16. Oral comments from Kings County Water District at public hearing.

a. Comment: ". . . enforce our support for the Lake Kaweah Enlargement Project and the Locally Preferred Plan."

Response: Same response as Costa a.

17. Oral comments from Tulare County Flood Control District at public hearing.

a. Comment: ". . . officially state that the district thoroughly supports this project, especially the Locally Preferred Plan as proposed."

Response: Same response as Costa a.

18. Letter from Tulare Lake Basin Water Storage District dated August 1, 1996.

This letter has numerous detailed comments on the U.S. Fish and Wildlife Service's Draft Coordination Act Report, which is an appendix to the draft EIS/EIR. A copy of the letter has been forwarded to the U.S. Fish and Wildlife Service since they are responsible for the final Coordination Act Report. The Corps has thoroughly reviewed the comments for their relevance to the existing text in the main draft EIS/EIR and has found that no changes need to be made to the main draft EIS/EIR.

18. Oral comments from Tulare Lake Basin Water Storage District at public hearing.

a. Comment: "In brief, the . . . District supports the Locally Preferred Plan."

Response: Same response as Costa a.

19. Letter from Tulare Lake Drainage District dated August 26, 1996.

This letter has numerous comments on the U.S. Fish and Wildlife Service's Draft Coordination Act Report, which is an appendix to the draft EIS/EIR. A copy of the letter has been forwarded to the U.S. Fish and Wildlife Service since they are responsible for the final Coordination Act Report. The Corps has thoroughly reviewed the comments for their relevance to the existing text in the main draft EIS/EIR and has found that no changes need to be made to the main draft EIS/EIR.

ORGANIZATIONS

20. Letter from American Whitewater Affiliation dated August 26, 1996.

a. Comment: "The Water Resources Development Act of 1996 (WRDA '96) has already authorized this project, provided that the report is completed not later than December 31, 1996. This legislation makes a mockery of the No Action Alternative 1."

Response: The Water Resources Development Act of 1996 would authorize the Kaweah River Basin project provided the feasibility report is completed by December 31, 1996. However, the act has not yet been enacted into law. The no action alternative describes the expected conditions without a project and provides the basis for comparison with the action alternatives.

b. Comment: "Raising the dam every three to five decades is clearly not a sustainable solution to the silt problem. We recommend a more thorough investigation of alternative methods for dealing with silt buildup, ..."

Response: Same response as Beck a.

c. Comment: "The Draft Feasibility Report has grossly underestimated the lost recreational benefits . . . ." The American Whitewater Affiliation then recommends four specific mitigation measures to offset the loss of whitewater recreational opportunities.

Response: Same response as Beck c.

d. Comment: "We believe that federal funding for both flood control and irrigation water supply are unacceptable, as the downstream beneficiaries should pay the cost."

Response: Same response as Beck b.

e. Comment: "We hope that in the future the Army Corps try to find more progressive and cost-effective ways to deal with flood control issues, such as funding flood control management plans for flood-prone areas and the use of non-structural alternatives."

Response: The Corps considered flood control management and nonstructural alternatives during the Kaweah River feasibility study. As participants in the National Flood Insurance Program, Tulare and Kings Counties have already adopted ordinances or other controls to regulate land use and construction within the Federal Emergency Management Agency's 100-year flood plain.

The Corps used the Nonstructural Evaluation computer program to evaluate the feasibility of nonstructural measures in the urban areas of Visalia and Farmersville. Six different nonstructural measures were evaluated for structures of average size and value. These measures included temporary closures, ring levees around structures, floodwalls around structures, raising existing structures above the 100-year flood elevation, relocating structures, and raising future construction above the 100-year flood.

Results of the evaluation indicated that only raising future construction above the 100-year flood elevation was economically feasible. However, this measure is already required by local government regulations and was considered to be a without-project condition. Since no other nonstructural measures were economically feasible, they were not considered further.

21. Letter from California Native Plant Society dated August 26, 1996.

a. Comment: The Society is concerned about the occurrence of Kaweah brodiaea in the Slick Rock area. They have enclosed a copy of a California native species field survey documenting a sighting of 100 plants of Kaweah brodiaea in this area in 1992. The Society is also concerned that the 5-foot protection zone noted in the EIS/EIR seems narrow since only one inundation would "wipe out" any populations of the plant in this area.

Response: To identify existing populations of Kaweah brodiaea in the study area, the Corps consulted previous studies and surveys, the California Natural Diversity Database, and local experts. In addition, the reservoir area was surveyed for Kaweah brodiaea and other plant species in 1995 by the Department of Water Resources and John Stebbins. This 1995 survey identified a population of the plant upstream from the Slick Rock area. (This population had not been seen during surveys by Stebbins in 1991.) The survey form does not include sufficient detail on the location of the 1992 population to determine if the two populations are the same.

b. Comment: The Society asks for additional details about the salvage and relocation of the Kaweah brodiaea populations if they would be inundated by the project.

Response: During preconstruction engineering and design, a detailed topographic survey of the reservoir area would be made. If this survey determines that the populations of Kaweah brodiaea would be inundated, a site-specific relocation plan would be developed. This relocation plan would be coordinated with the Fish and Wildlife Service, Department of Fish and Game, lake personnel, and others such as the California Native Plant Society. Although lake personnel would likely implement any relocation plan, all relocations would be supervised by a qualified botanist. Lake personnel have knowledge of plant populations around the reservoir and would be available to do continuous monitoring to ensure survival of the plants.

c. Comment: The Society expresses concern about the off-site mitigation for riparian habitat and oak woodland that would be inundated. Specifically, they ask about the proposed Kaweah River Rock Expansion project, survival of mitigation plantings, enforcement, and effect on wildlife species.

Response: Mitigation site D is downstream of the Kaweah River Rock Expansion project site. The hydrologic modeling studies for the expansion project indicate that there would be no net loss of Kaweah River flows from the gravel mining operations. During preconstruction engineering and design, a detailed mitigation and monitoring plan would be developed in coordination with the non-Federal sponsor and other agencies. This plan would include agency responsibilities, as well as monitoring and enforcement activities. Basically, the Corps and the non-Federal sponsor would be responsible for maintenance during the monitoring period. After this period, the non-Federal sponsor would prepare annual reports documenting the status of the mitigation sites. The wildlife which currently inhabit the new inundation area (riparian habitat) around the reservoir could relocate to the new scrub shrub mitigation area on site, continue to inhabit riparian areas that would be inundated infrequently, relocate to adjacent habitats, or relocate to off-site habitats (birds). Since the new inundation area would not be cleared of vegetation, the bald eagle could continue to roost in the trees in this area.

22. Oral comments from Central Valley Bass Masters at public hearing.

a. Comment: ". . . strongly support the Locally Preferred Plan [and] believe this plan better serves the need of all the people in Tulare and Kings County."

Response: Same response as Costa a.

23. Letter from Environmental Defense Fund dated August 26, 1996.

a. Comment: ". . . deeply concerned with the . . . 'solution' of raising dams to address problems resulting from reservoir siltation. . . . raising of dams to address these re-occurring cycles does not provide a sustainable solution. Careful and serious analysis of more sustainable alternatives (including, but not limited to, reservoir dredging, sediment sluicing, and demand-side management) must be included as part of the final Kaweah River Basin Study."

Response: Same response as Beck a.

Water supply and use by municipal, industrial, and agricultural interests is determined by legal appropriation, historical use, court decisions, and stipulations by various Federal, State, and local agencies. Although the Corps has no authority to regulate water supply and use, every effort was made to consider these issues and to coordinate and cooperate with these other agencies and users.

b. Comments: ". . . concerned with . . . costs to the taxpayer. . . . project beneficiaries, be they flood plain residents or irrigators, should be responsible for the majority, if not the entirety, of the costs for any improvement project."

Response: Same response as Beck b.

c. Comments: ". . . Tulare lakebed restoration should be thoroughly examined as a potential joint-benefit flood control/environmental restoration alternative."

Response: One of the missions of the Corps is environmental restoration, especially in connection with existing Corps projects. At the request of non-Federal interests, the Corps has several authorities under which to evaluate restoration opportunities related to water resources. The Corps did not consider restoration opportunities in the Tulare lakebed because non-Federal interests expressed no support for restoration. However, all significant adverse environmental effects resulting from the project would be mitigated.

24. Oral comments from Etco Marine at public hearing.

a. Comment: ". . . we want to give our support to the Locally Preferred Plan and will be aggressively confronting state and local officials to support the plan."

Response: Same response as Costa a.

25. Statement from Kaweah Lake Preservation Group dated July 23, 1996.

a. Comment: ". . . we support the raising of the spillway and believe that the LPP Plan, over the NED Plan, best meets the recreational needs of the community."

Response: Same response as Costa a.

b. Comment: "This letter will also serve notice that an addendum will be filed by a qualified recreation sponsor to resite the recreational facilities that are not resited in the current study."

Response: Comment noted. Once such an addendum is filed, the Corps would work with the non-Federal recreation sponsor to resite recreation facilities.

26. Letters from Kaweah Marina dated July 23 and August 12, 1996.

a. Comment: "The study does not address the recreation needs of the general public that live and work in the area. . . . Tulare County and the City of Visalia receive economic benefits [from recreation] in the amount of $2.6 million annually. . . . The resiting of the recreational facilities at high water level would . . . insure that the recreational facilities at the project would be there for the life of the project. . . . By the year 2020, the population is expected to double in Tulare County. Recreation will be twice as valuable to this area in the very near future. . . . The Local Preferred Plan is the ONLY one that gives recreation a chance."

Response: The recreational needs in the study area are identified under "Recreation" in Chapter 3 of the FR. In addition, the EIS/EIR describes the recreational resources, potential impacts of the alternatives on these resources, and benefits and costs in Section 3.3.3, Section 4.4, and Appendix F, respectively. To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources.

b. Comment: "A dedicated permanent minimum pool is missing from this plan. The water districts, County of Tulare and the City of Visalia, . . . should come together and see that enough water is provided in the winter to sustain the existing fishery."

Response: Alternative 3 would allow for increased water storage over the winter rainflood season. As a result, winter conditions for fish resources in the reservoir would likely improve over existing conditions and anticipated conditions with Alternative 2. However, summer conditions would continue to adversely affect the fishery although the warm water fishery would survive.

c. Comment: "As per the recreation study, Appendix F Draft EIS, I hereby request that Mr. Tom Bonetti, Environmental Specialist, revisit his figures as to the dollar value of $4.57 per user." Mr. Mehrten mentions that other studies indicate that the dollar value is actually higher.

Response: Recreation activities at Lake Kaweah include camping, hiking, picnicking, swimming, fishing, boating, water skiing, and nature study. The overall recreation value of the existing project was determined by using the Unit Day Method in accordance with Corps policy guidelines. This method relies on expert or informed opinion and judgement to assign point values to the characteristics of the general recreation activities at the Kaweah Reservoir. These point values were then converted into a dollar value.

Mr. Bonetti thoroughly reviewed his methodology, assigned point values, and calculations for recreation at Lake Kaweah. Updating his figures to FY 1996 values, Mr. Bonetti revised the overall recreational value to $4.69 per Corps regulations converting points to dollar values. Details of the recreation methodology and analysis are included in Appendix F of the EIS/EIR.

Visitation in 1982 was 781,200 recreation days or 644,300 visits. In recent years, however, Lake Kaweah has experienced an average of only 570,000 annual recreation days. In addition, fishing-related expenses often apply to more than just fishing at Lake Kaweah. For example, a fishing license and tackle could be used to fish at other lakes and rivers throughout the State. As a result, part of these expenses would not apply to Lake Kaweah, and the $11 figure would be high. The values assigned to fishing in other studies would be expected to vary because different methodologies are used depending on the geographical location, environmental conditions, type of fishing, and type of fish.

d. Comment: Mr. Mehrten would like the EIS/EIR to contain a listing of the years that the allowable storage in the reservoir would have been zero under both the LPP plan and the NED plan. "This would be a very clear picture of what we are facing in regards to our local fishery. A dedicated permanent minimum pool would remedy this problem."

Response: Reservoir operation modeling for the NED plan indicated the potential for drawing down the reservoir to essentially zero storage in roughly 5

years out of 30 based on strict adherence to the reservoir operating criteria.

e. Comment: "I also favor an addendum to the project to include the resiting of the recreational facilities."

Response: Once such an addendum is filed, the Corps would work with the non-Federal recreation sponsor to resite recreation facilities. To date, however, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses.

27. Letter from Lakeside Ditch Company dated July 11, 1996.

a. Comment: "We . . . recommend the selection of the locally preferred plan (LPP). . . . The LDC also encourages inclusion of the Terminus Reservoir Enlargement Project in the Water Resources Development Act (WRDA) of 1996. . . . further recommends that the Corps proceed immediately with Pre-Construction Engineering and Design (PED) of the project to allow construction at the earliest date and prevent further escalation of costs."

Response: Same response as Costa a and b.

27. Oral comments from Lakeside Ditch Company at public hearing.

a. Comment: ". . . concern with the . . . cost. . . . of the $38 million of which $4 million is interest during construction. The spillway modification, the construction cost, and the spillway modification was only $14 million, yet the four wildlife facilities, $2.4 million. The mitigation cost for the inundation of the riparian habitat that occurs only a few months during three years of ten seems excessive."

Response: Methodologies used in the development of mitigation measures were closely coordinated between the Corps and the Fish and Wildlife Service. During the preconstruction engineering and design phase, mitigation measures may be reviewed to more efficiently accomplish appropriate mitigation.

b. Comment: "Three years is a long time to design such a simple project. . . . cut two years off the total engineering and construction time and put the project on line by the turn of the century."

Response: The duration of total engineering design and construction is influenced by the engineering and construction activities required as well as budgetary constraints. Federal funding, given current Federal budgetary

conditions, and funding by non-Federal sponsors also govern the ability to accomplish the required activities in a timely manner. The duration of engineering and construction identified in the report is considered to be a realistic timetable given current funding and budgetary constraints.

28. Letter from Law Offices of Richard L. Harriman dated August 27, 1996.

a. Comment: Mr. Harriman believes that the discussion of cumulative impacts in the EIS/EIR is inadequate for various reasons.

Response: The EIS/EIR considers makes a "good faith" effort to consider the cumulative effects of the proposed project and past, present, and reasonably foreseeable actions. Historical development in the region modified the natural environment and flow patterns. More recent projects include mitigation measures to offset adverse environmental impacts of individual projects. The Kaweah River Basin project includes mitigation measures to reduce adverse impacts to less than significant. However, the Corps recognizes that additional multiagency studies and action are needed to address basin-wide water use and management in the San Joaquin Valley. The Corps would be an active participant in such studies.

b. Comment: "This reader could find no cost estimates or analysis of the varying alternatives based upon the cost of the alternatives."

"Furthermore, the alternative of conservation, plus dredging of Lake Kaweah was not analyzed. . . . coupled with the sale of dredging spoils as sand and gravel aggregate."

"Alternative wetland mitigation sites in the Tulare Lakebed should be discussed, . . ."

Response: Economic analyses of the alternatives are included in Chapter 4 and 6 and Appendixes A and C of the FR.

Same responses as Beck a and McCallister c.

The EIS/EIR discusses two potential mitigation sites for project-induced adverse effects at the Tulare lakebed. A description of these two sites is included in Section 4.10.4.

c. Comment: Mr. Harriman believes that the air quality section is inadequate for several reasons.

Response: Section 4.8 of the EIS/EIR discusses the effects of the proposed project on air quality. Daily equipment emissions for the project were calculated and compared with Federal and State thresholds. These figures are shown on Tables 4-6 and 4-7. Acceptable pollutant threshold limits and mitigation measures were coordinated with the San Joaquin Valley Unified Air Pollution Control District and the Sacramento Metropolitan Air Quality Management District. In addition, the U.S. Environmental Protection Agency reviewed the EIS/EIR and did not comment on the air quality evaluation.

29. Oral comments from San Joaquin Paddling Club at public hearing.

a. Comment: Mr. Latendresse expressed concern about Holiday rapids.

Response: Currently, Holiday Falls rapids is partially inundated when the reservoir is at gross pool (about once every 3 years). With the project, this rapids would likely be fully inundated about once every 3 years because the gross pool would increase. However, as the water level in the reservoir recedes, the rapids would become usable. No other upstream rapids would be affected by the project.

b. Comment: ". . . think that dredging should be explored."

Response: Same response as Beck a.

c. Comment: "The flood damage that is happening, I think, is coming in on Dry Creek and some of the other unregulated streams that are coming in below the dam."

Response: Dry Creek flows are the major unregulated contributor to floodwater reaching Visalia and Tulare lakebed. During plan formulation, two preliminary alternatives were evaluated to regulate Dry Creek flows in conjunction with raising the spillway at Terminus Dam by 21 feet. The alternatives consisted of constructing either an ungated flood detention dam or a large storage reservoir on Dry Creek. However, economic analyses of the preliminary alternatives indicated that neither plan was economically feasible (benefit-to-cost ratios less than 1.0) so the plans were not considered further.

d. Comment: "It [the project] is going to make more water available for some people. . . . Some farmers out in the Tulare Lake basin, et cetera. I'd like them to pay more for it than me because I'm not getting any benefit out of it. The homeowners aren't getting any benefit out of it."

Response: The feasibility phase of ' study is being cost-shared with local interests, including potential downstrear ,ficiaries of the project. If a project

is authorized for construction and funded by Congress, downstream beneficiaries would also share in the costs of advanced design and construction.

The plan would increase the levels of flood protection to the 70-year event for downstream communities and the 3.2-year event for the Tulare lakebed. The general economy and welfare of the people working and living downstream of the dam would benefit from this increased flood protection.

30. Oral comments from Three Rivers - Lemon Cove Business Association at public hearing.

a. Comment: ". . . we cannot support any of the three options wholeheartedly. We find each of them to be flawed and find it unfortunate the options are as limited as they are. However, we find the LPP, the Locally Preferred Plan, to be the least flawed. . . . Option one, to take no action . . . totally unacceptable."

Response: Same response as Costa a.

b. Comment: Mr. Disinger, the president of the association, then discusses possible adverse effects of each alternative on sedimentation, fishery, recreation, local business, and residents.

Response: The possible adverse effects of each alternative plan on geology and soils, fisheries, recreation, and socioeconomics were thoroughly evaluated during the feasibility phase of the study. The results of this evaluation are included in the EIS/EIR.

31. Letter from Tyrrell Management Company dated August 20, 1996.

a. Comment: "I am concerned about the loss of public access to the river itself if the lake level is raised."

Response: Same response as Krase d.

INDIVIDUALS

32. Letter from Keith Beck, M.D., dated July 20, 1996.

a. Comment: "I . . . strongly oppose Options 2 & 3. The reservoir will continue to silt up; raising the dam is therefore not a reasonable solution. You should instead pursue an evaluation of dredging, or of moving the sediment to the bottom and sluicing it out as alternatives."

Response: Both dredging and sluicing to remove excess sediment from the reservoir area were evaluated as possible measures during plan formulation. About 9,300 acre-feet (15,004,000 cubic yards) of material would need to be removed to return the reservoir to its 1962 storage capacity of 150,000 acre-feet.

Dredging and disposal to remove this large amount of sediment would require high mobilization, removal, demobilization, and disposal costs. Costs for excavation alone are estimated at $2.50 per cubic yard. This compares to a cost of about 50 cents per cubic yard of additional storage to raise the spillway at Terminus Dam. Selling this excavated material as a means to offset the high cost of dredging was also evaluated. Unfortunately, the gradation and quality of material would likely require extensive processing before any commercial use.

Sluicing sediments through the outlet works would require transporting sediments from the upper end of the reservoir to the outlet works where flow velocities could move the material out of the reservoir. This process would require nearly draining the reservoir to obtain the necessary flow velocities. As a result, the recreation, fishery, and water supply benefits of the existing facilities would be seriously affected. Sluicing sediments could also cause serious flood control problems downstream when sedimentation reduces existing channel capacity.

Due to the high costs and potential adverse effects on existing resources and downstream channel capacity, these two measures were not considered further. (Additional details are included under "Removing Sediment from Lake Kaweah" in Chapter 5 of the FR.)

b. Comment: ". . . in this climate of fiscal responsibility, federal funding for local flood control is unacceptable. This is even more the case for new irrigation supplies (especially where there is a major problem with irresponsible ground water pumping in the district, as there is in the KDWCD. Downstream beneficiaries should pay the cost if such projects are pursued."

Response: At the request of the Kaweah Delta Water Conservation District, the Corps was directed by Congress to conduct a study of flood control and related water resources issues in the Kaweah River Basin. The feasibility phase of the study is being cost-shared with local interests, including potential downstream beneficiaries of the project. If a project is authorized for construction and funded by Congress, downstream beneficiaries would also share in the costs of advanced design and construction.

c. **Comment:** "It is mandatory that you conduct a full evaluation of the recreational losses that would result from raising the dam. The loss of Holiday Falls rapid alone is substantial; . . . ." Mr. Beck also asked about specific costs of several types of new recreational facilities to compensate for any recreation losses.

Response: The recreational needs in the study area are identified under "Recreation" in Chapter 3 of the FR. In addition, the EIS/EIR describes the recreational resources, potential impacts of the alternatives on these resources, and benefits and costs in Section 3.3.3, Section 4.4, and Appendix F, respectively. To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources.

Currently, Holiday Falls rapids is partially inundated when the reservoir is at gross pool (about once every 3 years). With the project, this rapids would likely be fully inundated about once every 3 years because the gross pool would increase. However, as the water level in the reservoir recedes, the rapids would become usable. No other upstream rapids would be affected by the project.

33. Letter from Lowell E. Brown, Jr., dated July 15, 1996.

a. **Comment:** ". . . opposed to the proposed raising of the spillway on Terminus Dam . . . do not wish to see any more of the river become lake bottom with the attendant destruction of riparian vegetation and drowning of rapids."

Response: Construction and inundation of the project would destroy or degrade 93 acres of riparian scrub and 70 acres of riparian forest vegetation around the lake. However, this loss would be fully mitigated with riparian plantings in designated areas.

Currently, Holiday Falls rapids is partially inundated when the reservoir is at gross pool (about once every 3 years). With the project, this rapids would likely be fully inundated about once every 3 years because the gross pool would

increase. However, as the water level in the reservoir recedes, the rapids would become usable. No other upstream rapids would be affected by the project.

b. **Comment:** ". . . opposed to raising the level of the reservoir because recreational facilities around the lake will be lost . . . and there is no provision in the proposed increase in storage to replace these facilities."

Response: The recreational needs in the study area are identified under "Recreation" in Chapter 3 of the FR. In addition, the EIS/EIR describes the recreational resources, potential impacts of the alternatives on these resources, and benefits and costs in Section 3.3.3, Section 4.4, and Appendix F, respectively. To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources.

c. **Comment:** "The study says flooding comes from unregulated downstream tributaries: Dry Creek. Raising the spillway does nothing about that."

Response: Dry Creek flows are the major unregulated contributor to floodwater reaching Visalia and Tulare Lakebed. During plan formulation, two preliminary alternatives were evaluated to regulate Dry Creek flows in conjunction with raising the spillway at Terminus Dam by 21 feet. The alternatives consisted of constructing either an ungated flood detention dam or a large storage reservoir on Dry Creek. However, economic analyses of the preliminary alternatives indicated that neither plan was economically feasible (benefit-to-cost ratios less than 1.0) so the plans were not considered further.

d. **Comment:** ". . . providing flood protection for the Tulare Lake bed is a ridiculous proposition - it is where the water is supposed to go!!"

Response: Excess floodflows into the Tulare Lakebed damage crops, roads, levees, irrigation systems, stream channels, and utilities and disrupt traffic. The general economy and welfare of the people working in and living near the Tulare Lakebed would benefit from increased flood protection.

e. **Comment:** "Kaweah Delta Water Conservation District's interest in this seems to me to <u>really</u> be: (1) Getting more irrigation water storage (water = $$) [and] (2) Generating more electricity to sell (with increased storage to run through the new hydro plant they have at the dam.)"

Response: The project would increase the average annual irrigation water supply of the district's service area by about 8,400 acre-feet. However, this water is not new to the system but currently occurs as floodwater in the early summer. This floodwater would be captured in the enlarged reservoir space and released as irrigation water at a later time for use by farmers.

Without improvements to the 17-megawatt hydropower plant at Terminus Dam, the project would actually decrease the hydropower capacity of the plant by about 7,700 megawatts because the turbines cannot produce power when the gross pool elevation exceeds 701 feet. The current owners have indicated their intent to modify the plant to eliminate this loss provided final feasibility studies continue to show favorable feasibility.

f. **Comment:** Given current budget deficits and the need to cut government spending, Mr. Brown questions the use of public funds for this project.

Response: Same response as Beck b.

34. Letter from Betty Douglas dated July 22, 1996.

a. **Comment:** Mrs. Douglas expresses support for "Plan 3," which is the Locally Preferred Plan.

Response: Same response as Costa a.

35. Letter from Bill Douglas dated July 25, 1996.

a. **Comment:** Mr. Douglas expresses support for the "Local Preferred Plan" because "it is important to me & my family to have increased water storage that can be used for recreational purposes."

Response: Same response as Costa a.

36. Oral comments from Darrel Hall at public hearing.

a. **Comment:** Mr. Hall expressed his opposition to the original dam project, which he feels ruined the Tulare Lake basin. He is concerned that "one of these days that dam is not going to give the protection that you are told it will give because it's going to fill up with boulders . . . [and] run over the top."

b. **Response:** Sediment deposition is a problem in reservoir projects. Erosion from watersheds is a natural process. Watershed management measures can reduce the amount of erosion occurring within a basin but can never totally

eliminate the natural erosion. Consequently, sedimentation within reservoirs will always be a consideration in their effectiveness. Options of sluicing sediment from the reservoir also pose significant problems. Sluicing of sediments into downstream channels tends to aggravate flood control problems downstream by reducing the carrying capacity of the channels. In the future, sediment dredging may become the most economical method of providing flood control.

37. Letter from Margaret Austin Hall dated July 14, 1996.

a. Comment: "Please evaluate dredging as a specific alternative . . . . Reservoirs always silt up, and continuing to raise the dam is not a sustainable option."

Response: Same response as Beck a.

b. Comment: "Please also evaluate the specific alternative of pushing the sediment to the bottom of the reservoir and sluicing it out through the bottom of the dam over a period of several seasons."

Response: Same response as Beck a.

c. Comment: ". . . loss of Washing Machine rapid is unacceptable." Ms. Hall also identifies four measures to compensate for the loss of whitewater resources and states that a new campground would be needed to replace the one near Horse Creek.

Response: Currently, Holiday Falls rapids is partially inundated when the reservoir is at gross pool (about once every 3 years). With the project, this rapids would likely be fully inundated about once every 3 years because the gross pool would increase. However, as the water level in the reservoir recedes, the rapids would become usable. No other upstream rapids would be affected by the project.

To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources including campgrounds.

d. Comment: ". . . new federal funding for flood control and irrigation supplies is wasteful. Downstream beneficiaries should pay the cost . . . . 60 year flood control . . . should be more than sufficient."

Response: Same response as Beck b.

38. Oral comments from Brad Howard at public hearing.

a. Comment: "In my opinion, none of the proposed options are acceptable as written. Either we do nothing and our lake continues to fill with sedimentation and deteriorate or we increase the storage capacity at public expense for flood control and irrigation and do away with recreational facilities."

Response: Same response as Beck b, McCallister b, and Hall c.

b. Comment: ". . . I feel that the leaders of the surrounding cities and counties should meet and put an action plan into writing to relocate and improve the recreation facilities at Lake Kaweah."

Response: To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources.

c. Comment: "This project will be constructed at the primary expense of the people. It is not right, and it is not fair that the people and their needs be written out of this project."

Response: At the request of the Kaweah Delta Water Conservation District, the Corps was directed by Congress to conduct a study of flood control and related water resources issues in the Kaweah River Basin. Throughout the entire study process, the Corps and local interests have attempted to involve the public. An initial public workshop was held in March 1986 to solicit ideas from local residents, businesses, and interest groups regarding water resources problems and potential solutions. Public meetings and a hearing were held in 1987 and 1996 to inform the public of the progress and results of the reconnaissance and feasibility studies. Environmental documents were circulated for public review and comment. All public comments have been considered fully during the planning process.

39. Oral comments from John Kirkpatrick at public hearing.

a. Comment: ". . . the economic study as provided in the feasibility report is inadequate, . . . give much more attention to the possibility that not only is there a cost to removing sediment but there may also be a number of offsetting benefits that have not been considered."

Response: The economics of offsetting the high cost of dredging was evaluated. The possibility of commercially selling sediment which is dredged or

excavated from the reservoir area is limited. The gradation and quality of material would likely require the extensive processing of the material for any commercial use. The high costs of dredging or excavating operations and extensive processing make the commercial mining of this material unlikely.

40. Letter from Kyle Knight dated July 21, 1996.

a. Comment: Mr. Knight does not support a "project [that would] dam the river and ruin its excellent recreational opportunities. He asks the Crops to "evaluate pushing the sediment to the bottom of the reservoir basin and sluicing it out through the bottom of the dam over a period of several years as a specific alternative."

Response: Same responses as Kaweah Marina a and Beck a and c.

b. Comment: Mr. Knight feels that Federal funding for flood control and "new" irrigation supplies is unacceptable and that downstream beneficiaries should pay the costs.

Response: Same response as Beck b.

41. Letter from Robert Krase dated August 19, 1996.

a. Comment: ". . . I question whether the project is appropriate at all, since downstream efforts can achieve all of the flood control benefits for less cost and without any detriment." Mr. Krase then discusses benefits of downstream channelization and levees and the adverse effects of raising the dam.

Response: One of the flood control measures considered during plan formulation was a comprehensive downstream channelization and levee flood control project on the Kaweah and St. Johns Rivers. Such a project would involve channelization of major distributaries from Mckays Point to the Tulare Lakebed and construction of a water storage basin in the Lakebed area. Land costs would be high, and levee, channel, and storage basin work would have significant adverse environmental effects. A preliminary cost estimate for the plan was $200 million. Due to high costs and adverse environmental effects, this plan was not considered further.

b. Comment: "Sedimentation is not a problem for Kaweah Lake, since most of the sediment came in one event soon after the dam on the Kaweah was built. To the extent that yearly sedimentation may occur, dredging would be an easier and more permanent solution."

Response: Same response as Beck a and McCallister b.

c. **Comment:** "The issue of the costs involved and who is to benefit are important because the project is not cost effective."

Response: During feasibility studies, a detailed economic analysis of the benefits and costs of the alternative plans was conducted. Based on Corps policies and methodologies, the proposed project has a benefit-to-cost ratio of 1.2:1 and is therefore economically feasible. Additional details on the economic analysis are found under "Economic Analysis" in Chapter 4, "Project Cost," "Economics Analysis," and "Benefit-to-Cost" in Chapter 6, and Appendix C of the FR.

d. **Comment:** ". . . I am concerned about the loss of public access to the river itself if the lake level is raised. This is mitigation that should be done if the project goes forward."

Response: To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources.

42. Letter from Micheal Latendresse dated August 22, 1996.

a. **Comment:** Mr. Latendresse mentions numerous reasons why he opposes the project to raise the dam. These reasons include high costs and few benefits, dam functioning as intended, downstream flooding from drainages below the dam, viable alternatives such as dredging and sluicing, no mitigation for recreational losses, future siltation, and payment by downstream beneficiaries.

Response: Same responses as Lakeside Ditch Company a, San Joaquin Paddling Club c, Beck a, Kaweah Marina a, McCallister b, and Beck b, respectively.

b. **Comment:** Mr. Latendresse opposes further inundation of Holiday rapids and loss of public access to the river. He also feels that "campgrounds and other public sites to be drowned by the proposal should be relocated/mitigated."

Response: Same response as Beck c and Krase d.

43. Letter from Robert Lawson dated July 29, 1996.

a. Comment: ". . . the 'Locally Preferred Plan' is the best option. The only problem with the plan is it seems to only benefit the flood control and farming issues while recreation is completely left out. . . . recreation and a set minimum pool must be included into the project."

Response: The recreational needs in the study area are identified under "Recreation" in Chapter 3 of the FR. In addition, the EIS/EIR describes the recreational resources, potential impacts of the alternatives on these resources, and benefits and costs in Section 3.3.3, Section 4.4, and Appendix F, respectively. To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources.

The Locally Preferred Plan would allow for increased water storage over the winter rainflood season.

b. Comment: "Another item that needs to be addressed is the [inundation of the] eastern parking lot and launching ramp." Mr. Lawson is concerned that traffic on Highway 198 would pose more of a hazard to recreationists who park along the road.

Response: To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources including the eastern parking lot and launching ramp. Increasing the parking facilities at the lake could be considered in a recreation plan.

44. Letter from Karla Little dated August 21, 1996.

a. Comment: Ms. Little opposes raising the dam. She feels that "dredging out the lake has not been fully investigated" and does "not see why the products removed by dredging cannot be recycled in one way or another. . . . The problem is that the Kaweah Lake is filling with sediment . . . . a maintenance program of dredging every 10 years will keep up with the demands of Mother Nature."

Response: Same response as Beck a and McCallister c.

45. Letter from Bard McAllister dated July 25, 1996.

a. Comment: "Seismic concerns. If this topic was dealt with, I failed to find it. Would you please provide page numbers?"

Response: Seismicity is discussed in the following sections and pages of the FR: "Seismicity and Faulting" on pages 2-8 through 2-10; "Seismic Stability" on pages 4-11 through 4-12; "Seismic Stability" on page 6-18; and "Seismicity" on page 3 of Appendix A. Seismicity is also discussed in Section 3.2.3 on pages EIS 3-2 through EIS 3-4 of the EIS/EIR.

b. Comment: ". . . the control of siltation must be carefully studied before this project goes any further."

Response: In 1989 the Corps conducted a detailed sediment engineering study of the Kaweah River Basin below Terminus Dam to determine the impacts of the project on the Kaweah River, St. John's River, and Dry Creek. This study is included as Attachment 3 to Appendix A in the FR.

The study found that the increase in the gross pool elevation would not worsen existing erosional problems in the rivers nor cause additional sedimentation. In addition, raising the gross pool would not change the amount of sediment entering the reservoir nor would it change the depositional characteristics. Currently, most of the sediment entering the reservoir pool is trapped.

c. Comment: "Building aggregate is in very short supply, . . . desperate for sand and gravel."

Response: An extensive deposit of alluvial sand and gravel along the Kaweah River has been used for Federal, State, and private industry concrete construction for over 40 years. Two large commercial aggregate suppliers, Lone Star Industries and Kaweah River Rock, currently process aggregate from river terrace deposits.

The possibility of commercially selling sediment which is dredged or excavated from the reservoir area is limited. The gradation and quality of material would likely require the extensive processing of the material for any commercial use. The high costs of dredging or excavating operations and extensive processing make the commercial mining of this material unlikely.

d. Comment: "Let's store water where it does the most for agriculture--in the underground aquifer."

Response: Local water conservation districts currently use spreading basins and percolation ponds to store floodwater and recharge ground water. Increasing the number of spreading basins as a flood control measure was evaluated. However, numerous basins and channels would be required to alleviate the flooding problem, and an economic analysis indicated that this measure was not economically feasible. Changing the timing of water deliveries could affect the rate of ground water pumping. The proposed project would improve ground water resources by improving surface water supplies thereby reducing the need for ground water pumping.

46. Letter from Marilyn Messa dated August 27, 1996.

a. Comment: "Siltation and sedimentation is the problem and will continue to occur. Dredging has not been considered as an alternative in this project."

Response: Same as Beck a.

b. Comment: "The project proposes to raise the gross pool to add flood storage space. This would be a minimal change in flood velocity to the properties that have been allowed to be developed in flood prone areas."

Response: The proposed project would reduce the frequency and depth of flooding in the flood plain. This would reduce damages associated with flooding over the life of the project.

c. Comment: ". . . little change in the base pool left for recreation purposes. All present recreation areas will be inundated and will include the loss of a beautiful hiking area known as the Cobble Knoll Trail. No plans are included in the reports to allow for re-structuring of camping areas or to address these issues."

Response: Alternative 3 would allow for increased water storage over the winter rainflood season. To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses. If such a non-Federal sponsor is identified in the future, the Corps would work with them to compensate for lost recreational resources.

47. Letter from William Pooley dated August 26, 1996.

a. Comment: "I disagree with the portion of the proposal that would increase the operating level of the lake to serve irrigation purposes with the benefits limited to only the agriculture business."

Response: Increasing the downstream water supply for agriculture would have regional benefits. Some water applied to fields would percolate into the ground and recharge the groundwater basin. Also, the general economy and welfare of the people working in and living near the agricultural area would benefit from increased activity and crop production.

b. Comment: "The loss of recreational area on Lake Kaweah and upstream on The Kaweah River during the peak recreation times of May through July is inconsistent with the need for the recreation opportunities provided by the Kaweah River and Lake Kaweah . . . . support the continued and expanded use of the Kaweah River and Lake Kaweah as a recreational site . . . ."

Response: Same response as Kaweah Marina a.

c. Comment: "Public pressure for more river access will increase . . . . In mitigation for the loss of the river's recreational value at Holiday Falls I believe the Corps should purchase easements to the Kaweah at three spots upstream of the lake . . . . in addition to providing a public access point at the new high water point."

Response: Same response as Krase d.

48. Letter from Rick Mitchell dated August 23, 1996.

a. Comment: ". . . I am concerned that the proposed flood protection can more cheaply and efficiently be achieved by means of channelization and creation of levees downstream."

Response: Same response as Krase a.

b. Comment: "Sedimentation of Terminus Dam . . . will likely reoccur. If removal of the sediment is not cost effective now, what will we do when the new heightened dam again receives major amounts of sediment build-up?"

Response: As sediment builds up in the reservoir in the future, it is likely that it will be more economical to dredge sediment from the reservoir than raise the spillway or dam, or relocate structures within the flood plain. At this time, the proposed project provides the most economical means of providing additional flood control.

c. Comment: Mr. Mitchell is concerned that the project would eliminate public access to the Kaweah River. He feels that additional public river access points should be made available if the project is constructed.

Response: Same response as Krase d.

d. **Comment:** ". . . raising the dam provides only **temporary** increased flood protection. I would highly recommend that downstream channelization/levees or removal of the sedimentation be reconsidered."

Response: Same response as Krase a.

49. Letter from Stanley Stephens dated August 26, 1996.

General Comments

a. **Comment:** The existing Horse Creek Bridge is unsafe. "I am concerned that relocation of the bridge 500 feet upstream from the current location may worsen the situation"

Response: Final design of the Horse Creek Bridge relocation will be fully coordinated with Cal Trans during the preconstruction engineering and design phase. The new bridge will meet all State safety requirements. Advance bridge replacement benefits are described in Appendix C of the Feasibility Report.

b. **Comment:** The recreational value at Lake Kaweah was not properly valued or mitigated by this proposal. The economic value of recreation losses at Lake Kaweah was undervalued.

Response: Same response as Merhten Marina c.

c. **Comment:** Dredging should be examined more as a potential alternative. Sediment will eventually fill in the reservoir and flood control capacity will diminish. Watershed management should be implemented. The rate of sedimentation needs to be explained. There is a lack of mitigation for the spawning pond in Greasy Creek.

Response: Same response as Beck a, Stanley Stephens specific comments c,e,h,i, and q.

Inundation of the spawning pond on Greasy Creek with the project would increase in some years but we don't feel the spawning pond would cease to function. There would still be water in the pond when lake levels are low. Animals would still be able to use the pond for drinking water. The pond would not be large enoug to support large numbers of waterfowl. If pond turtles survive periodic inundation without the project they would survive with the project. Our analysis indicated that the spawning pond would not be significantly affected by

the project therefore no mitigation is needed.

d. Comment: Hydropower production was not adequately addressed in the docunment.

Response: See expanded discussion in Feasibility Report chaPTERS 5, 6 AND Appendix C.

e. Comment: The establishment of a minimum recreation pool should be considered as part of the LPP.

Response: Recreation features require a non-Federal sponsor. No sponsor has been identified to date.

Specific Comments

DEIS/EIR

a. Comment: Page DEIS 1-3, 1st paragraph, sentence - This statement does not accurately describe the hydrological connection with San Joaquin River.

Response: During extremely wet periods, the Tulare Lakebed was connected to the Sacramento San Joaquin Delta. These two areas were last connected in 1878.

b. Comment: Page DEIS 1-4, paragraph, sentence - Underestimates importance of Dry Creek to downstream flooding.

Response: Same as response for Lowell E. Brown, Jr. c.

c. Comment: Page DEIS 1-7, 2nd paragraph, sentence - Isn't there more current data on groundwater overdraft condition than 1975?

Response: Groundwater data from 1975 and 1993 was used in this paragraph.

d. Comment: Page DEIS 1-8, 1st paragraph, sentence - How will project affect downstream flooding?

Response: The plan would increase the levels of flood protection to the 70-year event for downstream communities and the 3.2-year event for the Tulare Lakebed. However, other downstream tributaries would still contribute flows to the Lakebed, along with local drainage.

e. **Comment:** Page DEIS 1-9, paragraph, sentence - Where would the water for the "minimum pool" come from (water right) and who would pay the annual storage fee? What are the likelihood that this water would evacuate from the reservoir during significant flood events? What are the impacts of continued sedimentation on this pool?

Response: There is no minimum pool with any of the proposed alternatives. Alternative 3 (LPP) allows for 12,000 acre-feet of conditional storage during the winter rainflood season. The NED plan allows the storage of 7,000 acre-feet of conditional storage. During the winter rainflood and spring snowmelt season, the reservoir could be evacuated at any time for flood control purposes. Continued sediment buildup in the reservoir would eventually adversely effect the storage set aside for flood control.

f. **Comment:** Page DEIS 2-4, paragraph, sentence - The numbers are not correct for actual storage and sedimentation. The original calculated storage was 150,000 acre-feet; but this was never the actual storage. Discussion of dredging costs are incorrect. I believe that dredging of sediments from the reservoir can be done by private contractor and actually result in a profit (check study for Success reservoir by COE).

Response: Same response as Beck a.

g. **Comment:** Page DEIS 2-7, paragraph, sentence - Relocation of Horse Creek Bridge is a concern. The current bridge design and location (on a curve and at the bottom of a hill) apparently contribute to a high accident rate. Is the relocation of the bridge upstream going to increase the hazards associated with this bridge?

Response: Same response as van Gilluwe a.

h. **Comment:** Page DEIS, 2-8, 2nd paragraph - Interesting discussion of changes in flood events with project, including paragraph three which states that the 225 year flood event would actually increase downstream flooding.

Response: Comment noted.

I. **Comment:** Page DEIS 3-16, 1st paragraph - Update the discussion of parking availability at Lemon Hill to reflect the completion of the additional parking area recently completed.

Response: The FEIS/EIR and feasibility report have been updated to reflect the completion of additional parking facilities at Lemon Hill.

j. Comment: Page DEIS 4-3, 4th paragraph - It is incorrect to state that this proposed project will "eliminate" the chance of flooding.

Response: There are some lands in the downstream area that would be removed form the 100-year floodplain. Flooding from a 100-year flood event would then be eliminated from those specific areas. Figure 3 in Appendix E shows these areas.

k. Comment: Page DEIS 4-7, last paragraph , 4.2.4 Mitigation - The proposed mitigation downstream for loss of riparian vegetation within the fluctuation zone of Kaweah Reservoir is not acceptable. Riparian vegetation, especially willow trees, are an important habitat for gamefish, especially young bass and other centrarchids. Grass does not provide the same king of habitat, especially following evacuation of water from the reservoir. Flooded grasses are killed by being inundated by water. When exposed to air by the receding water levels, decomposition has rendered the grasses useless as habitat for fish. Mitigation for loss of riparian habitat must be in-kind and in-place.

Response: Mitigation for riparian scrub-shrub habitat would be accomplished on project lands as described in Section 4.10.4 and 5.7.1. Mitigation for riparian forest habitat would be done downstream of the reservoir.

l. Comment: Page DEIS 4-9, 2nd paragraph, last sentence - It cannot be stated that the 30 employees that would not have jobs without this project. This project would hopefully be constructed with at least some skilled labor who may or may not currently be employed. How does this compare to any loss in recreation dependent jobs and for how long a period?

Response: This paragraph states that the proposed project would generate approximately 30 jobs. The recreation facilities at Lake Kaweah are maintained by Corps personnel with or without the project.

m. Comment: Page DEIS 4-10, 3rd paragraph - It would appear that the loss of motel rooms may go unmitigated.

Response: It is estimated that one hotel would be lost with the project. This hotel owners would be fully compensated under appropriate laws. The hotel would not be mitigated.

n. **Comment:** Page DEIS 4-11, 2nd paragraph - This discussion of the sedimentation pool is not accurate. The discussion needs to include the problems that currently exist with the 8,000 acre-foot sedimentation pool.

Response: This section describes the without project conditions and the without project future condition of the sediment pool related to recreation resources.

o. **Comment:** Page DEIS 4-12, 1st paragraph - The relocation of recreational facilities should be funded by this project. These are facilities that were paid for by the tax payer. This project would eliminate these few recreational facilities during the peak of the recreational season. It is not fair to blame the failure to move these facilities on the sportsmen who were able to raise the necessary match funds to be included in this process. Flooding of existing recreational facilities are an impact of this project and need to be fully mitigated.

Response: Same response as Department of Interior f.

p. **Comment:** Page DEIS 4-12, 3rd paragraph - Please check the accuracy of this statement. It would appear to me that at an elevation of 700 feet msl., the Kaweah Recreational facility would not be useable. This would result in a 100% loss of recreational use at this facility at or near the peak recreational season.

Response: The recreation analysis considers recreation use over an entire year. With the project, neither Kaweah recreation facilities or campgrounds would be adversely affected for an extended period of time. In the years the reservoir reaches gross pool, the recreation facilities would be usable for the remainder of the year.

q. **Comment:** Page DEIS 4-9, 4th paragraph - Please check this statement for accuracy. If access to the campground is flooded, it would appear that during the high water period, there would be a 100% loss of recreation use at this site. Has any consideration been given to the development of a new (higher elevation) access road to the campground?

Response: The recreation analysis considers recreation use over an entire year. With the project, neither Kaweah recreation facilities or campgrounds would be adversely affected for an extended period of time. In the years the reservoir reaches gross pool, the recreation facilities would be usable for the remainder of the year.

r. **Comment:** Page DEIS 4-12, 2nd paragraph, 5th sentence - This statement is not entirely accurate. Both Tulare County Boat Patrol and the COE

barge are stationed on the lake. It is not normally necessary to launch these craft each time they are used.

How many campsites are available at the campground? While we support the extension of the ramp at the upper end, consideration should also be given to the extension of the ramp at the lower end. At these lower lake levels, the ramp is out of the water and only small boats launched from the shore can access the lake. Consideration should be given to the construction of an additional launching facility at the Horse Creek Campground.

Response: The boat ramp at Lemon Hill would be extended to allow for patrolling of the reservoir. Remainder of comment same as the Department of Interior f.

s. Comment: Page DEIS 4-12, 2nd paragraph, last sentence - This statement could use clarification.

Response: Comment noted.

t. Comment: Page DEIS 4-13, 1st paragraph - How much flooding would occur at Slick Rock? How would flooding at this site affect parking availability?

Response: The final EIS/EIR and the feasibility report include a discussion of flooding and recreation loss at Slick Rock.

u. Comment: Page DEIS 4-13, 5th paragraph - There is something wrong with this discussion of winter fishing. There may be need to include a discussion of the fact that once the water level is below a certain elevation, the lower end of the boat ramp is out of the water and only a few trailer launched boats use the lake. This is a significant decrease in recreational use due to the revised flood control diagram.

There may be some negative impacts to the fish population associated with low water conditions. There can be fish kills resulting from unseasonably warm weather and low water conditions, loss of fish downstream due to low water conditions, or increased predation due to crowding of fish due to low water conditions and the absence of escape cover in the lower reservoir pool.

Response: Alternative 3 (LPP) would allow the storage of 12,000 acre-feet of conditional storage int he reservoir during the rainflood season. The recreation analysis notes that the analysis of past recreation use statistics show that regardless of the amount of water in the reservoir during the winter months, recreation use remains fairly constant.

Alternative 3 would allow for more storage in the winter months which benefits fisheries.

v. Comment: Page DEIS 4-13, 1st paragraph, last sentence - The meaning of this statement is unclear. It appears the statement is meant to state that the establishment of a 12,000 acre-foot "minimum pool" would not result in an increase in recreational benefits. This would be measured in terms of visitor days. I suspect there would be a slight increase in use, especially by boaters, because the boat ramp would be in the water (it would be out of the water at the 1,000 acre-foot volume or Alternative 2. In addition, under Alternative 3, a fish population would remain in the reservoir, unlike Alternative 2.

Response: There would be no minimum pool with alternative 3.

Also see response comment u.

w. Comment: Page DEIS 4-14, 3rd paragraph, 4.4.4 Mitigation - We would repeat our comment about the need for recreational facilities to be relocated as a part of this project, and mitigation for lost angler days. One possible way to mitigate would be the purchase of a downstream gravel pit and the development of a recreational facility for bank anglers.

Response: Same response as the Department of Interior f.

x. Comment: Page DEIS 4-46, Table 4-8 - Separate out wetlands from agricultural land. Was there a reason for combining these two entirely different types of land?

Response: Page DEIS 4-54 discusses project effects on habitat in the Tulare Lakebed. The habitat that would be affected due to the project is intermittently flooded habitat on agricultural lands and in the flood detention basins. Since the habitat affected was similar, the agricultural lands and flood detention basins were grouped together in Table 4-8 for convenience purposes.

y. Comment: Page DEIS 4-48, 2nd paragraph - This discussion should also include a discussion of the value of the flooded riparian vegetation to fish life.

Response: Fisheries resources are discussed in Section 4.11 of the DEIS/EIR.

z. Comment: Page DEIS 4-49, 2nd paragraph - There may be a need to add a discussion here about the impacts of dewatering, or a drawdown to 1,000 acre-feet, on the aquatic resources of the lake, including the fish population.

Response: The project purposes for Terminus Dam and Lake Kaweah are flood control and water supply. The current operating criteria for the reservoir includes drawing down of the reservoir for flood control purposes. The Corps recognizes the adverse effects of a reservoir drawdown to the fishery resources of the reservoir.

aa. Comment: Page DEIS 4-57, 2nd paragraph, Kaweah Reservoir, next to last sentence - It might be helpful to point out that this it trespass grazing. There is no allotment that allows this grazing to occur. Grazing by cattle should not be allowed in this area of the reservoir not only because it is trespass, but beaus of the negative impact on fish and wildlife habitat.

Response: The grazing that occurs on reservoir lands is trespass grazing. Although negotiations with one land owner for a permit to graze on Corps lands is underway.

bb. Comment: Page DEIS 4-61, 41st paragraph - What is the basis for the conclusion that no sediment space would remain in the reservoir by the year 2000? Tulare County owns a small water right. What is the right and wouldn't this water remain in the reservoir. This is a minor point, because the drawdown would result in the lose of the fishery.

Response: Same response as McAllister a. Any water rights that Tulare County has for Kaweah Reservoir water is separate from space alloted within the reservoir for sediment accumulation. Tulare County would still have rights to their water when the sediment space fills in.

cc. Comment: Page DEIS 4-61, 2nd paragraph - The statement is made that DFG or local interests could stock gamefish on an annual basis to replace the gamefish lost due to evacuation of water from the reservoir. You are most likely making reference to the same local interests that couldn't raise the $4,000 for cost sharing to have recreation considered as part of this project. They will not provide funding for restocking due to lack of organization and resources. The DFG lacks the manpower or funding to accomplish this tasks. Fish would have to be removed form other popular fisheries. My experience in the past with such operations (restocking Kaweah Lake following the 1987 chemical treatment) demonstrated that anglers at other reservoirs strongly objected to this action. The other alternative is to purchase fish from private aquaculturist, which is expensive. In addition, with the exception of stocking catchable size trout (a fall/winter activity) an instant fishery can not be established by means of stocking. Several years of reproduction is required to accomplish this task. This all makes a reevaluation of the dredging option look more promising.

Response: Page 4-61 of the DEIS/EIR states that the DFG or local interests could stock additional warmwater gamefish in the reservoir when adequate water conditions return. Due to financial constraints, restocking gamefish in Lake Kaweah is not guaranteed.

dd. Comment: Page DEIS 4-63, 4th paragraph, last sentence - Please explain what is meant by the statement that summer conditions would continue to adversely affect the fishery.

Response: The summer drawdown conditions severely stress adults and juvenile largmoouth bass and other centratchids. Also, juveniles would be more susceptible to predation as the reservoir shrinks in area and depth due to incoming sediment. Unsatisfactory water quality conditions would adversely affect spawning and juvenile recruitment. This information is on page DEIS 4-62.

ee. Comment: Page DEIS 4-64, 1st paragraph, last sentence - It would appear to me you are confusing the terms fishery and fish population. it would appear you are stating that Alternative 2 & 3 would have no significant effect of the reservoir fish population. Under Alternative 3 winter conditions could be better due to additional water would remain in the reservoir during this draw down period. While most of this may be true, there will be a significant impact to the fishery. Fishery is referring to the recreational fishery. With the flooding of most of the recreational facilities at Kaweah Lake during early summer, access to many popular fishery areas will be eliminated. We there will be a significant impact to the recreational fishery at Kaweah Lake as the result of this project and it should be mitigated.

Response: Alternative 2 would not likely significantly worsen conditions for the fishery in the reservoir over without-project conditions. Alternative would improve conditions for the fishery in the winter but summer conditions would still be poor. Effects on the recreation use of the reservoir is discussed in Section 4.4 of the DEIS/EIR.

ff. Comment: Page DEIS 5-3, last paragraph, next to last sentence - Consider replacing fish habitat with trout habitat.

Response: In the cumulative impacts section, future projects for Pine Flat Dam are discussed. Fish habitat improvement in the lower Kings River is the goal for the turbine bypass project.

gg. Comment: Page DEIS 5-11, 3rd paragraph - We are concerned about the relationship of lost habitat within the reservoir and the acreage of replacement habitat. Why was there more of a one-for-one replacement. For example, 70

acres of riparian will be lost, but only 14 acres of this type of habitat will be developed.

Response: Section 4-10 discusses project effects on vegetation and wildlife. Riparian forest habitat adjacent to and within the reservoir would be degraded with increased inundation. The habitat would survive but be degraded in quality. During the HEP analysis, contained in the draft Coordination Act Report Appx. A, the effects on riparian habitat was considered and the mitigation reflects the degradation of the habitat and not complete loss. Therefore, 70 acres of riparian forest would be degraded and replaced with 14 acres of mitigation.

hh. Comment: Page DEIS 5-11 4th paragraph, 5.7.1, Riparian scrub-shrub - We believe Greasy Creek is a good area to establish this type of habitat. It appears to be an important area of the lake for young fish. Cattle trespass has been a continuing problem in the area of the lake. The Department has to fence the small spawning pond to exclude trespass cattle damage to spawning beds. We experienced numerous instances of damage to the fence. The adjacent land owner needs to be informed that his is an important mitigation measure will not succeed if cattle trespass is allowed.

Response: Concur with this comment. A portion of the riparian scrub-shrub mitigation would be done in the Greasy Creek area. The mitigation area would likely be fenced to control cattle grazing.

ii. Comment: Page DEIS 5-22, last paragraph, 3rd sentence - This statement appears to be a little misleading. While it may be true that the current standard foundation elevated building above the 100 year flood level, many of the buildings in down town Visalia are near ground level with very low foundations.

Response: Currently, the standard foundation elevates buildings above the 100-year flood plain. Older buildings may have lower elevations and are subject to flooding. The proposed project would reduce flooding for the structures with lower base elevations.

jj. Comment: Page DEIS 5-24, 1st paragraph, last sentence - The statement is made that the Corps "currently recognizes long-term recreational development as a full-scale project purpose on an equal basis with other established purposes of water resources development." if this it true, then why are recreational facilities and recreation access to these facilities going to be so negatively impacted by the proposed project. There needs to be additional mitigation for the seasonal loss of these facilities.

Response: While the Flood Control Act of 1944 (P.L. 534) states that the Corps has since recognized long-term recreation development as a full-scale project purpose on an equal basis with other established purposes of water resources development, the Federal Water Project Recreation Act of 1965 (P.L. 89-72) defined the basis for sharing the financial responsibilities in joint development of recreation resources at Federal water projects. To date, no non-Federal sponsor has been willing to cost share in a recreation plan to compensate for potential recreation losses.

Comments on Appendix A of the DEIS/EIR

This section contains numerous comments on the U.S. Fish and Wildlife Service's Draft Coordination Act Report, which is an appendix to the draft EIS/EIR. A copy of these comments have been forwarded to the U.S. Fish and Wildlife Service since they are responsible for the final Coordination Act Report. The Corps has thoroughly reviewed the comments for their relevance to the existing text in the main draft EIS/EIR.

Comments on Appendix C Biological Data Report

a. Comment: There is no longer a category 2 classification. I believe they are now called species of special concern.

Response: Comment noted. Candidate species are now called species of special concern.

b. Comment: Page 2, last paragraph - Why weren't fish included in this discussion? When flooded, vegetation provides important cover for fish.

Response: Page 2 of the Biological Data Report describes the project area. A discussion of fishery resources would not be appropriate here

c. Comment: Page 9, 3rd paragraph, 2.3.3. List of Species to be Surveyed - Why aren't state listed Species of Special Concern included on this list? This would include, but not limited to, California roach, hardhead, etc.

Response: The criteria for the selection of species to be surveyed is in section 2.3.2. The criteria included suitable habitat in the project area, historical and recent occurrence in the study area, potential for direct impact by the project, and current Federal and State status of the species. State species of special concern were considered for surveys and subject to the criteria in section 2.3.2. If a species was not surveyed for, the survey criteria was not met.

d. **Comment:** Page 45, 6th paragraph, 3rd sentence - This statement is not accurate. There is a population of Kern brook lamprey upstream from Pine Flate Reservoir. Additional survey for Kern brook lamprey should be conducted upstream and downstream of Kaweah Lake. Historically, Kern brook lamprey were also located in the Kaweah River downsream of Terminus Dam.

Response: Comment noted. The sources for the information presented for the Kern brook lamprey are on page 97 of Appendix C.

e. **Comment:** Page 52, 5th paragraph, Project Occurrence, western pond turtle - I have observed what appear to be western pond turtle in the spawning pond in Greasy Creek.

Response: Comment noted. The sources for the information presented for the western pond turtle are on page 99 of Appendix C.

ENVIRONMENTAL IMPACT STATEMENT, APPENDIX E - LAND USE STUDY

a. **Comment:** Page 14, 5th paragraph, 1st sentence - Is this valid definition for a desert? A more widely used definition is less than 10 inches of annual rainfall.

Response: A desert is an area with low rainfall. Therefore, a desert described as an area where evaporation is greater than rainfall is a valid definition.

b. **Comment:** Page 14, 6th paragrph, 1st sentence - Is it accurate to state that agricultural water supply was adequate until the recent drought? It seems that agricultural demand for water exceeded the supply many years ago.

Response: Comment noted. In the past, average annual supplies were generally adequate to meet average net water demands for agriculture in the region.

c. **Comment:** Page 16, 3rd paragrph - Please provide support for the statement that without this proposed project "increasingly high costs for water...lands will go out of production."

Repsonse: The support for the statement on page 16, "Without the proposed project, increasingly high costs for water and the reliability of water supplies will likely result in lands going out of production", is in the preceeding paragraphs. Ground-water overdraft can affect water supplies and the quality of water. Without the proposed project, ground-water overdraft problems would

worsen leading to higher costs for water and a less reliable water supply.

d. Comment: Page 24, last paragraph - Under Alternative 3 there is a proposed 12,000 acre-foot pool of water that could be available as a minimum pool. However, for this to occur and be a dedicated minimum pool, there needs to be a water right established for this water as well as a right to store this water.

Response: There is no miminum pool with Alternative 3. Alternative 3 allows for up to 12,000 acre-feet of conditional storage space during the winter rainflood season. No water rights are needed to establish this space in the reservoir, it would be part of the current operating criteria for the reservoir.

e. Comment: Page 25, 3rd paragraph, last sentence - What assurance is there that additional irrigation water will not result in the development of additional irrigated crops? There should be some guarantee that at least a percentage of this newly stored water is used to restore underground water.

Response: The proposed project is described in section 2.4.2. With the increased storage capacity in the reservoir with the proposed plan, there would be more flexibility in using ground-water recharge basins within the Kaweah Delta Water Conservation District. There would be no significant conversion of vacant land to agriculture production with the project. Generally, lands that are not currently in agriculture production due to their location, slope, lack of water supply or conveyance system, poor soil type or value. The propose project would nt change these factors; therefore, natural lands are expected to remain the same with the project.

ENVIRONMENTAL IMPACT STATEMENT, APPENDIX F - RECREATIONAL STUDY

a. Comment: My general opinion of the recreation study is that it is inadequate. Recreational use at Kaweah Lake contributes an estimated $10 million to the local economy annually. This is based a crude estimation. This estimate of recreational value does not include multiplies which are commonly used in this type of estimate. It is suggested that this study can not be complete unless dollar values are assigned to recreation. The COE recreational use data is broken down by type of recreational use (fishing, boating, camping, etc.).

Response: Same response as Kaweah Marina c.

b. **Comment:** Page 1, 3rd paragraph, 2nd sentence - Please define a "recreational day." Is this equal to 12 hours of recreational use?

Response: A recreation day is defined as a standard unit of use consisting of a visit by one individual to a recreation development or area for recreation purposes during any reasonable portion or all of a 24 hour period. It should be noted however, that the analysis used for this study was based upon a visitation methodology.

c. **Comment:** Page 2, 3rd paragraph, last sentence - Please use the 52% figure for this calculation. There is not justification for changing this figure from 52% to 50% for "ease in calculating...."

Response: Comment noted. Analysis is considered adequate.

d. **Comment:** Page 3, 1st paragrph - It would be helpful if recreational use during the remainder of the months were included. Impacts to recreation due to flooding of recreational facilities is occurring during the peak recreational use period. What percent of the total recreational use do these figures represent?

Response: Recreational losses are estimated to be about 11 percent of the existing visitation.

e. **Comment:** Page 4, Estimated Annual Benefit Lost - The calculation of estimated annual benefits lost as the result of the proposed project is an embarrassment. How this evaluation arrived at a value for a unit value (recreational day) at $4.57 is unclear. How or who assigned the point value in Table 3? Please explain or show an example of how this value was arrived at? The estimate average annual recreational benefit lost of $195,000 appears to us to underestimate the actual loss. We are not sure what this figure means.

Response: Same response as Kaweah Marina c.

f. **Comment:** There are numerous studies that estimate the value of various forms of recreation. The U.S. Fish and Wildlife Service conducts a nationwide hunting and fishing survey every 5 years.

Response: Comment noted.

KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA, DRAFT FEASIBILITY REPORT

a. **Comment:** Page 2-17, 4th paragraph, next to last sentence - It should make clear that a self sustaining fishery does exist downstream of Terminus Dam. There are areas, from the dam to the Wutchumna diversion, that hold permanent water. In addition there are numerous other downstream areas that hold water year round.

Response: There are limited areas downstream from Terminus dam which may hold water year round. These areas are generally shallow with very warm water however. Consequently, no extensive self sustaining fishery exists below the dam. See EIS for more information on the existing fishery resources.

b. **Comment:** Page 2-19, 2nd paragraph, 2nd sentence - Please correct to indicate the Lemon Hill Parking Lot has been completed and is in operation.

Response: Comment noted. The Lemon Hill Parking area has been completed.

c. **Comment:** Page 2-27, last paragraph - I believe that conclusion that recreational use at Kaweah Lake is expected to decline without this project is incorrect. The annual loss of the fishery at the lake would affect only the angling section of the visitors (estimated to be about 25% of the users The population in Visalia is expected to reach 160,000 by 2020. There will be an increasing demand for water related recreation. Much of this recreation is non-fishing. Given these estimates, we would expect the demand for recreation at Kaweah Lake to increase in coming years.

Response: The Corps recognizes that demand for recreation will continue to increase long into the future. However, the ability of Lake Kaweah to provide recreation opportunities will diminish as sediment fills in the reservoir and their is increasing pressure to essentially drain the reservoir during the winter for flood control purposes.

d. **Comment:** Page 3-3, 2nd paragraph - It would appear from this summary of historical flooding that no significant flooding of Visalia has occurred since the construction of Terminus Dam. Flooding of Tulare Lakebed has continued to be a problem. However, this was once the largest lake west of the Mississippi.

Response: Based upon an analysis of historical flows in the Kaweah River basin the existing facilities at Terminus Dam only provide Visalia a 46-year level of protection. While flooding in Visalia has not occurred in the recent past the

historical record indicates a significant threat still exists.

e. **Comment:** Page 3-7, 5th paragraph, last sentence - This discussion of sedimentation accumulation in the reservoir is a little confusing. In the 30 years the reservoir has been in operation, over 7,000 acre-feet of sediment has been collected. Most of this sediment is believed to have entered the reservoir during one major flood event (1969). The sedimentation rate had averaged about 220 acre-feet of sedimentation annually. At this rate, by the year 2000 (4 years away) an additional about 880 acre-feet of additional sedimentation would occur. This would be a total of an estimated 7,880 acre-feet of sedimentation. This means that an estimated 142,120 acre-feet of water storage would remain. The estimates in this paragraph are reasonable. However, we do not agree with the statement in the 4th sentence that the total amount of sediment at that time (the year 2000) would total 9,300 acre-feet. It would appear that accumulated sedimentation would be more like 7,880 acre-feet (150,000 acre-feet - (7,000 acre-feet + 880 acre-feet)) = 7,880 acre-feet.

All of this make a good argument for the need of some commitment to a program to reduce the amount of sediment in the reservoir. What happens under the proposed project when sedimentation reaches 8,000 acre-feet. Will there be an upward adjustment in the volume of the sedimentation pool when the spillway is enlarged? One of the selling points of the preferred alternative is the establishment of a "minimum pool." What happens to this minimum pool if there were several years of rapid increase in the sediment stored in the reservoir?

Response: Sediment analysis is a complex, inexact science. The analysis presented on 3-7 is considered to be a reasonable assessment of the conditions and expected conditions at Lake Kaweah. The Corps of Engineers supports good watershed management practices in watersheds to minimize erosion but has no authority to implement or police such management practices. Consequently such practices cannot be relied on in designing or planning for reservoir operations. In the proposed alternatives a sediment pool is not formally established. Sediment will fill in the reservoir at its own rate. Flood control operations will have to adjust over time to accommodate this occurrence. No minimum pool is established in either alternative identified in the report. The conditional rainflood storage space established in the plan is operated differently than a true minimum pool. This conditional storage space in the alternatives is maintained over the life of the project.

f. **Comment:** Page 3-8, 4th paragraph, last sentence - Consider changing the statement that it is illegal to park along Highway 190 to it is illegal to park...

We would repeat eariler statements that recreation is not adequately being included in this document. Many of the recreational facilities and opportunities will be lost during peak months without any mitigation. In my view this is a significant impact of the proposed project and needs to be mitigated.

Response: Comment noted. Current Federal policies require that recreation projects be cost shared and operated and maintained by a non-Federal sponsor. The lack of a non-Federal sponsor to date for the recreation facilities at Lake Kaweah has influenced the formulation of the proposed alternatives.

g. **Comment:** Page 3-9, 3rd paragraph - This discussion of hydropower is incomplete. What are the impacts on hydropower production given the three alternatives. What are the projected increases in annual power production from the power plant on Terminus Dam under the preferred alternative? What is the relationship between the non-Federal sponsors of this project and the hydropower owners.

Response: Additional information has been provided in chapters 5 and 6 related to the hydropower issues.

h. **Comment:** Page 4-7, 3rd paragraph, next to last sentence - I don't understand why the 120 acre-feet per year of sedimentation is used in these calculations. Since the reservoir was completed in 1964, annual sedimentation has been about 220 acre-feet per year. Why is the assumption made that future sedimentation rate will be half the actual rate?

Response: Sedimentation into reservoirs generally occurs during high peak flows in single flood events. Because these single events generally occur with many years in between it is difficult to accurately asses rates of sedimentation with methods suggested by commentor unless extremely long periods of record (100 years or more) are available. Generally rates of sedimentation are determined based upon many watershed considerations including soil conditions, ground cover, precipitation patterns, stream channel characteristics, etc.

I. **Comment:** Page 5-7, 3rd paragraph - We do not believe this an accurate evaluation of sediment removal. Given the projected demand for sand and gravel in Tulare County, we believe that this material could be removed by a willing contractor. Once sedimentation has reached a level that flood protection is seriously compromised, dredging will then become a desirable projet. Why not get a jump on the sediment now? Please give dredging a serious cost/benefit analysis from the point of selling the material or at a minimum subsidy for the operation.

Response: Additional information has been provided in chapter 5 related to sediment dredging options.

j. **Comment:** Page 5-29, 1st paragraph, last sentence - The use of the $195,000 figure for lost recreational value does not reflect the true worth of this loss (see general comments).

Response: The methodologies used for quantifying recreational losses are accepted standard methods for economic evaluations of recreation projects.

k. **Comment:** Page 5-29, 2nd paragraph, last sentence - Why were the economic impact to the hydroelecric operation quantified. It would be helpful to the decision makers, and the public, to know what these figures are over the life of the project with and without the preferred alternative.

Response: Additional information has been provided in chapters 5 and 6 in the respective hydropower sections.

l. **Comment:** Page 5-30, Table 5-7 - Why are recreational benefits (a loss) the same for all levels of flooding. Wouldn't fewer recreational facilities be flooded with a 10 foot increase in water levels compared to a 26 foot increase? Also, how the cost of the bridge relocation be seen as a financial benefit?

Response: The 10 foot spillway raise inundates essentially all of the remaining recreation facilities. Consequently, the adverse impacts associated with recreation at the 10 foot raise are essentially the same as at the 21 foot raise. A discussion of bridge replacement benefits is found in Appendix C.

m. **Comment:** Page 5-36, Main Features of the Plan, last bullet - Elsewhere in the plan it is stated that the Lemon Hill Boat Ramp would be extended at the upper end and widened. Does this plan call for increasing the width of the boat ramp to compensate for the loss of the Kaweah Boat Ramp due to flooding? As mentioned earlier, under the NED alternative, the boat ramp should be extended to a lower elevation in the lake to allow boat launching at lower pool levels.

Response: The extension of the boat ramp at Lemon Hill would not compensate for the loss of the Kaweah boat ramp. The extension at Lemon Hill is being done primarily for public health and safety issues requiring access to the lake, not as mitigation for lost recreation.

n. **Comment:** Page 5-37, Alternative 3, primary features - I am confused by the 3rd bullet. The current maximum storage during the winter is 1,000 acre-feet, not 7,000 acre-feet. Does this change the 12,000 acre-foot figure? If the

12,000 acre-feet is guaranteed (page 5-38, 3rd paragraph, last sentence), then how can flood control capabilities be maintained?

Response: Under the proposed alternatives a new conditional rainflood storage space is established on top of the existing sediment deposition. In the NED plan 7,000 acre-feet of space is established and under the LPP 12,000 acre-feet is established.

o. **Comment:** Page 5-37, last paragraph, last sentence - How would this commitment change when additional sedimentation (and reduction) of the reservoir occurs? At 220 acre-feet per year (this has been the sedimentation rate to date) there could be another 15,000 acre-feet of sediment in the reservoir by the year 2064.

Response: As sediment occurs this alternative maintains the 12,000 acre-feet of conditional space. This causes a reduction in the level of flood protection over the life of the project.

p. **Comment:** Page 5-40, Table 5-11 - I fail to understand how the bridge relocation can be a $17,000 average annual benefit. This is going to cost the tax payers a great deal of money. There is a possibility the bridge could be less safe than the existing bridge. Please add the economic benefits of the hydropower project to this chart.

Response: A discussion of advance bridge replacement benefits can be found in Appendix C. Also, Appendix C discusses in detail the hydropower benefits and losses.

q. **Comment:** Page 5-41, Table 6-13, Recreation - The description of impacts to recreation for the NED and Locally Preferred Plan are not accurate. It is not accurate to state that "some recreation facilities would ge periodically flooded. It would appear that one out of three years most recreational facilities would be flooded during the peak recreational season. Seventy-five percent of the campsite at Horse Creek Campground would be under water, not to mention the access to these sites. The Kaweah Boat Ramp and parking lost would be flooded and put out of commission. This would significantly increase the use of the Lemon Hill Boat Ramp. Unless some major modifications are made to this ramp, the level of increased use during periods of high water will most likely become a safety issue. Please change these descriptions to indicate major impacts on recreational use during periods of flooding.

Response: The derivation of impacts to recreation facilities is detailed in Appendix F of the EIS. Significant impacts to the existing recreation facilities are

recognized by the Corps. However, the recreation facilities at Lake Kaweah were never intended to be operated and maintained by the Federal government. Current policy requires a non-Federal sponsor to take on operation and maintenance of recreation facilities and to date no sponsor has been identified. Consequently, in the formulation of this project, only minimum facilities were relocated for public health and safety purposes.

r. **Comment:** Page 6-1, last paragraph, 2nd sentence - Why weren't these other factors included in the benefits analysis?

Response: The report has been revised describing hydropower affects (see Chapters 5, 6 and Appendix C). Recreation impacts are also shown. Employment benefits are also shown in Chapter 6.

s. **Comment:** page 6-8, 2nd paragraph, 2nd sentence - I remain confused about the reference to the 7,000 acre-foot winter conditional pool. This has been reduced to 1,000 acre-feet under the revised flood control diagram. You again make the same reference in the last sentence of this paragraph. The sedimentation pool was 8,000 acre-feet, 7,000 of which has been reported to be filled.

Response: Detailed discussion of the operation of the winter conditional rain flood storage space can be found in Appendix A, Attachment 2. This space is maintained above the existing sediment deposits.

The existing recreation analysis identifying impacts is considered adequate. Current Federal policy dictates that recreation facilities be operated and maintained by non-Federal sponsors. No non-Federal sponsors have been identified to operate and maintain the facilities at Lake Kaweah. Consideration will be given to requiring a cost sharing non-Federal sponsor to cover increased costs associated with increased inundation. Safety considerations associated with increased traffic at Lemon Hill as a result of limiting access will be addressed during the preconstruction, engineering, and design phase.

This entire discussion of the impacts on recreation under estimates the impacts during the peak season. Winter use at the lake is relatively low compared to spring and summer use. Kaweah Lake has limited access by foot traffic. Access is from just east of the Horse Creek Campground to just west of the marina. May of the areas inbetween are not accessible due to lack of parking or steep banks. The most frequency used areas for access to the lake are Slick Rock, Horse Creek Campground, Kaweah Recreational Area and Lemon Hill Recreational Area. It would appear that this proposed project is going to eliminate or greatly reduce access to the lake during the peak use months at three of the

four sites one in three years. We could suggest that this concentration of people into one area will result in a safety issue. Will the Corps of Engineers have their budget augmented to deal with these additional problems? what will be the cost to the COE to refurbish the recreational facilities that are damaged by flooding? will this be paid for by the taxpayers and where does this appear in the cost benefit analysis?

t. **Comment:** Page 6-8, 3rd paragraph, 5th sentence - Please identify who the "owners of the hydropower facility are.

Response: The owners of the hydropower facilities are embodied in the Kaweah River Power Authority.

u. **Comment:** Page 6-9, 1st paragraph - It seems very expensive ($17 million) to raise the Horse Creek Bridge 6.6 feet. How high can the lake surface elevation be raised before the bridge has to be raised. Going back to Table 5-7, dos the bridge have to be relocated if the elevation were raised 10 feet (table says yes)? How about 15 feet increase?

Response: Current CALTRANS standards require relocation of the Horse Creek bridge with any of the proposed raises. Estimated costs are deemed appropriate.

v. **Comment:** Page 6-14, 2nd paragraph - It would appear to us that this cost-benefit analysis is inadequate. The value for lost recreation is undervalued (see general comments above). You have not included a large number of costs associated with the PFF. How about the cost to the COE for refurbishing the recreational facilities? You can not do a cost-benefit analysis for this proposed project just considering the two items listed. we fail to understand how the bridge relocation (we assume Horse Creek Bridge) can be considered as an annual benefit. In my view, a properly done cost-benefit analysis would show a ratio of less that 1:1.

Response: More detailed description of the costs and benefits have been provided in chapters 5 and 6, and in Appendix C The analysis is considered to be appropriate.

w. **Comment:** Page 6-14, Bridge Replacement - This is amazing logic. using this same logic, couldn't you estimate the picnic table benefits as a result of relocation. These too could be paid for by the tax payer.

Response: See Appendix C for a more detailed description of bridge replacement benefits.

x. **Comment:** Page 6-15, 4th paragraph - Once again, this description of the impacts from this proposed project are not accurate in my view. The recently completed parking lot at Lemon Hill was built to help alleviate the lack of parking. During the peak recreational months, boaters would launch their boats and then park their vehicles and trailers along highway 190. This is an extremely dangerous highway due to heavy traffic use. If the Kaweah boat ramp and parking area are flooded and not available, this will return the Lemon Hill Recreational Area to the same overcrowding problem that occurred before completion of the new boat ramp. The loss of the Kaweah Ramp and parking needs to be mitigated by this project. This is a safety issue.

Response: See response to comment page 6-8.

y. **Comment:** Page 6-18, 4th paragraph, next to last sentence - How can the statement be made that it is "equally likely that no sediment will be deposited over the life of the project"? The facts are that since the reservoir began operation (32 years), over 7,000 acre-feet of sediment has entered the reservoir. we also disagree with the conclusion that the average sedimentation rate should b a compromise between what has happened in these 32 years and the assumption that no additional sedimentation will occur within the next 100 years. This is an unrealistic assumption and not justified. Please revise your assumed sedimentation rates to reflect what has happened in the past.

Response: See response to comment page 4-7.

z. **Comment:** Appendix C - Economics, 3rd paragraph, next to last sentence - I do agree with the conclusion that raising the winter lake level has no recreational benefit. When the lake surface levels gets low in the winter months, the lower end of the boat ramps are out of the water. This means that most boaters can not launch their boats. Only small boats can be launched off the shoreline. Attempts to launch larger boats (i.e., bass boats) often result in vehicles becoming stuck in the mud. When the lake become too low in the winter, this also prohibits the DFG from stocking trout in the lake. There may be reduction in the trout harvest if boaters are not allowed access to the lake. It would be a great benefit to winter recreation at the lake if there was more water in the lake.

Response: Comment noted.

aa. **Comment:** Page 47, 2nd paragraph, last sentence - I disagree with the value placed on a visitor day. Please describe how the $4.57 value per visitor day was determined. this far below any figure we have seen and does not represent a realistic figure. The actual value should be much greater. We any multipliers used

to determine this value (used to determine the economic impact of recreation related jobs to the local economy)? Please see the discussion under the general comments of this letter for additional details.

Response: See appendix F of the EIS. The methodologies used for determining adverse affects are considered appropriate.

bb. **Comment:** Page 49, Hydropower Benefits - I do not understand why the economics of the hydropower generation were not included in this analysis. We believe that it is important to the decision to be made and we think the inclusion of dollar figures would be appropriate in the final document. Again, there is a failure to identify who the owners of the hydropower project are.

Response: See revisions in chapters 5, 6 and the Appendix C.

50. Oral comments from Del Strange at public hearing.

a. **Comment:** "I'm fully in support of the LPP plan as presented, . . ."

Response: Same response as Costa a.

b. **Comment:** Mr. Strange is concerned about the "perpetual problem of silt and sediment coming into the reservoir" and feels that "there is a long-term solution of mining or dredging" to benefit the people of Tulare County.

Response: Same response as Beck a and McCallister c.

c. **Comment:** "During the construction of Horse Creek Bridge and the dam itself, the spillway, one of the issues that was addressed is servicing and refueling of the equipment to make sure that there's full containment and that there's no spillage of fuels or lubricants into the lake or into the creeks or the soils. I suggest that this verbage be added to the document that quote, servicing and refueling of all equipment shall be done only inside of the containment structure, end of quote. And this can be added on pages DEIS 44 dash 44 and DEIS 44 dash 45."

Response: Concur. The phrase has been incorporated into the text of the EIS/EIR.

d. **Comment:** ". . . growth inducing impacts . . . was not addressed in the draft environmental impact statement." Mr. Strange feels that increasing the storage in the reservoir would decrease ground-water pumping, increase ground-water storage, and induce growth in the area.

Response: Growth-inducing impacts are discussed in Section 5.3 of the EIS/EIR. Increasing the storage in the reservoir and modifying the timing of irrigation releases could decrease ground-water pumping and possibly increase ground-water storage. However, growth in the downstream areas is not expected to increase over current conditions and will continue to be regulated by local authorities.

51. Letter from William S. Tuthill dated July 24, 1996

a. Comments: The text of the letter was nearly identical to the letter from Margaret Austin Hall.

Responses: Same responses as Hall a, b, c, and d.

52. Letter from Peter van Gilluwe dated July 22, 1996.

a. Comment: ". . . the existing design of the bridge [Horse Creek Bridge] and approaches has caused a high number of serious and fatal accidents, and in my opinion, the construction of a new bridge would follow the same general design, and with the approaches at even a greater angle to the bridge surface, could make for even a more hazardous traffic situation." Mr. van Gilluwe then lists eight specific problems that he sees with the existing design and requests that alternative bridge designs be considered.

Response: If the project is authorized and funded, detailed designs for the new Horse Creek Bridge would be completed during advanced planning and design phases of the project. All designs would be closely coordinated with the California Department of Transportation and meet all State highway design standards. Safety issues would be an important consideration in selection of the final design.

53. Letter from Mrs. W. Woods received July 1, 1996.

a. Comment: Mrs. Woods supports dredging the reservoir to save money.

Response: Same response as Beck a.

b. Comment: "Enough people living on the river lost their homes when this dam was built, now you are taking more homes for it."

Response: The project would increase the elevation of the reservoir and inundate one motel and six dwellings along the shoreline. However, the owners of these structures would be entitled to relocation assistance.

COMMENT LETTERS/STATEMENTS

Congressmen
- Costa, Jim, State Senator
- Radanovich, George, U.S. Representative
- Thomas, William, U.S. Representative

Federal Agencies
- Department of the Interior
- Environmental Protection Agency

State Agencies
- California Water Commission
- Department of Fish and Game
- Department of Forestry and Fire Protection
- Department of Water Resources

Cities and Counties
- Kings County Department of Agricultural Commissioner
- Tulare County

Local Agencies
- Tulare Lake Basin Water Storage District
- Tulare Lake Drainage District

Organizations
- American Whitewater Affiliation
- California Native Plant Society
- Environmental Defense Fund
- Kaweah Lake Preservation Group
- Kaweah Marina
- Lakeside Ditch Company
- Law Offices of Richard L. Harriman
- Tyrrell Management Company

Individuals
- Beck, Keith, M.D.
- Brown, Lowell, Jr.
- Douglas, Betty
- Douglas, Bill
- Hall, Margaret Austin
- Latendresse, Micheal
- McAllister, Bard
- Knight, Kyle
- Krase, Robert
- Lawson, Robert
- Little, Karla
- Messa, Marilyn
- Mitchell, Rick
- Pooley, William
- Stephens, Stanley
- Tuthill, William
- van Gilluwe, Pete
- Woods, W.

Congressmen

STATE CAPITOL
ROOM 2054
SACRAMENTO, CA 95814
(916) 445-4641

2550 MARIPOSA MALL
SUITE 2016
FRESNO, CA 93721
(209) 264-3078

901 TOWER WAY
SUITE 202
BAKERSFIELD, CA 93309
(805) 323-0442

California State Senate

SENATOR
JIM COSTA
SIXTEENTH SENATORIAL DISTRICT

COMMITTEES
CHAIRMAN
COMMITTEE ON AGRICULTURE & WATER RESOURCES
MEMBER
BUDGET & FISCAL REVIEW
FINANCE, INVESTMENT & INTERNATIONAL TRADE
HOUSING AND LAND USE
PUBLIC EMPLOYMENT & RETIREMENT
CALIFORNIA WORLD TRADE COMMISSION

July 23, 1996

Colonel John N. Reese, District Engineer
U.S. Army Corps of Engineers
1325 "J" Street
Sacramento, California 96814-2922

Dear Colonel Reese:

The Kaweah Delta Water Conservation District has asked for my support of the Locally Preferred Plan (LPP) over the National Economic Development (NED) plan for the Kaweah River Basin Flood Control Project. As the state Senator representing lands in the Kaweah drainage, I want you to know I fully endorse the district's recommendations.

Flood control as well as irrigation benefits will be obtained through operation of the LPP. Greater fishery, recreation and other environmental benefits will also be realized through the plan's modification of the lower stages of the flood control parameters. The LPP provides increased storage capacity over the NED, and also has the support of the projects sponsors and recreation interests.

It is my hope that preconstruction engineering design will begin this fiscal year. While recognizing that the State must also try to make scarce resources available for the project, I would like to encourage the Corps of Engineers to expedite the project to increase flood control capabilities and irrigation benefits for the Kaweah River Basin.

Thank you for your consideration of this request. Should you have any questions or need additional information, please contact Alfreda Sebasto of my Fresno District Office.

Sincerely,

JIM COSTA
Member of the Senate
Sixteenth District

THE HONORABLE GEORGE RADANOVICH

STATEMENT BEFORE THE KAWEAH RIVER BASIN INVESTIGATION
PUBLIC HEARING
JULY 23, 1996

First, I wish to express my strong support for the Lake Kaweah Enlargement Project which would raise Terminus Dam's existing spillway by 21 feet and widen it by 148 feet, increasing its storage capacity by 42,600 acre feet. Toward that end, I have been successful in obtaining funding through the Fiscal Year 1996 Appropriations process for completion of the Feasibility Study and Preconstruction Engineering and Design Work. For Fiscal Year 1997, $1,000,000 has been provided by the House Appropriations Committee, $400,000 above the Corps' budget request, in order to maintain an optimum schedule for this work, as well as $680,000 to accelerate completion of the ongoing seismic analysis.

Since its completion in 1962, Terminus Dam has done much to help control floods while providing storage and control of irrigation water supplies. However, some flooding problems continue to exist, placing in jeopardy the communities of Visalia, Farmersville, Tulare, Ivanhoe, and Goshen, as well as disrupting crop cycles on valuable farmland located downstream from the dam. The Enlargement Project would help to mitigate these problems, enhancing the current 46 year level of flood protection to approximately a 60 to 70 year level, while expanding irrigation storage to allow for more effective management of the area's precious supply of surface water.

The Kaweah River Basin Investigation Feasibility Study prepared by the US Army Corps of Engineers describes three alternative plans.

Alternative 1 (No Action) is clearly unacceptable. The Corps, as well as the local sponsors, have demonstrated a need for action and substantial taxpayer and sponsor funds have been expended.

Alternative 2 (NED Plan). The National Economic Development Plan, while meeting the structural specifications to gain the enhanced flood control and irrigation storage capacity being sought, includes a water control diagram and basin wetness parameter considered undesirable for recreation uses.

Alternative 3 (LPP Plan). I give my support and recommendation for operation under the Locally Preferred Plan. Structurally identical to the NED Plan, the LPP provides similar flood control and irrigation benefits while providing substantially greater fishery, recreation and other environmental benefits. This plan was developed by consensus and has the support of the local sponsors, as well as recreation interests.

Finally, I emphasize that it is imperative that the Chief's Report stay on course to be completed in 1996 in order to meet the criterion for conditional authorization in the 1996 Water Resources Development Act. Failure to meet this deadline would result in greatly increased costs to the local sponsors and the federal taxpayers and could jeopardize the future of this important project, which has already experienced several delays and cost overruns.

WILLIAM M. THOMAS
21ST DISTRICT, CALIFORNIA

COMMITTEES:
CHAIRMAN, HOUSE OVERSIGHT COMMITTEE
CHAIRMAN, WAYS AND MEANS SUBCOMMITTEE ON HEALTH
MEMBER, WAYS AND MEANS SUBCOMMITTEE ON TRADE

2208 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515-0521
(202) 225-2915

Congress of the United States
House of Representatives
Washington, DC

ADMINISTRATIVE ASSISTANT
CATHERINE M. ABERNATHY

DISTRICT OFFICES:
4100 TRUXTUN AVE. #220
BAKERSFIELD, CA 93309
(805) 327-3611

319 WEST MURRAY AVENUE
VISALIA, CA 93291
(209) 627-6549

Statement of Congressman Bill Thomas
July 23, 1996

I appreciate this opportunity to comment on the draft Environmental Impact Statement (EIS) and feasibility report on options for raising Terminus Dam at Lake Kaweah.

The history of severe flooding below the dam and the likelihood of future flooding makes improved flood control important for people in Tulare County. Although the completion of reports at hand has been delayed, it is good to see that both the Corps of Engineers and local sponsors recognize the need to enlarge Terminus. Other approaches either fail to provide benefits greater than their cost or have unacceptable environmental consequences.

The issue is not what project to construct but rather how to operate the reservoir. I believe the local sponsors have developed an option that could create a win-win situation for everyone. Their "Locally Preferred Plan" would increase conditional water storage capacity to 12,000 acre-feet and enhance fisheries and recreational opportunities at the lake.

The locally preferred option offers both the Corps and project sponsors an opportunity to meet a variety of needs while protecting communities below the dam from serious flooding. I urge the Corps to examine this proposal and to begin action on its engineering design before this coming October.

Federal Agencies

orig for: PD
CF: PM-C

United States Department of the Interior

OFFICE OF THE SECRETARY
Office of Environmental Policy and Compliance
600 Harrison Street, Suite 515
San Francisco, California 94107-1376

August 27, 1996

ER 96/0428

Lt. Colonel Dorothy F. Klasse, District Engineer
Sacramento District, U.S. Army Corps of Engineers
ATTN: Regulatory Functions Branch
1325 'J' Street, 12th Floor
Sacramento, California 95814-2922

Dear Lt. Colonel Klasse:

The Department of the Interior (Department) has reviewed Draft Feasibility Report and Environmental Impact Statement/Report (DEIS/R) for the Kaweah River Basin Investigation, Tulare and Kings Counties, California. These comments are provided for your use and information when preparing the Final Environmental Impact Statement (FEIS/R).

The Bureau of Reclamation (BOR) has projects which this proposed action could affect. One is the Friant-Kern Canal siphon where it passes under the Kaweah River. Reclamation also funds the Kaweah River Delta Corridor Enhancement Study managed by Kaweah Delta Water Conservation District.

Work on the Kaweah River Delta Corridor Enhancement Study (DEIS 5-4) is in process, so the information presented here is out of date. One of the three benefits of the project is stormwater protection rather than emergency flood control.

On DEIS 4-68 (4.12 Effects on Endangered Species), in relocating populations of Kaweah Brodiaea (*Brodiaea insignis*) and Spiny-sepaled Coyote-thistle (*Eryngium spinosepalum*) care must be taken as these plants may be exacting in their requirements.

On DEIS 4-69, it would seem more prudent to have a tentative plan in place to avoid any impacts to southwestern pond turtle rather than possibly delaying construction in the Horse Creek area.

In section 5.7, restoration and enhancement of the riparian and oak woodland/savanna habitats downstream from Terminus Dam is an excellent idea (DEIS 5-15 - 5-16) due to the significance of these high-value habitats along the Kaweah River corridor.

You may wish to reconsider the value of putting blue oak on Lower San Joaquin Irrigation District (LSID) sites. Although some blue oaks will be taken upstream, they are not found down onto the valley floor. There appear to be no alternatives to using the LSID sites and no mention about what arrangements for these have been made.

Periodic inundation of many of the recreation facilities (DEIS 4-11 - 4-13, 4.4 Effects on Recreation) raises concern. The issue's dismissal on the basis that "no non-Federal sponsor was initially willing to cost share in a recreation plan to relocate" the facilities seems abrupt.

In spite of possible authorization restrictions, it seems that some reasonable proposal could be devised, described, and evaluated.

Thank you for the opportunity to comment.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

cc: Director, OEPC, w/original incoming
Regional Director, FWS, Portland
Regional Director, BR, Sacramento

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

FACSIMILE - TRANSMITTAL

TO: Colonel Dorotht Klasse, District Engineer Attention: Jane Rinck

Organization U.S. Army Corps of Engineers

FAX #: 916-557-7856 PHONE #

SUBJECT: Comments on DEIS Kaweah River Basin Investigation

Date: August 22, 1996 # pages including cover 6

From: Laura Fujii

Federal Activities Office Fax: 415-744-1598 Phone: 415-744- 1579

Comments:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
75 Hawthorne Street
San Francisco, CA 94105

August 21, 1996

Colonel Dorothy Klasse
District Engineer
Attn: Jane Rinck
U.S. Army Engineer District, Sacramento
1325 J Street
Sacramento, DA. 95814-2922

Dear Colonel Klasse:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement (DEIS) for the project entitled **Kaweah River Basin Investigation, Tulare County, CA.** Our review is pursuant to the National Environmental Policy Act (NEPA), Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508), and Section 309 of the Clean Air Act.

The US Army Corps of Engineers (Corps) and the non-Federal sponsors propose to increase flood protection downstream of Terminus Dam and increase the storage space in Lake Kaweah for irrigation water supply by making modifications to the dam and the operation of the reservoir. The proposed action would raise the spillway 21 feet. The gross pool would be raised from 694 feet, mean sea level (m.s.l.), to 715 feet, m.s.l., inundating an additional 243 acres in the reservoir area. Alternatives evaluated in detail include no action (Alternative 1), the National Economic Development (NED) Plan (Alternative 2), and the Locally Preferred Plan (LPP)(Alternative 3). The structural features of the LPP alternative would be the same as the NED Plan. However, the water control diagram and basin wetness parameter for Lake Kaweah would be modified to allow storage of conditional carryover water of up to 12,000 acre-feet during the rainflood season (fall/winter). The tentatively selected plan is the NED plan.

Although EPA recognizes the need for additional flood protection and water supply to reduce the groundwater overdraft problem, we remain very concerned with the potential adverse impact to riparian scrub and oak woodland/savannah habitat and the limited scope of alternatives which were evaluated in detail. We note that the proposed action would provide only a small incremental improvement to the existing flood protection and water supply problems. We believe that maximum utilization of existing facilities, such as the percolation ponds; sluicing or dredging sediment in Lake Kaweah; water conservation and/or demand-side management measures; or a combination of these features should be further explored as potential solutions to the flood protection and water supply needs. We urge the Corps to address the long-term sedimentation issue, the underlying cause of the lost storage space, instead of focusing only on a short-term fix to the problem.

Adverse impacts on vegetation, wildlife, and endangered species would occur as a result of increased inundation around the reservoir and reduction of winter flood waters in Tulare lakebed. Mitigation to a level of insignificance would be provided by developing new

habitat areas. In addition, adverse impacts on recreation would occur due to increased inundation of recreational facilities and upstream rapids, and the eventual loss of the recreational pool to sedimentation. We commend the Corps and local sponsors for their commitment to all of the US Fish and Wildlife Service's recommended mitigation measures. However, we remain concerned because of the debatable success of replacement/recreated habitat. In addition, the proposed mitigation does not address the potential adverse effects to recreation and fisheries. Of the two alternatives currently proposed, we believe the Locally Preferred Plan (LPP) alternative would best address the adverse impacts to recreation and fisheries while meeting the flood protection and water supply project purposes. Thus, if other more comprehensive alternatives are not proposed, we recommend the LPP plan be the selected plan.

Because of the above concerns, we have classified this DEIS as category EC-2, Environmental Concerns - Insufficient Information (see attached "Summary of the EPA Rating System"). We appreciate the opportunity to review this DEIS. Please send two copies of the Final EIS to this office at the same time it is officially filed with our Washington, D.C. office. If you have questions, please call me at (415) 744-1584, or invite your staff to call Ms. Laura Fujii at (415) 744-1579.

Sincerely,

Carolyn E Yale (for or)

David J. Farrel, Chief
Office of Federal Activities

Enclosure: (3 pages)

Filename: kaweah.dei
MI001306

cc: USFWS, Mike Fris, Sacramento
CDFG, Sacramento
DWR, Sacramento
Kaweah Preservation Group

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.

COMMENTS

Alternatives Analysis

The DEIS evaluates only three alternatives: a no action alternative and two action alternatives which are physically the same. NEPA requires a rigorous exploration and evaluation of all reasonable alternatives, including alternatives not within the jurisdiction of the lead agency [CFR 1502.14(a) and (c)]. We do not believe the DEIS totally complies with the intent of NEPA as stated above. We strongly urge the Corps and project sponsors to evaluate, in detail, additional options to increase flood protection and water supply. Possible options to consider include new storage areas in the Tulare Lakebed, maximum use of existing percolation ponds/storage areas, sluicing sediment out of the bottom of Terminus Dam, dredging, a basin-wide water management plan, and demand-side water management measures.

General Comments

1. The DEIS clearly states that the liquefaction susceptibility of the alluvium foundation of Terminus Dam is still unknown (pg. 4-12). Thus, a significant unresolved question regarding the safety of the dam remains. Although dam safety and stability would be similar for both the existing and raised pool conditions, it is possible that the larger gross pool could increase the dam's potential for failure due to the increased weight of water on the dam. We strongly recommend the Corps conclusively resolve the dam safety issue prior to a decision on raising the spillway or increasing the size of the gross pool.

2. The confirmatory environmental site assessment for hazardous waste sites done by the California Department of Water Resources (Appendix G, Feasibility Report) describes several sites which could delay implementation of the proposed action because of remediation requirements. The DEIS recommends detailed site assessment investigations and remediation plans be done during the project preconstruction engineering and design after project authorization (pg. 9 DEIS Summary). Proceeding with the proposed action prior to knowing the feasibility of remediation could place the Corps and local sponsor at risk of losing sunk costs if a significant project delay occurs. We urge the Corps and local sponsor to conduct the detailed site assessment studies and remedial plan development prior to the final decision on the proposed action in order to minimize the loss of sunk costs.

3. The Lindsay Strathmore Irrigation District site is proposed as a mitigation site for riparian and oak/savannah habitat. However, the DEIS indicates that there are several locations on this property which may require detailed site assessments. In addition, well water samples from 1.5 miles south of the site have indicated potential contamination of the groundwater by fertilizers and pesticides (pg. DEIS 4-16). Because of this information, we recommend the FEIS include an additional evaluation of the feasibility of the Lindsay site as a mitigation site. The evaluation should include possible fallback options, if this site proves to be unusable.

4. Cumulative adverse effects to wildlife, wetland habitat, and threatened and endangered species are clearly described in the DEIS (pg. DEIS 5-6). As part of this evaluation, the Corps states the need for a San Joaquin Valley basin-wide plan to address water management effects in the area. We urge the Corps and project sponsors to demonstrate leadership on this issue and to commit to actions which will encourage the development of a basin-wide water management and management effects plan. We believe this is especially appropriate given the new restoration mission of the Corps and the critical regional issues of groundwater overdraft, water supply, and cumulative impacts from multiple water supply and flood protection actions.

5. A detailed Section 404(b)(1) alternatives analysis was not included in the DEIS. It is our understanding that such as evaluation was not pursued due to the lack of impacts to wetlands. The DEIS does not explicitly demonstrate that wetlands will not be affected. For instance, raising the spillway would cause the gross pool to periodically inundate additional upstream sections of the Kaweah River which may have wetlands along the riparian corridor. The FEIS should clearly show that wetlands are not adversely affected by the proposed project.

State Agencies

STATE OF CALIFORNIA - THE RESOURCES AGENCY

PETE WILSON, *Governor*

Department of Water Resources
CALIFORNIA WATER COMMISSION
1416 NINTH STREET, ROOM 1148
SACRAMENTO, CALIFORNIA 95814

Katherine Dunlap, Chair - Los Angeles
Daniel F. Kriege, Vice Chair - Capitola
Stanley M. Barnes - Visalia
Kenneth S. Caldwell - Camarillo
Donald C. Cecil - Willows
Michael D. Madigan - San Diego
Martin A. Matich - San Bernardino
Rikard L. Sorensen - Walnut Creek
Audrey Z. Tennis - Chico

Please Address Communications to:
The Chair of the Commission
P.O. Box 942836
Sacramento, CA 94236-0001
Phone: (916) 653-5958
FAX: (916) 653-9745

July 8, 1996

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

Dear Col. Reese:

The Draft Feasibility Report for the Kaweah River Basin Investigation has been received by the California Water Commission. Any detailed comments the Commission has on the report will be sent to your district at a later date; however, there is a policy issue that the Commission would like to express to you at this time.

The Commission has supported the basic concept of increased flood protection and other benefits for Lake Kaweah for some time and is encouraged by the progress you are making on the project. Because the release of this report followed the Commission's March meeting held to discuss federal appropriations for flood control projects, the Commission took separate, specific action on the project at its June 7 meeting. They voted to support the Locally Preferred Plan (LPP) and encourage expeditious completion of the necessary work to begin preconstruction engineering and design this fiscal year. As you know, the LPP is structurally identical to the NED plan identified in your report; it will, however, provide greater fishery enhancement, increased recreation and other environmental benefits.

The Commission is impressed that the flood control benefits under the LPP are nearly as great as under the NED plan, and they are particularly mindful that local support for Lake Kaweah enlargement is highly dependent on maximizing fishery, recreational and other environmental benefits at the least possible increase in the local cost burden. They are hopeful that the Corps will recommend the operation under the LPP and that Corps procedures will allow for accordant allocation of project costs.

The Commission considers this project to have particular merit and will continue to follow its progress. If you have any questions, please call me at (916) 653-5958.

Sincerely,

Raymond E. Barsch
Executive Officer

cc: Members, California Water Commission

Bruce George, Manager
Keweah Delta Water Conservation District
P.O. Box 1247, Visalia, CA 93279

Louis Beck, Chief, San Joaquin District
Department of Water Resources
3374 East Shields Avenue
Fresno, CA 93726-6990

STATE OF CALIFORNIA--THE RESOURCES AGENCY Pete Wilson, Governor

DEPARTMENT OF FORESTRY AND FIRE PROTECTION
Mt. Home Demonstration State Forest
P.O. Box 517
Springville, California 93265
Telephone: (209) 539-2855/Winter
539-2321/Summer

August 12, 1996

John Reese
Department of Army
Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922

Dear Mr. Reese:

The Tulare Ranger Unit of the California Department of Forestry and Fire Protection has had the opportunity to review the Draft Environmental Impact Statement Kaweah River Basin Investigation. We have the following comments on this draft document in regards to public safety and the concerns of the Tulare Ranger Unit and Tulare County Fire Department.

The report does not address fire prevention engineering of equipment related fires during the construction process. The raising of Terminus Dam will involve the use of heavy equipment at the quarry site and at Horse Creek. Will the construction efforts occur during fire season? Will fire patrols be provided and by whom?

Increase in the shore line will increase the area of contact by recreationists. This is especially true on the North Shore and Greasy Cove area. Any fire starts, during peak reservoir storage, will place the start higher on the hillside allowing for more rapid spread. The fires that currently occur along the shoreline are illegal campfires and occur on relatively mild slopes. Starting the fire on the steeper "mid-slope" will have an adverse affect on our ability to contain the fire before it reaches a larger size.

Thank you for the opportunity to comment on your draft report.

Sincerely,

David Dulitz
Forester II

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, Governor

DEPARTMENT OF FISH AND GAME
REGION 4
1234 East Shaw Avenue
Fresno, California 93710
(209) 243-4014

August 26, 1996

District Engineer
U.S. Army Corps of Engineers
Engineer District, Sacramento
1325 J Street
Sacramento, California 95814-2922

Attention Ms. Jane Rinck

Dear Ms. Rinck:

Draft Feasibility Report and Draft Environmental Impact Statement; Kaweah River Basin Investigation, California

We have reviewed the subject documentation, regarding the Kaweah River Investigation, as circulated for National Environmental Policy Act review by your agency. We offer the following comments in our Department's capacity as California's legally designated custodian of public trust fish and wildlife resources (State Fish and Game Code Section 711, and 1801). We have a definite interest in the fish and wildlife resources of the Kaweah River, Tulare Basin and Terminus Reservoir (Lake Kaweah), and in the recreation which those resources support. In our opinion, some of the project alternatives, if properly designed, operated or conditioned, could have significant positive effects on area flood protection, economic development and fish and wildlife.

Unfortunately, the opposite is also true if the project is designed or operated with a narrow view, lacking resource or local economic sensitivity; or if the design of the project features precludes important opportunities for improvements or benefits in the foreseeable future. We believe this is the case with the National Economic Development (NED) alternative. At a time when many federal agencies (such as the Fish and Wildlife Service, Natural Resources Conservation Service, Bureau of Reclamation, Bureau of Land Management, and the Army Corps of Engineers) are all working on various local programs to recover and improve fish and wildlife resources within the south Central Valley Region, it would seem inconsistent for this alternative to proceed with an insulated vision that fails to contribute, and even detracts from those other costly and difficult regional initiatives.

In general, we recognize the need for flood protection in the Kaweah River drainage, and we support the Locally Preferred Alternative (LPA). We fully recognize the economic importance of the residential, agricultural and urban properties that are subject to potential flood damage. At the same time, we acknowledge the limitations of the flood protection provided here, absent coordinated flood control measures on tributary streams such as Dry Creek, Yokohl Creek and Mehrten Creek. In heavy rain events, these creeks collectively discharge volumes of water which far exceed downstream channel or control facility capacities. Even with the current Terminus Dam and/or proposed enlargements, future major precipitation events would continue to have serious consequences. The poor cost feasibility of flood control measures on the tributary streams seems to detract seriously from the "flood protection" scope of benefits. Positive consideration of the project would, therefore, seem to be closely tied to ancillary benefits, such as fish and wildlife conservation or recreation. Conversely, project impacts would appear to be quite important in the benefit-cost analysis; therefore, great effort would seem to be indicated toward avoidance of impacts wherever possible. For these reasons, we very strongly prefer the LPA alternative. With minor improvements, it potentially provides improved protection for fishery resources and associated recreational use. It presents opportunities for impact avoidance and mitigation that far exceed those available under the NED alternative. With appropriate inclusions and operational parameters, as discussed below, we believe the LPA could hold very positive improvements for the natural and human environments of the region.

By comparison, the "No Action" alternative would have few associated impacts, but would also hold few opportunities. The National Economic Development (NED) alternative would need to be modified to a point where it emulates the LPA (along with the modifications suggested herein), in order to be acceptable to us. We believe remediation of our concerns, as expressed below, will point to the LPA as the best alternative framework.

Impacts of the Proposed Project:

We believe some features of the various alternatives could have potentially serious environmental effects that warrant avoidance or mitigation/compensation. For discussion here, we have grouped the impacts into the following seven general categories:

- In-lake Fish Habitat
- Riparian Habitat

- Minimum Reservoir Storage for Fishery Protection
- Recreational Facilities and Access
- Sediment Management
- General Recreation
- Wildlife Habitat

1. In-lake Fish Habitat:

Maintenance of fisheries in Kaweah Lake requires fish populations to be able to feed, shelter, find appropriate water quality, and reproduce. This necessitates appropriate water level management to provide water of suitable quality and quantity. It also involves suitable in-lake habitat in the form of structural cover for hiding, feeding, and spawning. Where sessile-spawning species, such as sunfish, black bass, or catfish are concerned, some degree of water level stability is also needed during reproductive seasons to avoid nest desiccation or adverse temperatures. All of these components currently exist in Kaweah Lake, in an array that supports self-perpetuating warmwater fisheries and associated recreation. Trout fisheries seasonally augment the warmwater fisheries, based on cool-season stocking by the Department of Fish and Game, subject to funding availability. The no-action alternative would have little to no effect on the existing situation. The NED and LPA alternatives would both affect water management and volumes, as well as in-reservoir vegetation and other fish habitat considerations.

Under both alternatives, the extension of the maximum pool elevation would inundate much shoreline vegetation to a deeper depth and for a longer period annually. This would eliminate plant species which have limited flooding tolerance at their present established locations, and necessitate reestablishment at higher elevations. This would be at least a temporary impact to fishes which use the shallow-inundated vegetation as shelter or as a spawning substrate. During seasons when the reservoir is seasonally drawn down to lower levels, the relocated plant populations would be out of the water and provide no fishery value.

The presently established vegetation is a complex mix of annual grasses, forbs and perennial woody plants. Ecologically, all of these play important roles as fish habitat. Forbs and grasses die and decay with inundation. In doing so, they provide a source of nutrients which become available to the aquatic food chain. Perennial shrubs provide dense structural material as

shade, shelter or escape cover. They also provide a substrate for periphyton and insect life which contribute to nutrient flow. Both of these components are necessary in order to maintain the present fishery diversity at Kaweah Lake. We recommend the Final EIS consider the aforementioned habitat impacts, and provide reasonable mitigation for any losses that will occur. We recommend, as a goal, that vegetation be replaced in-kind and on-site to the degree possible.

2. Riparian Habitat:

The willows and other shrub vegetation along the shoreline of Kaweah Lake provides valuable riparian habitat. It provides thermal and escape cover for wildlife species which frequent the reservoir basin, in addition to shading the water's edge. The proposed modifications in reservoir operating levels will adversely affect this vegetation, due to deeper and longer seasonal inundation. Any such loss should be mitigated in-kind, and as near the impact site as is practicable.

The enlargement of the reservoir operational pool will also inundate some substantial stands of oaks, formerly on the reservoir margins. The EIS mentions cutting of these trees, presumably to eliminate navigational hazards and avoid them floating free and affecting Terminus Dam operations. If the trees are cut, we recommend that local sportsmen be allowed to cable them in place as submergent fish habitat (when inundated) and as wildlife brush-piles when the reservoir is evacuated. Properly spaced brush-piles can greatly improve the access of wildlife to water; especially given the now-broadened fluctuation zone.

3. Minimum Reservoir Storage for Fishery Protection:

The NED alternative calls for essentially draining the reservoir to levels that would be unusable by fish on nearly an annual basis, to accommodate maximum flood protection storage. This alternative fails to address the loss of the fisheries, except to erroneously state that they can be maintained by artificial stocking by State or private interests, or that anglers can simply go elsewhere.

First, the natural resource itself deserves closer attention. It is contrary to National policy to simply eliminate a fishery resource and assume it will somehow either not be missed or be replaced at the expense of some other person or organization. Both NEPA and the Fish and Wildlife Coordination

Act require appropriate consultation and mitigation to be employed to avert, to the extent practicable, adverse impacts to fish and wildlife resources. In our opinion, the NED alternative reflects very shallow acknowledgement of this responsibility.

Second, there is significant recreation that now is supported by the existing Kaweah Lake fishery. We estimate, based on Corps of Engineers use records, that said recreation supports more than $10 million in direct benefits annually to the local economy (and much more if the "ripple effect" is included). The NED alternative would not significantly improve the fishery and its associated use, except as it might be replaced by others, at no project cost. We point out that this is not a "recreational enhancement" or "development" issue requiring a non-federal sponsorship, but rather an "impact" issue (loss of an existing economic or natural feature), legally requiring disclosure and inclusion of available and reasonable mitigation, pursuant to the National Environmental Policy Act.

The Draft Feasibility Report and Draft EIS both erroneously state, under the NED alternative, that fisheries can alternatively be produced by artificial stocking. This is incorrect. Fisheries of this magnitude and diversity cannot be maintained by hatchery production. First, the cost of a production operation of that size would exceed the capability of any user group or agency. Second, there are simply no facilities available which are suitably designed for production of the many native and introduced species involved. These problems are irrespective of the physical problems associated with transportation, stocking and distribution of fish within the reservoir itself.

When our Department chemically treated Kaweah Lake, in 1987, to eliminate illegally introduced white bass, the restocking effort was a very intensive and burdensome process. It involved: (1) winter stocking of trout from production facilities, at great expense, (2) collection and stocking of warmwater fish from surrounding "natural" sources, at prohibitive cost and with substantial public outcry, and (3) a time lag pending the warm-water fishery reaching minimally attractive sizes and/or numbers. Even in this highly focussed and intensive effort, only minimal populations of most of the species were immediately attained. It required several years before natural growth and reproduction produced an attractive warmwater fishery. To presume that this kind of program could proceed on a regular/annual basis denies economic realities, and ignores the biological problems involved with timely providing fish of acceptable sizes and numbers.

Our Department also has no revenue source for such continuing programs at this level, and the local public certainly has no capability to generate the millions of dollars needed to emulate the recreational fishery levels as they exist at Kaweah Lake today. We note also that the above assumptions about State or local stocking are provided without crediting any of the associated cost toward in-lieu non-federal recreation sponsorship. Again, we note that Federal projects are responsible to mitigate their impacts to fish and wildlife as a project cost, and that this burden is not averted simply by the lack of a separate non-federal recreation sponsor.

Fortunately, many of the impacts of the LPA are less severe than the NED alternative. This locally preferred plan provides for "conditional storage" of 12,000 acre feet of water at times when imminent weather conditions do not preempt the space for flood protection. Depending on the operational criteria for this decision, this alternative could accomplish much of the minimum reservoir storage protection needed for fishery perpetuation. As we understand the project hydrology, evacuation of the "conditional pool" would be a fairly rare event, if based on flood control requirements alone. To the extent the "conditional pool" is actually physically maintained, the losses to the existing fishery, as described for the NED alternative, would not be expected to occur.

However, we believe the LPA will require clarification and probable modification, in order to meet minimal fishery protection needs. The "conditional pool" flood control evacuation criteria need to be clearly defined, such that evacuation does in fact occur as infrequently as possible. In that regard, we point out that the contribution of this 12,000 acre-foot "conditional pool" is relatively insignificant in the context of Dry Creek discharges that exceed 25,000 cubic feet per second (50,000 acre feet per day). As such, the fishery and recreational benefits of maintaining the "conditional pool" in perpetuity seem to greatly outweigh the meager comparative benefits the pool would provide toward flood protection. In that general vein, we recommend that the project EIS compare and display the differential flood event protection for the City of Visalia, and agriculture lands within Tulare Lake, with and without evacuation of the "conditional pool".

The potential for evacuation of the conditional pool for purposes other than flood control, by the local water rights owners, remains a source of serious concern. While we respect the fact that this stored water is owned by downstream users, who are required to pay for reservoir storage space, we still must

address the fishery effects that occur from those (albeit non-project) diversions, in context with other cumulative fishery impacts. We suggest that these cumulative effects be analyzed together, and that appropriate mitigation measures be developed and presented. We again clarify that we are referring here to "cumulative impact mitigation" (i.e., loss of an existing resource base), and not fishery or recreational "enhancement".

Given the above impact potentials, we believe one mitigation option might be for the Project to purchase water rights necessary to control the "conditional pool", thus enabling them to provide the pool in perpetuity (notwithstanding the flood control discussion above). This would eliminate one important scope of project impacts (that of reservoir de-watering), and provide on-site benefits that would offset many other fish-habitat-associated effects.

Certainly, the immediate proximity of the Friant Kern Canal within the Kaweah Lake service area suggests that a water exchange may be possible, whereby the Federal Central Valley Project (CVP) water from the canal could be exchanged for the volumes needed for fishery protection at Kaweah Lake. This could generally reduce the Federal and local-sponsors' mitigation costs, while also assuring against any supply-related impacts to end users. The exchange might take the form of a loan, under which CVP water is used and later replaced into the CVP system from Kaweah River sources during earlier or later seasons when the reservoir conservation pool is not at issue. We recommend these measures be given analysis and consideration in the Final EIS and Feasibility Report.

4. Recreational Facilities and Access:

The NED and LPA alternatives both call for raising of the Terminus Dam spillway by 21 vertical feet. This will elevate the maximum pool and cause inundation of existing recreational facilities. The relocation of the facilities is not an included part of the project, nor is replacement of parking areas, camp and picnic facilities, or boat ramp access that would be lost as a result of seasonally higher and/or lower water periods. We believe all of these are impacts that deserve to be addressed in the project EIS, and mitigated as features of the project.

The altered reservoir operations will render one of the two boat launching facilities unusable at times, creating reductions in recreation and/or human safety issues associated with vehicle parking. We recommend that the project mitigate these impacts by including measures to maintain service at pre-existing levels. Widening and extending the upper end of the Lemon Hill ramp has

been proposed; however, we believe this alone is inadequate. It would be helpful if the lower end of the Lemon Hill launch ramp were also extended, to allow launching when the lake level is low.

5. Sediment management:

Kaweah Lake is described as containing about 7,000 acre-feet of sediment, which occupies most of the "sediment management pool". We suspect the calculations in the Draft EIS are flawed, based simply on dividing the above volume by the years of project operation. We also submit that the distribution of sediment should be a significant consideration, since much of it is located in an area where it could be reasonably mined, during parts of the year. Tulare County presently has need for sand and gravel resources, which are in short supply. We believe sediment mining or dredging may thus be a viable and cost-effective option that would help to maintain the reservoir's operable flood control and recreational volumes over time. We recommend the Final EIS analyze sediment removal both as a governmental and contractual (i.e., privatized) operation.

6. General Recreation:

Based on our own calculations, it appears the estimates of economic value associated with recreation at Kaweah Lake are underestimated in both the Draft EIS and Draft Feasibility Study. We obtained the local recreation data from the Corps' office at Lake Kaweah, and then applied the values reported by various reputable sources. These included the 1991 U.S. Fish and Wildlife Survey of Hunting and Fishing, which placed a value of $32 on each angler day (U.S. Department of Interior, 1993). At these rates, the 84,834 angler days alone in FFY 1993-94 would have generated $2.7 million in direct economic benefits (excluding the economic "ripple effect"). On that basis, we submit that the 475,000 total visitor days reported by the Corps would certainly have a greater value than $2,632,000 as reported in Appendix C - Economics.

In 1992, freshwater recreational fishing created $5 billion dollars in personal income and created 1,753,849 jobs in California, accounting for 1 percent of the total state economy (University of California, 1994). These numbers are substantial, and as such, we believe the project recreational facility impacts should not be left unmitigated. Facilities paid for by the Federal Government will be flooded in one out of three years, which will damage the structures and facilities and prevent their use much of the time. There will be additional expense for

their perpetual repair and refurbishing; if indeed they are retained at all. We believe the project must accept responsibility for mitigating these important losses, at least at levels needed to assure continuation of basic public service.

7. Wildlife Habitat

(a) Change in Hydrologic Function

Table 4-2 (page 4-4) shows the number of acres in the downstream area that will no longer receive flood water; 72 acres riparian, 661 acres of grassland, and 618 acres oak savannah/woodland. All three habitat types are dependent on flooding as part of the natural hydrologic functioning of the system. For example, historic records show that valley oak and *Allenrolfea* regeneration are linked to flooding events. The occurrence of alder trees in the valley riparian habitats is also a result of flooding events that deposited seed. What will the long term impacts be to these habitat types if flooding is eliminated? We can expect declines of certain plant species from lack of suitable regeneration conditions which will equal a decrease in biological diversity. These downstream impacts need to be quantified, and mitigation measures proposed.

How will changes in flushing, sediment deposition, timing of water flow, etc. effect riparian vegetation and its associated wildlife? New operation of the reservoir will alter the season when water is in the downstream river system. This is a cumulative effect in addition to the changes that occurred after the original construction of the dam. Less water will make it into the river system during the normal spring runoff season, the time when vegetation and wildlife are adapted to its presence. Irrigation of riparian areas and other natural habitats that rely on this water through recharge of the groundwater aquifers will again be delayed into summer, past the peak growing season. Irrigation releases will be extended into early fall. What effect will all this have on natural habitats? This may have an increasing negative impact as the City of Visalia and other local entities try to restore riparian habitat in the Kaweah River delta corridor downstream of the dam. Several large projects are underway which involve riparian habitat restoration. The proposed riparian/oak woodland mitigation parcel lies in this area as well. How will reduced spring runoff and extended summer water deliveries affect these projects? The FEIS should discuss and quantify this impact.

(b) Mitigation Location and Management

The analysis of potential offsite mitigation areas is inadequate. Only four sites were reviewed. The key factors identified as important for consideration during site selection fail to include biological criteria. Selection of mitigation sites should be made primarily on the location that best meets the biological criteria for replacing the biological values that will be lost as a result of the project. A team of people that includes local biological experts should be assembled to conduct a more thorough evaluation of suitable mitigation sites. The Department, the agency with the most local biological expertise, was not included in the mitigation site selection process contrary to such a recommendation in the Fish and Wildlife Service's Coordination Act Report (CAR).

The CAR recommends that the Department be offered management responsibility and O&M funding for all non-reservoir mitigation lands. This issue is not discussed in the DEIS. Who will manage mitigation lands? If it is not either the Service or Department, some form of permanent conservation constraint should be placed on the land to insure that the mitigation lands will remain in conservation in perpetuity. There needs to be management oversight authority granted to either the Service or Department in this case.

We do not necessarily agree that all livestock grazing should be removed from mitigation sites. Properly managed livestock grazing can be an important habitat management tool to keep vegetation in a form most useable for wildlife. This option should be retained.

(c) Wetland Mitigation

In the CAR, the Service indicates that there are many sites in the Tulare Basin that would be suitable for mitigation of wetland impacts. Why has the ACOE focused in on one that is not even specifically identified in the CAR? What analysis was done of all the other sites and why were they eliminated from consideration?

There is no discussion of whether the location of the proposed mitigation wetlands (Site G, north of Corcoran, several miles from the lakebed edge) is adequate to meet the needs of waterbirds that now use flooded land in the lakebed. It appears that the wetland mitigation site was chosen based primarily on its location within the Kaweah Delta Water Conservation District boundary. A request by the local sponsor for the mitigation lands to be within the water district's boundary should not outweigh the biological need for an appropriate location of the mitigation habitat. A more thorough analysis of the most

suitable location for the mitigation lands needs to be completed that emphasizes the biological needs of the wildlife that will use the wetlands.

The Department has previously recommended that the Creighton Ranch be considered as a mitigation site. It could be used to mitigate impacts to riparian and wetland habitats simply by supplying an annual, stable water source and delivery. The CAR cites probable negative impacts to the Creighton Ranch from the reduction in flood waters which have historically aided with maintenance of riparian and wetland habitats. It states that some permanent loss of riparian forest is probable with this project (pg. 20). The impacts need to be discussed in the FEIS and appropriate mitigation proposed.

The mitigation proposed to make up for an average annual loss of 1412 acres of seasonally flooded land in the Tulare lakebed is 366 acres of wetlands flooded annually for the full waterbird breeding season. Who will be responsible for supplying the water for the wetlands, and will there be water delivered in even the worst drought years? If the local sponsor is responsible for providing the water, they may prefer more flexibility from year to year in supplying water to the mitigation land. If the wetlands are not fully supplied with water each year, the mitigation acreage would need to be greater to make up for the reduced habitat value of intermittent wetlands.

(d) Riparian/Oak Woodland Mitigation

The ACOE relied heavily on the Kaweah Delta Water Conservation District's Kaweah River Delta Corridor Enhancement Study (KRDCES) for their analysis of possible mitigation sites. The purpose of the KRDCES was to identify sites that would be suitable to meet three goals; groundwater recharge, temporary stormwater storage, and habitat enhancement. The evaluation for their project may have been significantly different from an evaluation of potential mitigation sites for the Kaweah Basin project. There are many other parcels in this area that may be suitable as mitigation sites, and that may be more important or beneficial over the long term. For instance, linear habitat restoration along the Kaweah and St. John's rivers through the actively cultivated agricultural landscape in the Kaweah River delta corridor would have much greater habitat benefits than adding riparian plantings in an already existing habitat area. In fact, enhancement on the mitigation site chosen (Site D) may result in habitat impacts during the "restoration" activities.

Planting blue oaks on the identified mitigation site is not appropriate (Site D, LSID) because it is a valley floor habitat that is unsuitable for blue oaks. It is questionable whether the site is appropriate for interior live oak as well. It is a valley oak forest in this area. Overland flooding will be compatible and beneficial to valley oaks and riparian species but would likely kill blue oaks and interior live oaks. The CAR identifies the LSID site as suitable for grassland, valley oak savannah and woodland, and riparian, but not for blue oak or live oak. The CAR identifies a mitigation planning goal of "no net loss of in-kind habitat value" (Resource Category 2) for oak woodlands. Since the LSID site is the only site identified by the ACOE for oak (blue and interior live) woodland mitigation, it should meet the Service's goal. There can be valuable habitat enhancements done in the Kaweah River delta corridor, but to use the LSID sites for mitigation, the ACOE must acknowledge the trade off of blue and interior live oak woodlands at the project site for enhancement of valley oak woodlands at the mitigation site.

Supplemental irrigation to establish riparian and oak woodland/savannah plants may need to be supplied for a longer period than the three years identified in the DEIS. Establishment of plants is dependent on many factors, of which the depth to the water table is an important one. We concur with the strategy recommended in the CAR. It recommends irrigation until the plants are self-sustaining and no longer require irrigation. Cutting off necessary irrigation too soon could result in mortality that exceeds the success criteria. Responsibility for supplying and delivering water for irrigation of plantings and overland flooding, should be designated. Will this irrigation be timed to best meet the needs of the young plantings, or will it only be delivered when it is convenient for downstream irrigation clients?

The CAR recommends that removal of grass around young plants will enhance the growth of the plantings. We concur that this is an essential management action. Recent observations by Mr. Mitch McLeron of the University of Arizona and Mr. Ray Ratliffe formerly with the Pacific Southwest Research Station (unpublished) show that competition from annual grasses may be the highest mortality factor for oak seedlings.

(e) Monitoring of Mitigation Measures

Performance variables - Numbers of individuals of each plant species planted should be reported in the tree habitat mitigation sites. Why is oak woodland the only habitat type that includes a performance criterion that measures a wildlife species' use of the site (four grey fox dens)? The ultimate measurement of success is when the replacement habitat is providing the same habitat quality for wildlife species as that lost to the project.

When must the final success criteria be met, year 10? What if the success criteria are not met? Expecting oak trees to reach 6.43 inches in diameter in 10 years is unreasonable. What does "number of tree/shrub species - 1.25" mean? Is one log or other cover enough to fit the success criteria for presence of logs and other cover for the entire mitigation site? We recommend this habitat characteristic be quantified with a density measurement. A definition of 'edge habitat' must be included for the wetland performance criteria. Water circulation criteria need to be defined. A yes/no monitoring is not sufficient to address whether the wetland is functioning well. Wetland success criteria should include wildlife species' use as a reflection of diversity of the habitat. For instance, what species are nesting on the site and at what densities. How many species use the wetlands during migration periods?

Monitoring activities should probably include rodent control in tree planting areas. Gophers are known to cause huge losses of oak seedlings at least to 3 or 4 years old. If no monitoring of young trees is to occur between years 3 and 6, gophers (or other causes) may cause mortality that will be missed until year 6, delaying completion of mitigation. We recommend annual monitoring through year 5, and further periodic monitoring at longer intervals until the success criteria are met.

The CAR states that monitoring plans must include remedial action plans. "If sufficient mitigation monitoring and remedial action plans are not implemented as part of the project, the Service would need to revise the HEP analyses appropriately, and mitigation requirements would likely be higher for most habitat types." The DEIS does not discuss remedial action plans for all mitigation areas. What remedial actions are planned, and what time is committed to accomplish them?

(f) Threatened and Endangered Species

Kaweah brodiaea - There is no recognition of this plant's listing status by the State of California as endangered. Kaweah brodiaea continues to be at risk throughout its limited range from development proposals on foothill lands. According to Mr. John Stebbins, a botanist with Fresno State University, the single largest population of Kaweah brodiaea was lost when the original dam was built and the Kaweah Reservoir filled with water. Lake personnel should not be responsible for relocating a state endangered plant. It should be conducted by experienced plant ecologists and botanists approved by the Department. In addition, the plants should not be relocated until just before inundation so that seed can be collected annually from the plants to be relocated and greenhouse propagation attempted.

Foothill yellow-legged frog - Foothill yellow-legged frogs are not found at high elevations in Sequoia National Park as stated on page 4-67. It is a foothill species, and is considered extirpated from the Park.

Red-legged frog - The DEIS is lacking an analysis of the potential impacts to red-legged frogs. This species was listed by the U.S. Fish and Wildlife Service earlier this year. Changes in water management and hydrologic function in the upstream and downstream areas may affect this species.

Bald eagle - We concur with the statement that habitat conditions will be better for bald eagle under Alternative 3 than under Alternative 2. However, we find no specific habitat enhancement measures included in the DEIS. We support the Service's recommendation for installing additional roosting perches around the reservoir.

(g) Cumulative Effects

The DEIS states that further analysis is needed to assess the cumulative losses in the Tulare lakebed because adequate data are unavailable. It states "The best available data suggest direct, significant, long-term, adverse, basin-wide alteration and loss of wetland resources would result from the proposed projects." The DEIS does not offer any suggestions on mitigating this impact. The CAR states that "the Service believes that the impacts of the Kaweah project would be magnified in a synergistic manner with concurrent implementation of either of the other projects" [Success or Pine Flat dams]. We concur with the Service's view that "neither this [CAR] nor any NEPA document the Corps subsequently produces will be complete without such an analysis."

Summary:

The above constitute our comments on the project and its impacts as described. We believe that the LPA is the best alternative under consideration; and conversely, we would have serious reservations with the selection of the NED alternative, as proposed. We believe many of the impacts discussed above can be appropriately mitigated under the LPA. Noteworthy exceptions would be relocation of existing recreational facilities and the procurement of a secure reservoir conservation pool.

We recognize the expense involved with facility relocation or reconstruction; however, we believe the public interests at hand warrant those mitigation expenditures. We have tried to contain the costs by focussing attention on those facilities that we know, based on long experience with the reservoir and angling public, are the key needs.

Regarding the need for a fishery mitigation minimum pool, we believe the need is a clear-cut one. We have tried to offer constructive suggestions regarding how such a fishery protection pool might be established, while minimizing costs and secondary water-user impacts. We recognize the complexity of articulating a CVP water exchange, and we are willing to consult further and participate directly in discussions of such an undertaking, if that will be helpful.

Please contact us at your convenience if you have any questions or if you desire to discuss the measures we have recommended. We continue to believe the project (LPA alternative) is worth pursuing, and we will provide technical support in any way we can. Please direct your inquiries to Mr. Dale Mitchell, Senior Environmental Specialist Supervisor, at the address and/or telephone number listed on this letterhead. Thank you for this opportunity to comment at this stage in the Kaweah Basin Investigation.

Sincerely,

George D. Nokes
Regional Manager

cc: Mr. Bruce George
General Manager
Kaweah Delta Water
Conservation District

STATE OF CALIFORNIA—THE RESOURCES AGENCY

PETE WILSON, Governor

DEPARTMENT OF WATER RESOURCES
East Shields Avenue
, CA 93726

July 23, 1996

Mr. Perry Metzger
Sacramento District
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Dear Mr. Metzger:

This letter addresses the National Economic Development Plan and the Locally Preferred Plan for the proposed enlargement of Lake Kaweah as described in the Corps of Engineers' Kaweah River Basin Investigation Draft Feasibility Report. The capital costs and the average annual costs are the same for both of these alternatives. The differences between the two plans are the use of conditional winter rain flood storage space and the benefit-to-cost ratio. While the NEDP has somewhat greater flood protection benefits, the benefit-to-cost ratio for the LPP is only slightly lower and is still greater than one.

We see some additional benefits offered by the LPP. These benefits include significant increases in the quality and quantity of fish and wildlife habitat as well as incidental recreational benefits. There is strong support for the LPP from the local sponsors and from the surrounding community. For these reasons and based on our experience with the study, we recommend that the Corps actively pursue the LPP.

If you have any questions in this regard, please contact me at (209) 445-5222 or Paula Landis of this office at (209) 445-5289.

Sincerely,

LABeck

Louis A. Beck, Chief
San Joaquin District

cc: Mr. Bruce George
General Manager
Kaweah Delta Water
Conservation District
Post Office Box 1247
Visalia, California 93279

Cities and Counties

Dennis F. Bray
Agricultural Commissioner
Sealer Of Weights And Measures

KINGS COUNTY DEPARTMENT OF
AGRICULTURAL COMMISSIONER
SEALER OF WEIGHTS AND MEASURES

680 N. Campus Drive, Suite B, Hanford, California 93230-3556
(209) 582-3211 Ext. 2830 • FAX (209) 582-5251

District Engineer
U.S. Army Engineer District, Sacramento
1325 J Street
Sacramento, CA 95814-2922
ATTN: Jane Rinck

August 26, 1996

Dear Ms. Rinck:

Thank you for the opportunity to comment on the Draft Environmental Impact Statement/ Environmental Impact Report for The Kaweah River Basin Investigation. I would like to express my support for raising the spillway at Terminus Dam as suggested in the Locally Preferred Plan (LPP). This alternate plan would support the protection and promotion of California's and Kings County's number one industry, agriculture.

There has been numerous years that I have personally witnessed vast blocks of land flooded along Cross Creek and in the Tulare Lake bed which have resulted in large scale crop destruction. Consequently, we experience substantial agricultural revenue reduction and loss of jobs which have an extreme impact on our local and state economy. The LPP is a rare opportunity to protect life and property from flooding and drought while benefiting agriculture and recreation.

It is also my hope that the selection of mitigation properties as found in the LPP for the purpose of wetland wildlife habitat development is flexible and objective.

Once again, thank you for the opportunity to comment on this important project and please call this department if you require any further information or have questions.

Sincerely,

Dennis F. Bray
Agricultural Commissioner
Sealer of Weights and Measures

DFB:dod

Tulare County
Planning and Developmen
Departmen.
Tulare County Courthouse
Civic Center Rm. 111
Visalia, CA 93291-4593
209-733-6254 (Planning)
209-733-6282 (Building Permits)
209-730-2604 (FAX)

August 12, 1996

Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J Street
Sacramento, CA 95814-2922
Attn: John N. Reese

RE: Kaweah River Basin Investigation Draft Feasibility Report and Draft Environmental Impact Statement

Dear Mr. Reese,

Tulare County appreciates the opportunity to comment on the above referenced project. The County has the following comments concerning this project.

Figure 1 needs to be revised to include a map showing the extent of the new lake area resulting from the raising of the dam.

Current analysis was inconclusive regarding the seismic safety of the existing dam, the actual safety level and potential for liquefaction of the foundation appears to be unknown. The report indicated that further foundation testing will be required before a final determination can be made regarding the safety of the existing dam, and that studies would be completed in 1996. Tulare County would like to be provided with the final report on the seismic safety foundation testing for the dam when it becomes available. We would also like to be provided with any further technical studies or monitoring reports on dam seepage.

Was on-site mitigation for riparian habitat considered? Mitigation habitat could be re-established within the elevational range of the new maximum pool. This would significantly reduce the costs associated with the project, and provide mitigation for wildlife that are currently utilizing the site.

Was the increased evaporation rate of the additional 152 acres of reservoir surface area analyzed, showing net gains or losses? As dredging was not considered as an option, please discuss why this sediment could not be utilized as a supply of aggregate.

George E. Finney, *Director*
Mary E. Beatie, *Assistant Director*

Sincerely,

Tim Battin, AICP
Environmental Assessment Division Manager

cc: George Finney, Planning and Development Director
Mary Beatie, Assistant Director
Julie McCauley, Planner II
File

Local Agencies

TULARE LAKE BASIN WATER STORAGE DISTRICT
ESTABLISHED 1926
1109 WHITLEY AVENUE • PHONE (209) 992-4127
CORCORAN, CALIFORNIA 93212

August 1, 1996

Colonel John Reese
Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Atten: SPK-PD-A (Mr. David Gore)

Re: Kaweah River Basin Investigation Draft Feasibility Report
Draft Environmental Impact Statement/Report
Draft Fish and Wildlife Coordination Act Report
Public Review Period Comments

Dear Mr. Gore:

Tulare Lake Basin Water Storage District submits the following comments on the Draft Fish and Wildlife Coordination Act Report (DCAR) contained in the Draft Environmental Impact Statement/Report prepared for the Kaweah River Basin Investigation Draft Feasibility Study Report dated June, 1996. Please note that we intend to also submit comments on the Draft Feasibility Study Report and the EIS/EIR prior to the end of the public review period.

General Comments

We believe that the DCAR contains a significant number of statements, including many that pertain to the Tulare Lakebed, that are inaccurate or misleading. Therefore, in the interest of improving the credibility of the DCAR, we attempt to identify specific statements of concern through the comments presented below.

The DCAR frequently refers to the "Tulare Lake Basin". It is not always clear if this reference is to the 12,500 sq. mi. hydrographic region that encompasses the southern San Joaquin Valley (identified as the "Tulare Basin" on page 5) or the 200,000 to 300,000 acre Tulare Lakebed. References to the Lakebed should be consistent throughout the document. Specific comments on the use of "Tulare Lake Basin" included below.

Specific Comments

Section II (Project Description), pg 3, 5th paragraph: With regard to second sentence, it is our understanding that the COE is assuming a reservoir capacity of 183,300 acre-feet in "Year 1" of the project life, not 185,600 acre-feet.

Section III (Project Description), pg 5, 2nd paragraph: The third sentence indicates that the locally preferred plan (LPP) "would modify the flood control diagram for Lake Kaweah" while the NED Plan and the "no-action" alternative would "both utilize the existing flood control

diagram". We believe this is not accurate. It is our understanding that the existing project, the NED Plan, the LPP and the "no-action" alternative all have different diagrams. This should be confirmed with the COE.

We also feel that the following changes are needed to clarify the third sentence; releases could (rather than "would") be required, depending of precipitation conditions in the watershed, and these releases potentially could (rather than "would") "nearly empty the reservoir". In the fourth sentence, water stored in the conditional space is subject to evacuation (rather than "is emptied") "when precipitation exceeds a threshold amount".

Section III (Project Description), pg 5, 3rd paragraph: The 12,000 acre-feet of storage referred to in the first sentence is conditional space that also is subject to evacuation.

Section III (Area Description), pg 5, 6th paragraph: The second sentence, which states that "Historically, Tulare, Buena Vista and Kern Lakes .... provided the single largest block of wetlands ...." should be clarified by indicating that the time period referenced is over 100 years ago.

Section III (Area Description), pg 7, 1st paragraph: With regard to the last sentence, it is reported that water levels in Tulare Lake fluctuated drastically, and the Lake did dry out completely prior to agricultural development.

Section III (Area Description), pg 7, 5th paragraph: With regard to the discussion of supplemental water supplies in the second sentence, the construction of dams on the Kings, Kaweah, and Tule Rivers did not produce a supply of "new" water for each basin individually or the Tulare Basin as a whole. These dams allowed local supplies of water to be regulated for flood control and irrigation purposes.

Section III (Area Description), pg 7, 6th paragraph: The COE's Reservoir Regulation Manual for Lake Kaweah states that 560 sq. mi. of the Kaweah watershed is tributary to the reservoir.

Section III (Area Description), pg 8, 1st paragraph: With regard to the first full sentence, several of the Kaweah River distributary channels flow through Visalia, not just Mill Creek which actually is an open channel through most of Visalia.

With regard to the last sentence, not all of the Kaweah distributary channels unite to form Elk Bayou. Kaweah Delta Water Conservation District staff can identify which channels do so.

Section III (Area Description), pg 8, 3rd paragraph: Contrary to what is stated, 1996 demonstrates that in a year in which Class 2 CVP water is allocated to Friant contractors, most of the contractors, including Tulare ID, will take delivery of virtually all their Class 2 allocation. We believe this pattern of use is representative of what typically happens in all years that Class 2 water is allocated with the exception of very wet years. In very wet years, a flood release from Lake Kaweah may limit Tulare ID's ability to take delivery of their full Class 2 allocation if there is a simultaneous flood release (of Class 2 water) at Friant Dam. This was the case in 1995, an extremely wet year.

Section III (Area Description), pg 8, 4th paragraph: The third sentence should read as follows: Up to 7,000 acre-feet of water is normally maintained on a conditional basis during this

period; however no minimum pool requirement exists. A new sentence should be added (following the third sentence) that reads as follows: This conditional water, which can be released for flood control or irrigation purposes, provides incidental environmental, fishery, and recreational benefits.

With regard to the last sentence; the "Kaweah Irrigation District" does not control irrigation water deliveries. Water right holders "own" the water in the reservoir (with the exception of water in the sediment space) and during the irrigation season the reservoir is operated according to their demands. The Kaweah & St. Johns Rivers Association's Watermaster coordinates these operations with the COE.

Section III (Area Description), pg 8, 5th paragraph: In the first sentence, the wording "project-related controversy" does not appear to be justified, particularly with regard to wetlands. The basis for the perceived "controversy" should be explained. Also, indicate if "the loss of wetlands" refers to the conversion of historic wetlands to agricultural lands that occurred approximately 100 years ago in the Lakebed or to more recent activities? If the reference is to losses caused by recent activities, indicate how and where the losses occurred. Clarify if "Tulare Lake Basin" refers to the Lakebed or Tulare Basin.

In the fourth sentence, the adjective "severely" should be deleted. While the dams have reduced flooding in the Lakebed, the management of flood waters that still reach the Lakebed and routine irrigation continue to provide incidental wildlife benefits.

Indicate which endangered and threatened species (referred to in the firth sentence) are effected in the Lakebed by the stated impacts of the four dams. Also indicate how these species are effected.

Section III (Area Description), pg 8, 6th paragraph: The third sentence is not accurate. Non-damaging Kaweah water can reach the Lakebed when the COE is operating the reservoir for "full irrigation and spreading demand" flood releases and such demand exists in the Lakebed.

Based on our assumption that the fourth sentence is referring to the Lakebed filling to such a degree that water can flow by gravity to North Fork Kings, the discussion should indicate that this is reported to have last happened in 1878.

Section III (Area Description), pg 8, 8th paragraph: The second sentence should be expanded to indicate that the conversion of historic wetlands to agricultural lands occurred approximately 100 years ago in the Lakebed.

Section III (Area Description), pg 8, 8th paragraph: With regard to the fourth sentence, the two big flood years in the past 35 years were 1983 and 1969. 82,000 acres were not flooded in 1982. In 1970 and 1971, land remained flooded with residual water from the 1969 event. Similarly, land remained flooded in 1984 with residual water from the 1983 event. In the wet years since 1962, with the exception of the 1969 and 1983 events, flooded agricultural land typically has been de-watered by June and planted with a late crop.

Section III (Area Description), pg 9, 2nd paragraph: This paragraph should be deleted. Land ownership in the Lakebed is not relevant to the analysis or otherwise significant. There was no mention of land ownership in the discussion of upstream lands.

Section IV (Methodologies), pg 9, 3rd paragraph: With regard to the fourth sentence, as

discussed above, residual flood waters from the 1969 event kept land out of production for three years (through 1971), while residual waters from the 1983 event kept land out of production for two years (through 1984).

The assumed 75/25 Lakebed inflow volume split referred to in the fifth sentence can be applied to a total volume of up to 133,333 ac-ft, at which point, the south flood area would be filled to its current capacity of 100,000 ac-ft.

Section V (Results), pg 10, 6th paragraph: The first sentence currently appears to be inaccurate. Based on a June 29, 1996, article in the Visalia Times Delta, it appears that the fishing in the lake currently is good, indicating that it has recovered since 1987 fish kill and long drought of the late 1980's and early 1990's.

Section V (Results), pg 11, Table 1: Table 1 indicates that white bass are "occurring in Lake Kaweah and the Lower Kaweah River." While white bass existed at one time in Lake Kaweah, we are not aware of the existence of any in either the Lake or Lower River at this time. Therefore, in the absence of reports to the contrary, Table 1 should be revised.

Section V (Results), pg 12, 4th paragraph: The third sentence indicates that most of the sediment space was filled in 1969; a source should be referenced. The projected filling of the sediment space by 1996 must be based on an assumed annual filling rate; if so, this should be stated. The projected filling date should be confirmed with the COE.

The last two sentences indicate that the LPP "would provide increased pool space in the future during most years" while the no-action alternative and NED Plan "do not currently provide for guaranteed water storage space". It should be noted that none of the three alternatives provide guaranteed space. As mentioned above, the LPP provides 12,000 ac-ft of conditional space that is subject to evacuation (depending on the wetness parameter), while the no-action alternative and NED Plan provide 7,000 ac-ft of conditional space that also is subject to evacuation. It should also be noted that the LPP's conditional space will not diminish during the 100-year life of the project as sediment enters the reservoir, while the conditional space for the no-action alternative and NED Plan will be subject to reductions as sediment enters the reservoir during the latter half of the project's life.

Section V (Results), pg 12, 5th paragraph: The COE is assuming that the initial (Year 1) capacity of the enlarged reservoir will be 183,300 ac-ft.

Section V (Results), pg 16, 7th paragraph: With regard to the last sentence, the Creighton Ranch "Nature Preserve" is no longer managed by the Nature Conservancy.

Section V (Results), pg 19, 8th paragraph: We believe the first sentence of this paragraph is not accurate. Lands within the existing 100-year floodplain in Visalia currently can be developed for urban uses provided that minimum floor elevation requirements are satisfied. Rural unincorporated lands within the 100-year floodplain currently also can be developed in a similar manner provided that the lands are not within FEMA's more restrictive "Floodway", which has been mapped along the Kaweah and St Johns Rivers for a distance of approximately seven miles below McKays Point. Development can occur within the "Floodway", although FEMA requires that impacts to the conveyance capacity within the "Floodway" are mitigated. Because lands in the floodplain currently can be developed, the proposed enlargement should not be considered an inducement to development.

Section V (Results), pg 20, 1st paragraph: We have several comments on the discussion pertaining to the Creighton Ranch in this paragraph.

- As mentioned above, the Creighton Ranch "Nature Preserve" is no longer managed by the Nature Conservancy. Therefore, while the landowner currently has no intention of developing the site, it should not be referred to as a "Preserve".
- Although Kaweah flood water can and does flow onto the Creighton Ranch, the majority of the flood water that flows to the Creighton Ranch comes from the Tule River. Therefore, for the sake of clarity, the first sentence should be revised to indicate that flood flows from the Kaweah River will be reduced with the project.
- While the document refers to the proposed Lake Success enlargement project, the current status of project should be noted: The COE's Feasibility Study for the proposed enlargement has been inactive since 1992 and, absent a new cost sharing arrangement, it currently appears very unlikely that the Study will be activated in the foreseeable future.
- Any "waterfowl habitat" value provided by the Creighton Ranch is incidental to the management of flood water and irrigation water on the site.
- The statements indicating that the Creighton Ranch has received little water in recent years and "riparian habitat conditions .... are already critical" appear to be somewhat out-of-date. Significant amounts of water were run onto the site in 1995 and 1996.
- Reference a source for the statement "Many riparian trees have already died due to lack of water".
- The last sentence of the paragraph indicates that the proposed project will contribute to the reduction of flood flows to the Creighton Ranch, and in doing so, "probably" cause the permanent loss of the riparian forest on the site. We feel that this claim is misleading and grossly overstates the value of Kaweah River water to the Creighton Ranch. As stated above, while the project will result in the reduction of Kaweah River flood flows to the Creighton Ranch, this reduction is not expected to be significant because most of the flood water run onto the site historically has been, and should continue to be, from the Tule River. As recent examples, in 1995, a very wet year, the volume of Tule water that flowed onto the site was significantly larger than the volume from the Kaweah River, and in 1996, a moderately wet year, virtually all of the water run onto the site was from the Tule River.
- The last sentence of the paragraph also refers to "appropriate mitigation" to avoid the permanent loss of the riparian forest. Because the proposed Kaweah project should not significantly alter the frequency or magnitude of flooding in the Creighton Ranch, as discussed above, we disagree that any mitigation is necessary. Based on our concerns with the last sentence, we feel strongly that it should be deleted from the document.

Section V (Results), pg 20, 2nd paragraph: We believe the fourth sentence regarding the importation of Friant flood releases is not accurate. There is an extensive history of importing flood release water from Friant Dam into the Kaweah Basin, including Class 2 water and, more recently, Section 215 water. As discussed above, the importation of flood release water from Friant Dam typically is only limited by a simultaneous flood release from Lake Kaweah. In fact, Friant flood release water recently has been imported during minor to moderate Kaweah flood release operations.

Because the Kaweah Basin will continue to be a "water-deficient" area that relies on groundwater even with the enlarged reservoir and there appears to be limited native lands in the lower Kaweah Basin, we agree with the assessment (in the latter part of the last sentence) that it is "unlikely" that native lands will be developed with additional supplies of CVP water.

Section V (Results), pg 20, 5th paragraph: With regard to the enlargement inducing the

development of agriculture or native lands, as discussed above, the increment of flood protection that the enlargement will provide is not expected to have a significant effect on future land development in the Study Area. Therefore, to say that with increased flood protection these lands "would now likely be developed" is inaccurate and misleading.

Section V (Results), pg 21, Sub-Section C (Tulare Lake Basin): The heading "Tulare Lake Basin" is confusing. Based on the discussion in the first paragraph under this heading, we concluded that the reference is to the larger area and not the Lakebed. However, if this is the case, why is the scope of the discussion so broad for a project that only effects the Kaweah River basin? On the other hand, most of the discussion in the subsequent paragraphs seems to focus on the Lakebed. Use either "Tulare Basin" or "Tulare Lakebed" and, as mentioned above, be consistent throughout the document.

Section V (Results), pg 21, 3rd paragraph: The discussion of the "Historical losses of wetlands ....", in the first sentence should indicate that the conversion of the historic Lakebed wetlands to agricultural lands occurred approximately 100 years ago.

If the scope of the discussion in this section of the document is the Tulare Lakebed, the third sentence is not accurate because there are no National Wildlife Refuges or duck hunting clubs in the Lakebed, nor is Kesterson NWR in the Lakebed.

Section V (Results), pg 21, 4th paragraph: In the first sentence, we believe it is not accurate to refer to the historic Lakebed wetlands as "permanent" because the Lake is reported to have occasionally dried out completely prior to the conversion of the land to agricultural uses?

The word "flooded" that is used to describe agricultural fields in the first sentence should be replaced with "irrigated". As discussed above, there are no private duck-hunting clubs or public wildlife refuges in the Tulare Lakebed.

It should be noted that the Lakebed is dominated by agriculture fields, and the flood water storage areas and evaporation ponds occupy less than 10 percent of the total area.

With regard to the second sentence, the Hacienda and Wilbur flood water storage areas are not considered "seasonally flooded habitat". This overstates the regularity with which flood waters are stored in these areas and the habitat benefits they actually provide. The COE's simulations of "existing" conditions for the 27-year period from 1966 to 1992 indicate that the Lakebed will receive water from the Kaweah system in 10 of the years with the inflow occurring in 40 months. Although the simulated magnitude of the inflow volume to the Lakebed may be higher than the volume actually observed, the simulated pattern of flooding is generally consistent with the actual flooding patterns. Since Terminus was completed in 1962, land in the Lakebed has been flooded with Kaweah water (and water from other sources) in eleven years, or on the average, once every three years, with the inflow typically occurring between the months of January and June. This history indicates that the Hacienda and Wilbur areas are flooded on an intermittent and seasonal basis. In the flood years since 1962, with the exception of 1969 and 1983, flooded agricultural lands typically have been de-watered by June and subsequently readied for a late crop planting. In these years, flood water stored in the Hacienda and Wilbur areas was disposed of through irrigation and evaporation by mid-to-late summer. In 1969, three years were required to de-water all of the flooded agricultural land, while two years were required in 1983.

Also with regard to the second sentence, the combined capacity of the Wilbur and Hacienda flood areas is approximately 100,000 acre-feet, not 200,000 acre-feet.

In the fourth sentence, indicate which species of riparian trees have become established in the flood areas.

Section V (Results), pg 21, 5th paragraph: The last sentence refers to a "riparian zone". Explain where and what the "riparian zone" is.

Section V (Results), pg 21, 6th paragraph: We have several comments on this paragraph:

- It is misleading to refer to sewage ponds, evaporation ponds, flood water storage ponds, and groundwater recharge ponds as "wetlands". These "ponds" are constructed and operated as single-purpose facilities. Any habitat benefit that they may provide in the course of their operation is incidental and generally unintentional. It should also be noted that water will be stored in the flood water storage areas and recharge ponds typically only in wet years. Therefore, these sites provide habitat on an intermittent and seasonal basis.
- Document the recent increases in the acreages of these facilities.
- As a mater of clarification, identify the sewage ponds and groundwater recharge basins that are located in the Lakebed. We believe that it would more accurate to say these facilities, as well as most of the evaporation basins that serve the Lakebed, are located outside of, but near, the Lakebed.

It should be noted that comments on statements pertaining to the evaporation ponds that serve the Lakebed, such as those contained in latter part of this paragraph and in subsequent sections of the document, will be submitted separately at a later date.

Section V (Results), pg 22, 2nd paragraph: We are not aware of any white bass currently in the Lakebed. A source should be referenced for this statement.

Section V (Results), pg 22, 4th paragraph: The last sentence indicates that "Pintails are typically found feeding in recently flooded fields, drainwater ponds, and flood storage areas of the Basin." We assume that these birds were observed prior to the publication of the 1987 USFWS document that was referenced in the prior sentence. If so, the statement should be clarified. As a matter for further clarification, indicate if the birds were observed in fields that had been flooded with excess flood waters or fields under irrigation.

Section V (Results), pg 23, 4th paragraph: Clarify "drier years". Indicate how much flood water will be stored in the Wilbur and Hacienda area in "drier years". In non-flood years, little if any Kaweah flood water will be stored in the Wilbur and Hacienda areas. In the event that a limited volume of Kaweah flood water was stored in a "dry" year, it probably would be confined to as small an area as possible in order to minimize its surface area and the associated evaporation losses.

Section V (Results), pg 23, 7th paragraph and pg 24, 2nd paragraph: Comments on the statements regarding drainage water contamination and the evaporation ponds that serve the Lakebed will be, as mentioned above, submitted independently at a later date.

Section V (Results), pg 24, 4th paragraph: The second sentence refers to "proposed" enlargements on Pine Flat and Success for flood control purposes. This statement is not

accurate and should be clarified. As noted above, the COE's Feasibility Study for the proposed enlargement of Success has been inactive since 1992 and, absent a new cost sharing arrangement, it currently appears very unlikely that the Study will be activated in the foreseeable future. With regard to Pine Flat, we are not aware of a current proposal to enlarge the reservoir for flood control purposes. The COE recently studied an enlargement of the reservoir for environmental enhancement reasons, not flood control purposes. However, this study was terminated and it is doubtful that the COE will pursue it again due to the high cost of the project.

Section V (Results), pg 25, 4th paragraph: The fourth sentence is not accurate. The proposed project will not effect cropping patterns or the number of acres planted in the Lakebed, or result in the development of the Wilbur and Hacienda flood areas for agricultural uses. Refer to comments below on the second paragraph of page 26 of the DCAR.

Section V (Results), pg 25, 7th paragraph: The second sentence is not accurate and should be clarified. As mentioned above, it is our understanding that there currently are no active projects to enlarge Pine Flat or Success. However, even if all of the reservoirs were enlarged for flood control purposes as described, flooding in the Lakebed would not be totally eliminated.

Section V (Results), pg 26, 2nd paragraph: The first sentence is full of conjecture and should be deleted. The Wilbur and Hacienda flood areas were developed (on lands with poor soils) at considerable expense to protect productive Lakebed farm land from flood waters. The relatively small increase in the level of protection that the proposed enlargement will provide to the Lakebed will not diminish the need for these facilities. Therefore, we can state with confidence, that the Wilbur and Hacienda flood areas will not be converted to agricultural uses in the foreseeable future.

With regard the last sentence, it should be noted, as discussed above, that water is stored in the Wilbur and Hacienda areas typically only in wet years. Therefore, habitat that is incidental to the management of flood waters, is provided only on an intermittent and seasonal basis.

Section V (Results), pg 26, 4th and 5th paragraphs: As mentioned above, based on recent history, most CVP contractors, including those in the Kings, Kaweah, and Tule basins, take delivery of virtually all of their Class 2 allocation in years that Class 2 water is allocated, with the exception of very wet years. In very wet years, such as 1995, contractors may be unable to take delivery of some Class 2 water. Therefore, we feel the statements in these two paragraphs are misleading. It might be more accurate to indicate that there may be a narrow window of conditions under which some additional CVP water could be imported.

Section V (Results), pg 26, 6th paragraph: Because it appears that opportunities for importing additional Class 2 CVP water are most likely to occur during very wet years, i.e. at a time when high flows are occurring in the San Joaquin River system, the proposed enlargement should not adversely effect conditions in the San Joaquin or the Delta.

Section V (Results), pg 26, 7th paragraph: The first sentence pertaining to the importation of CVP water into the Kaweah, Kings, and Tule basins and the associated potential conversion of agricultural lands to higher-valued crops and potential opportunities for water marketing is not relevant to the discussion of impacts in the Tulare Lakebed and should be deleted. The major impact of importing additional supplies of CVP water into the Kaweah Basin is expected to be an improvement in the groundwater overdraft condition that currently exists in the Basin,

not those identified in the document.

Section V (Results), pg 26, 8th paragraph: Comments on the statements regarding drainage water contamination and the evaporation ponds that serve the Lakebed will be, as mentioned above, submitted independently at a later date.

Section V (Results), pg 27, 2nd paragraph: The statements in this paragraph appear to be based on the premise that the importation of additional CVP water or the availability of other "new" water will increase the amount of irrigation water that is applied to lands in the Lakebed which, in turn, will produce more drainage water in the Lakebed. This premise reflects a lack of understanding of the farming/irrigation practices in the Lakebed. Cropping decisions generally are not based on the likelihood of having additional surface water available from the Kaweah, Kings, or Tule Rivers. Land planted in crops receives a full supply of irrigation water that comes from various surface water sources or ground water, or a combination of the two. Therefore, the availability of additional supplies of surface water from any of the three rivers should not result in increased irrigation demands. The additional surface water would be used for direct irrigation instead of groundwater or be spread in groundwater recharge facilities.

The last sentence of this paragraph, which indicates Service opposition to new evaporation ponds in the San Joaquin Valley without mitigation, should be deleted from the document (and from the discussion of project impacts in the Lakebed in particular).

Section V (Results), pg 28, 3rd paragraph: We believe that it is not accurate to state in the second sentence that the construction of Terminus Dam has resulted in the "conversion of endangered species habitat" to agricultural uses. It is doubtful that little, if any, native lands have been brought into agricultural production in the Kaweah Basin in general, and the Lakebed in particular, since Terminus Dam was constructed.

We also believe that it is not accurate to state in the third sentence that the proposed enlargement "may further these losses". We feel this conjecture overstates the potential impacts of the project. As we mentioned earlier, because the Kaweah Basin will continue to be a "water-deficient" area and there appears to be limited habitat in the lower Basin, it appears unlikely that existing habitat will be developed for agricultural uses as a result of the flood control or water supply benefits that the project will provide. With regard to the potential development of habitat for urban uses, the enlargement of the reservoir should not influence this process for the reasons discussed above.

Section V (Results), pg 33, 4th paragraph: With regard to the first sentence, we do not consider the Wilbur and Hacienda flood areas to be "season/intermittent wetlands". We consider these sites to be flood control facilities that are flooded on an intermittent and seasonal basis. Any habitat benefits they may provide is incidental.

The natural wetlands in the Lakebed were converted to agricultural lands approximately 100 years ago. To say that this process has occurred "over the last 130 years" is misleading.

To include "the losses of historic breeding areas" in the wetlands Resource Category determination for the project, suggests that the project is being penalized for perceived past sins, namely, the reclamation of the historic Lakebed wetlands and the reduction in Lakebed flooding associated with the construction of the four flood control/irrigation dams in the 1950s and 60s. This is not appropriate.

Section VI (Discussion), pg 41, 6th paragraph: The fourth sentence should be revised to indicate that the reservoir could be drained rather than "would" be drained under the NED Plan. As noted earlier, the reservoir also could be drained under the LPP.

Explain why draining the existing reservoir in the future (without the enlargement) will require an EA. Water stored in the reservoir's conditional space could be released pursuant to conditions specified in the COE's existing Flood Control Diagram or if the water rights holders request the release of this water. If the conditional space was evacuated, the only water remaining in the reservoir would be stored in the declining sediment space.

Section VI (Discussion), pg 41, 7th paragraph: With regard to the first sentence, we do not think that the proposed enlargement project should be expected to mitigate for fishery impacts because the future "without project" fishery conditions would be similar, if not worse, than the fishery conditions that would exist with the project?

Section VI (Discussion), pg 42, 3rd paragraph: With regard to the second sentence, as mentioned above, we feel that the potential growth inducing impacts of the project are not significant.

Section VI (Discussion), pg 42, 4th paragraph: With regard to the first sentence, we do not believe that a cumulative impact analysis should include projects at Pine Flat or Success because there currently are no active projects to enlarge these reservoirs for flood control purposes and it is very questionable at this time, as discussed above, whether such projects will be studied in the foreseeable future.

Section VII (Conclusions and Recommendations), pg 43, 3rd paragraph: With regard to the second sentence, it should be recognized that management of flood waters in the Lakebed already is a very high priority and the use of the Wilbur and Hacienda flood areas and the Creighton Ranch is maximized during flood events.

With regard to the last sentence, the City of Visalia, as a cost-sharing local sponsor of the Feasibility Study, expects to receive additional flood protection from the recommended project.

Section VII (Conclusions and Recommendations), pg 43, Recommendation No. 1: We believe that it is unrealistic to expect that "integrated" projects, such as the Kaweah River Corridor Study, can provide the same level of flood protection benefits to the Kaweah Basin as the proposed enlargement. It also is very uncertain if such projects can generate a B/C ratio that is greater than 1.0.

Section VII (Conclusions and Recommendations), pg 43, Recommendation No. 2: With regard to cumulative impacts, refer to our comments on the fourth, fifth, and sixth paragraphs on page 26 of the DCAR, the second paragraph on page 27, and the fourth paragraph on page 42.

Section VII (Conclusions and Recommendations), pg 43, Recommendation No. 3: It is our understanding that a local sponsor is required for fish and wildlife conservation to be considered a purpose of the this project or future projects. This requirement should be discussed.

Section VII (Conclusions and Recommendations), pg 44, Recommendation No. 14: We

do not believe that any mitigation is necessary in the Creighton Ranch. As stated above, the impacts of the project on the site are expected to be insignificant. Refer to our comments on the first paragraph on page 20 of the DCAR.

Should you have any questions concerning our comments, please do not hesitate to call me at (209) 992-5011.

Sincerely

TULARE LAKE BASIN WATER STORAGE DISTRICT

Walter Bricker

cc: Mr. Bruce George, KDWCD
Mr. Brent Graham, TLBWSD

TULARE LAKE DRAINAGE DISTRICT

BOARD OF DIRECTORS
JAMES B. HANSEN
THOMAS R. HURLBUTT
DANIEL F. NEWTON
JOHN P. RODRIGUES
RALPH A. GILKEY

OFFICERS:
JAMES B. HANSEN, President
DANIEL F. NEWTON, Vice Preside
MICHAEL R. NORDSTROM, Secretary and Attorney
JOSEPH B. SUMMERS, Engineer
DOUGLAS E. DAVIS, Manager and Treasurer

August 26, 1996

Lieutenant Colonel Dorothy F. Klasse
Department of the Army
U.S. Army Engineer District, Sacramento
Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Attn: Ms. Jane Rinch

Re: Kaweah River Basin Investigation Feasibility Study, California
Draft Environmental Impact Statement/Report, June 1996
Comments on the Draft

Dear Ms. Rinch:

Tulare Lake Drainage District is submitting the following comments on the Draft Fish and Wildlife Coordination Act Report contained in the Draft Environmental Impact Statement/Report, June 1996 for the Kaweah River Basin Investigation Feasibility Study.

Outlined below are comments and suggested revisions to the Army Corps of Engineers draft EIR for the Kaweah River project.

Issue: Several plans are reviewed in the Draft.

Comment: We prefer the locally preferred plan (LPP).

Issue: Migratory waterfowl and other water-associated birds of the Pacific Flyway and State and Federally listed endangered and threatened species are among the affected species (Page 8).

Comment: Results of avian surveys have documented the presence of a wide variety of migratory waterfowl and shorebirds which seasonally inhabit the San Joaquin Valley. Many of the migratory waterbirds nest and/or forage during their period of residency in the area. Bird species listed for protection under the State and Federal Endangered Species Acts are also known to inhabit the area. Although these species are present in the San Joaquin Valley, the individual and cumulative impacts of reduced flooding and flood plain functions within the Tulare Lake Basin are difficult to quantify and document.

Recommended Change: Migratory waterfowl and other water-associated birds of the Pacific Flyway, and State and Federally listed endangered and threatened species are known to occur within the Tulare Lake Basin, and would potentially be adversely affected by a change in the frequency or magnitude of flood plain inundation. The magnitude of these potential biological effects, however, is unknown.

Issue: The Tulare Lake Basin supports numerous species and significant populations of waterfowl and other waterbirds of the Pacific Flyway. It is perhaps considered most important to date as a concentration area for pintail ducks (Page 22).

Comment: The Tulare Lake Basin does provide habitat for a variety of migratory waterfowl and waterbirds. The area is used as foraging and nesting habitat for large numbers of shorebirds (e.g., American avocet and black-necked stilts) during the spring and early summer. The area also provides wintering habitat for a variety of waterfowl. Shorebird densities at evaporation basins are typically larger than are populations of waterfowl. Surveys of habitat use within the Tulare Lake Basin (Barnum and Euliss, reported in CH_2M Hill *et al.*, 1992 - Cumulative Impacts of Agriculture Evaporation Basins on Wildlife) shows that densities of pintail ducks (birds/acre; Table 5-4) are substantially higher on pre-irrigated cropland (9.7 pintail/acre), and at the Kern National Wildlife Refuge (5.5 pintail/acre) than are reported on hunting clubs (2.0 pintail/acre) or evaporation ponds (0.9 pintail/acre). Although the survey data cited (which was not reviewed as part of this response) may show that a substantial proportion of the pintail duck population seasonally inhabits the Tulare Lake Basin, the importance of this area in providing habitat to waterfowl is substantially less for most species (as discussed in the subsequent paragraph) than that presented for pintail ducks.

Recommended Change: The introductory paragraph under Section C. Wildlife should present a general, balanced overview which does not focus on one particular species. The discussion of the use of the Tulare Lake Basin for pintail

should be included in a separate paragraph, and should clearly identify the importance of pre-irrigated crop land as having the highest densities in the area. The discussion should also include a longer time period than simply surveys conducted during mid-August - September, but rather should represent the overall importance of the area as a wintering habitat for waterfowl. Furthermore, the discussion of pintail and other species should clearly identify the potential mechanisms through which the proposed project may or may not contribute to adverse impacts or identify specific mitigation measures for unavoidable losses. Given data showing the importance of the Kern National Wildlife Refuge, pre-irrigated crop land, and hunting clubs as wintering habitat for pintail, and many other waterfowl species, would the proposed project contribute to adverse, neutral, or beneficial effects on the quality and availability of these types of habitats within the Tulare Lake Basin?

Issue: The largest concentration of evaporation ponds is the complex serving the Tulare Lake Drainage District lands...many of these evaporation ponds have already been found to pose significant contaminant-related hazards to various waterbirds and other species of wildlife. (Page 24).

Comment: The text discussing potential effects of evaporation ponds on wildlife which are attributable to selenium exposure resulting in deformities, reproductive failure, and bird mortalities as presented in this discussion, is misleading. The discussion implying that adverse wildlife impacts occurring at the TLDD North, South, and Hacienda Evaporation Basins are "all at least as great as any recorded at Kesterson NWR", is misleading. Selenium concentrations within the San Joaquin Valley evaporation basins are characterized by a wide range of concentrations and corresponding levels of risk for adverse impacts on wildlife. The Cumulative Impacts of Agriculture Evaporation Basins on Wildlife (CH_2M Hill *et al.*, 1992) reports inflow selenium concentrations ranging from 0.3 to 940 ppb, and waterborne selenium levels within evaporation basins ranging from 0.2 to 2,200 ppb, which make a simplistic comparison with Kesterson Reservoir misleading. Similarly, at Kesterson, embryos or chicks with developmental abnormalities were found in 110 (19%) of the nest examined in surveys conducted at Kesterson. Results of monitoring surveys conducted at San Joaquin Valley evaporation basins have shown that the frequency of teratogenic effects is substantially lower at many of the evaporation basins than those observed at Kesterson. For example, no embryonic deformities (terata) have been observed from American avocet or black-necked stilt eggs collected during the past several years at the TLDD North, South, or Hacienda Evaporation Basins. To make a broad general statement that evaporation basins totaling thousands of surface acres are resulting in adverse impacts to waterbirds as great or greater than those observed at Kesterson is not supported by fact, and certainly not supported by

information documented as part of the EIR. In addition, the reliance in the EIR on information contained in the SJVDP 1987 report reflects a lack of depth and effort expended to document the large body of information available on these issues which has been published since 1987 (e.g., The Cumulative Impacts of Agriculture Evaporation Basins on Wildlife, 1992 and many other technical reports and monitoring studies).

Recommended Change: Evaporation basins, ranging in size from approximately 10 to 1,800 acres have been developed in the San Joaquin Valley for the disposal of agricultural drainage water. The evaporation basins are distributed within Fresno, Kings, Kern and Tulare Counties, with the largest number of evaporation ponds and greatest surface acreage occurring in Kings County. Water quality monitoring performed at these evaporation basins has demonstrated a wide range of concentrations for various chemical constituents including selenium, arsenic, boron, molybdenum, and salinity. The variation in water quality constituents reflects regional variation in the composition of soils and geologic structures, in addition to the effects of evaporation in concentrating material within a basin. Results of biological monitoring have similarly shown a relatively wide range in the numbers of species of waterfowl and shorebirds, in addition to other wildlife, inhabiting the evaporation basins on a seasonal or permanent basis. Many of the waterfowl and shorebirds use the evaporation basins as nesting and/or foraging areas where they may be exposed to elevated concentrations of various water quality constituents. Results of biological monitoring have shown adverse effects on the health and reproductive success of various species which generally correspond to the range in chemical concentrations observed within the basins. Adverse impacts on the reproductive success of several species, most notably American avocet and black-necked stilts, have been observed and/or predicted to occur at a number of the evaporation basins. Evaluation of the effects of evaporation basin operations on waterbirds and other wildlife is ongoing as part of a program administered by the Regional Water Quality Control Board - Central Valley Region. The monitoring program includes consideration of water quality and biological impacts in addition to implementation of a number of structural and operational changes to the evaporation basins designed to reduce and avoid adverse impacts in combination with compensatory mitigation for unavoidable impacts.

Issue: Another impact that would occur with the additional storage of water and importation of Friant-Kern canal water involves the effects of water and agricultural drain water problems in the Tulare Lake Basin (Page 26).

Comment: The discussion of evaporation basins and potential adverse impacts on waterbirds presented in this section suffers from the same flaws and

generalizations as discussed in earlier comments. The simplistic overgeneralized approach, and reliance on data collected in CDFandG (1988) rather than significant new information which has been developed in the past several years, reflects a lack of detail in evaluating potential adverse impacts of the proposed project. The conclusion that "additional evaporation ponds could be required to accommodate increased drain water" and the resulting adverse impacts on waterbirds and wildlife, is inconsistent with the current trend of reducing the number and acreage of evaporation basins within the area.

Recommended Change: Another impact that would occur with the additional storage of water and importation of Friant-Kern canal water involves potential effects on agricultural drainage water problems within the Tulare Lake Basin. As discussed above, evaporation basins are currently used in some areas for the disposal of sub-surface agricultural drainage water resulting in the exposure of waterbirds and other wildlife to potential adverse impacts. Data collected as part of biological and water quality monitoring programs since the mid-1980's has shown that elevated concentrations of many water quality constituents, including selenium, occur in agricultural drainage waters, and that waterbirds and wildlife may be adversely impacted by exposure to elevated concentrations of chemical constituents occurring in many of the basins. Adverse impacts which have been observed include reproductive failure and an increase in embryonic deformities (teratogenesis) in addition to reduced health and condition when exposed to high chemical concentrations.

As a consequence of the risk of adverse impacts associated with evaporation basin operations the Regional Water Quality Control Board - Central Valley Region has implemented waste discharge requirements for operating basins which include water quality and biological monitoring, in addition to structural and operational modifications to the basin to reduce wildlife usage and potential exposure to adverse conditions. As a consequence of the increased regulatory requirements imposed by the waste discharge requirements and other economic factors, there has been a recent trend in reducing the number and surface acreage of evaporation basins within the San Joaquin Valley. Any increase in irrigation which would result in increasing demand for agricultural drainage water disposal through the use of evaporation basins which would contribute to an increase in the number or acreage of basins over present conditions would have potentially adverse impacts on waterbirds and wildlife. Although the potential magnitude of an increase in demand for evaporation basins resulting from increased agricultural irrigation as part of the proposed project cannot be quantified, nor can the severity of potential adverse impacts be estimated at this time, the Service strongly opposes the construction or increased use of any new evaporation ponds in the San Joaquin Valley without full mitigation of their detrimental effects.

Issue: Acreage of certain wetland types, including sewage ponds, agricultural storage ponds, evaporation ponds, and groundwater recharge spreading ponds have increased in recent years to serve the expanded urban and agricultural communities...(Page 21).

Comment: In recent years the number and surface acreage of evaporation basins has declined, in part, in response to increased costs and operational constraints associated with waste discharge requirements issued by the Regional Water Quality Control Board -Central Valley Region. The general discussion of potential adverse impacts associated with evaporation basin operations on wildlife discussed in this section are the same as those addressed in previous comments. The statements presented in the EIR regarding beneficial usage of many of these wetland areas by waterbirds and other wildlife are not documented or supported by data presented in the EIR. In general, the EIR lacks technical or scientific information in addition to appropriate references to supporting documentation for many of the statements and conclusions being made.

Recommended Change: The EIR should present a tabular summary documenting the reported trend of increased acreage for various wetland types. A tabular summary should be presented documenting the increased surface area of sewage ponds, agricultural storage ponds, evaporation ponds, and groundwater recharge ponds which have been developed within the area affected by the proposed project over the past 10 to 20 years. Similarly, the EIR should present documented information regarding the usage and benefits of these areas to various waterbird species and other wildlife. Information regarding nesting density, reproductive success, or abundance of various species of wildlife utilizing these areas, should be included and/or referenced to support this discussion. The discussion should also acknowledge that, "many of the area's evaporation ponds are characterized by elevated concentrations of salt, arsenic, boron, selenium, and other elements, however the range in concentrations of these water quality constituents is relatively large among different evaporation basins. Similarly, results of biological monitoring surveys have demonstrated that waterbird usage of evaporation basins for nesting and foraging also varies substantially among basins. Biological data collected as part of these monitoring surveys has been used to identify specific operational and structural modifications which have been implemented at evaporation basins specifically designed to reduce usage by various waterbirds, particularly American avocet and black-necked stilts, in an effort to minimize and reduce their exposure to potentially adverse impacts. Many of these changes include the removal of interior windbreak islands, steepening levee slopes, and removal and control of vegetation." There are a number of reference documents which can be cited in support of these and other changes being made at evaporation basins.

Issue: Other waterbirds besides waterfowl are also important components of the Tulare Basin avifauna....Other common waterbirds species in the Tulare Lake bed include...(Page 23).

Comment: Although the discussion of the species composition of the bird community inhabiting the area is factual, the EIR should provide documentation on the specific source of this information. A number of scientific and technical reports have been prepared by the U.S. Fish and Wildlife Service, Point Reyes Bird Observatory, and other investigators regarding both the species composition and relative abundance of these populations seasonally, among years, and in response to land use practices which could also be included and documented as part of the EIR. The discussion of areas where the highest bird usage has been observed should be expanded to include specific locations and the years when surveys were performed along with appropriate documentation of the source of this information. As currently presented, much of this information is lacking in the EIR.

Issue: The Tulare Lake bed and surrounding areas within the basin have a significant agricultural drainage water contaminant problem which, among other impacts, severely jeopardizes the continued existence of waterbirds in the Tulare Basin. (pg 23)

Comment: There is no support, data, or rationale presented in the EIR to support the conclusion that evaporation basin operations "severely jeopardizes the continued existence of waterbirds in the Tulare Basin". As presented this statement is simply unsupported speculation which does not appear to be founded on any facts or analyses presented in this part of the EIR.

Recommended Change: The Tulare Lake bed and surrounding areas within the basin have a significant agricultural drainage water contaminant problem. The accumulation of sub-surface water within the Tulare Lake bed, as a result of shallow groundwater levels, is a major factor affecting agricultural production within the area. . . .

Issue: An excellent plan for providing suitable habitat for waterbird feeding and breeding was recently prepared by H.T. Harvey and Associates (1994) for Westlake Farms...(Page 38).

Comment: Compensation wetland habitat plans have been developed and implemented by both Westlake Farms and the Tulare Lake Drainage District. Biological monitoring has been performed at both compensatory habitats to document waterbird usage and reproductive success of American avocet and black-necked stilts. These plans are no longer draft, but have been fully implemented with monitoring results having been documented and presented over the past several years in compliance with the terms and conditions of waste discharge requirements issued by the Regional Water Quality Control Board - Central Valley Region. The discussion in the EIR should be updated to include this new information.

Recommended Change: Compensatory wetland habitat has been designed and implemented by both Westlake Farms and the Tulare Lake Drainage District. The wetland habitats have been primarily developed to provide foraging and breeding habitat for shorebirds including American avocet and black-necked stilts. The wetland habitats have been in operation over the past several years and results of biological monitoring have documented extensive waterbird usage and successful reproduction (H.T. Harvey and Associates, 1995, Tulare Lake Drainage District, 1995). The wetland habitats have been developed to provide compensation for unavoidable losses occurring as a result of evaporation basin operations. Water management within the wetlands has been designed to maximize the available shallow-water area for shorebird foraging and invertebrate production, while minimizing risks of avian diseases such as botulism. Vegetation control and exclusion of predators have both been identified as significant factors affecting the overall success of the managed wetlands. Monitoring of water quality and waterbird usage at the managed wetlands will continue to provide additional information regarding design criteria, water management, and the overall success of these managed wetland habitats in compensating for unavoidable losses occurring at the evaporation basins and for providing habitat for breeding waterbirds within the San Joaquin Valley.

Thank you for your consideration in these matters.

Respectfully Submitted,

Douglas E. Davis

Douglas E. Davis
District Manager

Organizations

american whitewater affiliation

August 26, 1996

Susan Scheufele
2121 Ocean Street Extension
Santa Cruz, CA 95060

Colonel John Reese, District Commander
U.S. Army Corps of Engineers, Sacramento District
Attn: SPK-PD-A (Dave Gore)
1325 J Street
Sacramento, CA 95814-2922

Dear Colonel Reese:

I would like to submit some comments on the Draft Feasibility Report and joint Draft Environmental Impact Statement/Environmental Impact Report (DEIS/DEIR) for the Kaweah River Basin, California. I am a Director of the American Whitewater Affiliation and the Conservation Chair for the Loma Prieta Paddlers. The American Whitewater Affiliation (AWA) is a nationwide group of paddlers which was formed in 1957 with the mission to conserve and restore America's whitewater resources and enhance opportunities to enjoy them. The AWA has 4,500 individual members and 100 affiliated clubs representing more than 30,000 private boaters. The Loma Prieta Paddlers is the whitewater activities section of the Loma Prieta Chapter of the Sierra Club, which is located in the Silicon Valley area and is also an AWA affiliated club. The Kaweah River is a popular southern California whitewater river, and many AWA and Loma Prieta Paddler members paddle the Class IV-V and Class II-IV whitewater runs.

The DEIS section 1.4 "Purpose and Need for Action" states that "The U.S. Army Corps of Engineers and the non-Federal sponsors, are proposing to increase flood protection downstream of Terminus Dam and to increase storage space in the reservoir for agricultural water supply. ... Construction is scheduled to begin in mid 1999." The Water Resources Development Act of 1996 (WRDA '96) has already authorized this project, provided that the report is completed not later than December 31, 1996. This legislation makes a mockery of the No Action Alternative 1.

The project is being proposed partly because Terminus Dam was designed to provide a 60-year level of flood protection, and has silted up to the point where it is only providing a 46-year level of protection "due to unexpectedly high amounts of precipitation and sedimentation that have entered the reservoir." As Marc Reisner wrote in Cadillac Desert, "Every reservoir silts up - it is only a matter of when." This reservoir was constructed in 1962, and in only three decades has accumulated an estimated 7,000 acre-feet of sediment, leaving only 1,000 acre-feet of "sediment space". Raising the dam every three to five decades is clearly not a sustainable solution to the silt problem. We recommend a more thorough investigation of alternative methods for dealing with silt buildup, since many Army Corps dams around the country are expected to have serious siltation problems in the next millenium.

The DEIS section 3.3.3 "Recreation" states that "Most of the existing recreation sites in the Kaweah River Basin are experiencing heavy visitation, which indicates a need for increased recreation opportunities in the basin. Visitation is limited by the lack of facilities and various lake constraints. Any new projects or increase in facilities will begin to alleviate the demand for recreation in the Kaweah Basin. The demand for recreation opportunities in the basin is expected to increase." However, this new

american whitewater affiliation

project is actually significantly decreasing recreational opportunities, with no mitigation for their loss. There are no plans to replace the existing campsites at the Horse Creek Recreation Area, which will decrease camping opportunities in the area. The project will also "completely inundate the "Holiday Falls" rapid when the reservoir is at gross pool" and will "increase inundation upstream of the reservoir about 2,325 linear ft.", which will cover a significant portion of the lower, 4 mile Class II-III "Three Rivers to the Reservoir" whitewater run, with no planned mitigations for the loss. The Draft Feasibility Report Table 6-7, "Average Annual Recreation Benefits Lost" lists $195,000. The AWA does not think think that the Army Corps could afford to reconstruct Holiday Falls Rapid below the dam for $195,000, let alone pay for the real estate and future operation and maintenance costs involved in replacing the camping area. The Draft Feasibility Report has grossly underestimated the lost recreational benefits, which to provide comparable camping facilities and whitewater recreational opportunities we estimate to be more in the order of $2 million.

The AWA would like to recommend the following mitigations for the loss of whitewater recreational opportunities, if there are to be any recreational mitigations for this "proposed" project:

* Purchase a public put-in at Gateway Bridge.
* Purchase a public put-in at Dinely Bridge.
* Provide a slalom course on the Class II run downstream.
* Make pertinent safety improvements on the Class II run downstream.

The Draft Feasibility Report Table 7-6 "Cost Apportionment Summary - NED Plan", shows the federal cost of the project to be $20.2 million, and the non-federal cost to be $14.3 million. We believe that federal funding for both flood control and irrigation water supply are unacceptable, as the downstream beneficiaries should pay the cost. We hope that in the future the Army Corps try to find more progressive and cost-effective ways to deal with flood control issues, such as funding flood control management plans for flood-prone areas and the use of non-structural alternatives.

Sincerely,

Susan Scheufele

Susan Scheufele
Director, American Whitewater Affiliation
Conservation Chair, Loma Prieta Paddlers, Sierra Club RTS

cc: Rich Bowers, AWA

California Native Plant Society

Alta Peak Chapter
PO Box 245
Three Rivers, CA 93271
August 26, 1996

US Army Corps of Engineers
Jane Rinck, District Engineer
US Army Engineer District, Sacramento
1325 J Street
Sacramento, CA 95814-2922
916-557-6715 FAX 916-557-7856

RE: Kaweah River Basin Investigation
Draft Environmental Impact Statement/
Environmental Impact Report

Dear Ms. Rinck,

The California Native Plant Society (CNPS) wishes to place the following comments into the public record for this project which proposes to raise the level of Kaweah Lake at the Terminus Dam in Tulare County.

On page 3-57 of the DEIS it states that Kaweah brodiaea (*Brodiaea insignis*) was located in the area near Slick Rock but was not in the area proposed to be inundated. On page 4-68 it states that a new population of five plants was located in 1995 at the 720ft elevation, 5 feet above the proposed inundation elevation of 715ft. We enclose a copy of a California Native Species Field Survey Form documented a sighting of 100 plants of Kaweah brodiaea in this area in 1992. This was determined by Mike Neuman, who was a biologist for Sequoia National Park and the Conservation Chairman of our chapter at that time. It is not clear in the EIS where this population is located in reference to the proposed inundation level. The five feet margin documented in the EIS is a very narrow protection zone for this rare plant which is a perennial bulb. It would only take one sudden flood event that causes inundation to go above the five ft margin to completely wipe out any populations of this plant in the Slick Rock area.

The EIS states on page 4-68 that if Kaweah brodiaea is inundated, the population will be removed to an appropriate location. Who and how will the potential for inundation be made? How will an appropriate location for replanting be determined? The EIS states that the park personnel will move the plants. How are they qualified to recognize these plants? What if the threatening flood inundation event occurs when the plants are in the dormant bulb stage and no foliage appears above ground?

It must be noted that the creation of the dam and Lake Kaweah destroyed large populations of Kaweah brodiaea which significantly contributed to limiting the occurrence of this species and caused it to be listed as a threatened rare species.

CNPS has concerns over the accountably for off-site mitigation for riparian habitat and oak woodland that will be lost with increased inundation. It is not clear where Mitigation site D is in relation to the proposed extensive mining expansion of Kaweah River Rock, or how this mining project could affect the hydrology of the Kaweah River flood basin which could impact water availability for a riparian habitat restoration site. Who will be accountable for the survival of acorn and seedling plantings? How will this be monitored? What enforcement will be in place to insure that this mitigation will work? How will the relocation of riparian habitat from the Horse Creek uplands and Kaweah River upstream from the lake accommodate the wildlife species, including the Bald eagle, that are dependent on this natural vegetation?

Please keep CNPS on the notification list for all public comment regarding this project. The Alta Peak Chapter covers the geographical area of Tulare County.

Sincerely,

Catherine Cort

Catherine Cort
Conservaton Chair

cc Emily Roberson, Public Lands Planning Analyst CNPS
David Magney, CNPS VP Conservation

Enc species field survey form

CALIFORNIA NATIVE SPECIES FIELD SURVEY FORM

MAIL TO: NATURAL DIVERSITY DATA BASE, CALIFORNIA DEPARTMENT OF FISH AND GAME, 1416 NINTH ST., SACRAMENTO 95814

OFFICE USE ONLY

Document Code _____ Quad Code _____
Index Code _____ Occurrence # _____
Copy Sent To _____

PLEASE ENTER ALL INFORMATION AVAILABLE TO YOU. USE THE BACK FOR COMMENTS IF NECESSARY. *PLEASE ATTACH OR DRAW A MAP ON BACK.*

Scientific name (no codes): Brodiaea insignis

Reporter: Newman, M.; Cart, C. Phone: (209) 561-4671

Address: 46076 Sierra Drive

Date of Field Work: 3-5-1992 (day mo. yr.) County: Tulare Collection? If yes, # _____ Mus./Herb _____

Location: West-facing slope along Kaweah River above Slide Rock area

Quad Name: _____ T _____ R _____ ¼ of _____ ¼ Sec _____

7½' 15' Elevation: _____ ft(m) T _____ R _____ ¼ of _____ ¼ Sec _____

Landowner/Manager ACE

Species found? ✓ Yes No If not, reason: _____

Is this a new location record? Yes No ✓ Unknown

Total # of individuals = 100 Is this a subsequent visit? Yes ✓ No Compared to your last visit: more same fewer

Phenology (plants): ? # vegetative 100% # flowering _____ # fruiting

Population Age Structure (animals): _____ # adults _____ # juveniles _____ # others

Site Function for Species (animals): breeding foraging wintering roosting denning other

Habitat Description: (plant communities, dominants, associates, other rare spp., substrate/soils, aspect/slope)

Annual grassland w/ Brodiaea elegans

Current Land Use/Visible Disturbances/Possible Threats: Reservoir - seasonally flooded

Overall Site Quality: Excellent Good X Fair Poor

Comments: Occurs w/ harvest brodiaea; possible hybridization.

Should/Could this site be protected? How?

Other comments:

DETERMINATION (Check one or more, fill in blanks)
- Keyed in a site reference _____
- Compared with specimen housed at _____
- Compared with photo/drawing in _____
- By another person (name) _____
- Other _____

OTHER KNOWLEDGEABLE INDIVIDUALS (Name/Address/Phone)

PHOTOGRAPHS (Check one or more)

Subject	Type
Plant/Animal	Slide
Habitat	Print
Diagnostic Feature	
Other	

May we obtain duplicates at our cost? Yes No

ENVIRONMENTAL
DEFENSE FUND

California Office
Rockridge Market Hall
5655 College Ave.
Oakland, CA 94618
(510) 658-8008
Fax: 510-658-0630

August 26, 1996

Colonel John Reese, District Commander
U.S. Army Corps of Engineers, Sacramento District
ATTN: SPK-PD-A (Dave Gore)
1325 J Street
Sacramento, CA 95814-2922

VIA FAX

Dear Colonel Reese,

We write to comment on the Draft Feasibility Report and joint Draft Environmental Impact Statement/ Environmental Impact Report (DEIS/DEIR) for the Kaweah River Basin Investigation, California.

The draft report's proposed action entails the raising of Terminus Dam as a means to provide 70 year (increased from 60 year) flood protection downstream of the Terminus Dam and increase the storage space in Lake Kaweah for irrigation water supply. The Environmental Defense Fund is deeply concerned with the apparent Army Corps "solution" of raising dams to address problems resulting from reservoir siltation. In the past three and a half decades alone, Terminus Reservoir has accumulated an estimated 7000 AF of sediment, leaving only 1000 AF of sediment space. Army Corps dams across the country have (or will have) similar siltation patterns and the raising of dams to address these re-occurring cycles does not provide a sustainable solution. Careful and serious analysis of more sustainable alternatives (including, but not limited to, reservoir dredging, sediment sluicing, and demand-side management) must be included as part of the final Kaweah River Basin Study.

We are additionally concerned with the apportionment of the majority of project costs to the federal taxpayer. Two purposes of the proposed project are to address flood protection concerns and to provide for increased irrigation supply storage to the Kaweah Delta Water Conservation District (KDWCD). At a minimum, project beneficiaries, be they flood plain residents or irrigators, should be responsible for the majority, if not the entirety, of the costs for any improvement project.

Finally, as part of any regional solution, the Kaweah River Basin's environmental resources must be protected, and, preferably, enhanced. Regional flood control and irrigation projects have already resulted in enormous impacts to riparian and wetland habitat and the raising of Terminus Dam will only exacerbate habitat losses in the riparian corridor. To this end, we suggest that, in addition to the above, Tulare lakebed restoration should be thoroughly examined as a potential joint-benefit flood control/environmental restoration alternative.

The Environmental Defense Fund appreciates the opportunity to offer these comments, and we refer you to comments submitted by the Environmental Protection Agency (EPA) and the American Whitewater Affiliation (AWA) for further details on the environmental and recreational impacts of the proposed project.

Sincerely,

Katrina Schneider

Katrina Schneider
Resource Analyst

National Headquarters

257 Park Avenue South	1875 Connecticut Ave., N.W.	1405 Arapahoe Ave.	128 East Hargett St.	44 East Avenue	6 Faneuil Hall Marketplace
New York, NY 10010	Washington, DC 20009	Boulder, CO 80302	Raleigh, NC 27601	Austin, TX 78701	Boston, MA 02109
(212) 505-2100	(202) 387-3500	(303) 440-4901	(919) 821-7793	(512) 478-5161	(617) 723-2996

Project Office

Kaweah Lake *PRESERVATION GROUP*
1525 East Noble Avenue · #235 · Visalia, California 93292

PUBLIC HEARING
KAWEAH RIVER BASIN INVESTIGATION
JULY 23, 1996

FOLLOWING ARE THE WRITTEN COMMENTS OF THE KAWEAH LAKE PRESERVATION GROUP (KLPG) ON THE PROPOSED PROJECT :

PRESENTED INTO PUBLIC RECORD AT THE HEARING BY:
JOHN K. NIKKEL
President, KLPG

The Kaweah Lake Preservation Group represents 25,000 people in Tulare/ Kings Counties interested in preserving the fishery/recreational aspects of Kaweah Lake.

The goal of this group is to assure a water level for Kaweah Lake that would preserve the fishery and recreational uses of the lake for present and future generations.

We have reviewed all aspects of the Draft Feasibility Report and based upon our understanding of the study we support the raising of the spillway and believe that the LPP Plan, over the NED Plan, best meets the recreational needs of the community.

This letter will also serve notice that an addendum will be filed by a qualified recreation sponsor to resite the recreational facilities that are not resited in the current study.

Sincerely,

John K. Nikkel

John K. Nikkel

Kaweah Marina

35597 SIERRA DRIVE
LEMON COVE, CALIFORNIA 93244

PHONE (209) 597-2526

July 23, 1996

Jane Rinck
Environmental Specialist, Planning Department
U. S. Army Engineer District, Sacramento
1325 J St.
Sacramento, CA 95814-2922

Dear Ms. Rinck:

As the owner-operator of Kaweah Marina, I have the following statement to make concerning the study to raise the lake level of Kaweah:

This study does not address the recreational needs of the general public that live and work in the area. It is true that Terminus is a flood control and irrigation reservoir but recreational needs have been met for the past thirty-two years. To take a step backwards at this point in time is not acceptable.

Tulare County and the City of Visalia receive economic benefits in the amount of $2.6 million annually. This is calculated at $4.57 per visit with the average annual visitation of 576,000 visitors per year. The resiting of the recreational facilities at high water level would be a one-time cost of $1.5 million to the local government. The other half to be paid by the federal government. This would insure that the recreational facilities at the project would be there for the life of the project and nobody would have to bear the cost of the clean-up of the facilities of $194,000 and the annual loss of $195,000 in recreational benefits.

By the year 2020, the population is expected to double in Tulare County. Recreation will be twice as valuable to this area in the very near future.

I would like to see the County of Tulare and the City of Visalia come together and file an addendum to the project, to include recreation and take advantage of the opportunity that this project puts forth now.

The Local Preferred Plan is the ONLY one that gives recreation a chance. A dedicated permanent minimum pool is missing from this plan. The water districts, County of Tulare and the City of Visalia, being the agencies that are working to get the dam raised twenty-one feet, should come together and see that enough water is provided in the winter to sustain the existing fishery.

Sincerely,

Dale Mehrten

Dale Mehrten

c: Bruce George, KDWCD
Evan Long, Visalia City Councilman
Bill Sanders, Tulare County Supervisor
George Radanovich, Congressman
Bill Thomas, Congressman
Cal Dooley, Congressman

Kaweah Marina

35597 SIERRA DRIVE
LEMON COVE, CALIFORNIA 93244

PHONE (209) 597-2526

August 15, 1996

U. S. Army Corps of Engineers
Atten: SPK-PD-A (Dave Gore)
1325 J St.
Sacramento, CA 95814-2922

Dear Sirs:

I am writing in regards to the study on raising the Lake Level at Kaweah, Terminus Reservoir. I have already written my comments but wish to add the following:

As per the recreation study, Appendix F Draft EIS, I hereby request that Mr. Tom Bonetti, Environmental Specialist, revisit his figures as to the dollar value of $4.57 per user.

I have reviewed the Draft EIR of June, 1984 prepared by the California Dept. of Fish & Game. They stated that there were 781,200 visitors in 1982. They listed fishing as the primary activity of 30% of the visitors. The Sport Fishing Institute estimated that the average angler spent $11 per fishing day. That estimate included license, tackle, lodging, meals, gasoline & Transportation. A telephone call yesterday to Mr. Mike Hill, DFG (916-227-2268) yielded the following information: In a 1991 National Survey of Fishing, Hunting, & Wildlife Associated Recreation done by the U. S. Fish & Wildlife Service, it was stated that an average of $674 per year per fisherman is spent on fishing related expenses. (or $47.00 per day)

I am sure that there are other studies out there which would indicate that $4.57 is not a true picture of the value of the fishery and the recreation that we have here.

It is also noted that recreation facilities would be fully inundated certain years under with project conditions. I would like to see a listing of both the LPP plan and the NED plan of Terminus allowable storage and those years that the allowable storage would be zero included in the EIS. I believe for the LPP plan, this would have been years 1967, 1969, 1970, 1978, 1980, 1983, 1984, 1993, 1995. (Nine out of 30 years). This would be a very clear picture of what we are facing in regards to our local fishery. A dedicated permanent minimum pool would remedy this problem.

I also favor an addendum to the project to include the resiting of the recreational facilties.

Sincerely,

Dale Mehrten

Dale Mehrten

LAKESIDE DITCH COMPANY

9304 Houston Avenue • Hanford, California 93230 • Phone 584-3396

July 11, 1996

United States Army
Corps of Engineers
1325 "J" Street
Sacramento, CA 95814-2922

Attn: Colonel John N. Reese, District Engineer

Re: Kaweah River Basin Investigation, Draft Feasibility, June 1996

Dear Colonel Reese:

The Lakeside Ditch Company (LDC), a member of the Kaweah & St. Johns Rivers Association with water rights on the Kaweah River system and a subcontractor of storage space in Terminus Reservoir, has a service area that covers about 55,000 acres of prime irrigated agricultural lands near Cross Creek in Kings County. The LDC has been and continues to be in support of the Terminus Reservoir Enlargement Project of raising the spillway 21 feet, that provides an additional 42,600 acre-feet of flood control and irrigation storage space and improves the flood protection downstream of the reservoir for a one in 70 year event.

We have reviewed the Kaweah River Basin Investigation, California, Draft Feasibility Report, June 1996 and recommend the selection of the locally preferred plan (LPP) that provides 12,000 acre-feet of conditional winter rain flood storage space that does not diminish over time for winter carryover storage of irrigation water and for the benefit of recreation, fish and wildlife resources.

The LDC also encourages the United States Army Corps of Engineers (Corps) support for the inclusion of the Terminus Reservoir Enlargement Project in the Water Resources Development Act (WRDA) of 1996 as currently under consideration by the U. S. Congress.

The LDC further recommends that the Corps proceed immediately with Pre-Construction Engineering and Design (PED) of the project to allow construction at the earliest date and prevent further escalation of costs.

Very truly yours,

Jon Verboon, President

RLS/mep
cc: Kaweah Delta Water Conservation District

KENNETH CARTWRIGHT, Superintendent • GERALDINE LAMBERT, Secretary - Treasurer • RICHARD L. SCHAFER, Consulting Engineer
DOOLEY & HERR, Attorneys

— BOARD OF DIRECTORS —
DONALD R. MILLS, President • BRUCE GEORGE, Vice-President • STANLEY CHAMPLIN • DEAN GRABOW • ALLISON HOWE • JON VERBOON • CHARLES YOCUM

LAW OFFICES OF
RICHARD L. HARRIMAN
643 Flume Street
Chico, California 95928
Telephone: (916) 899-5100
Telecopier: (916) 899-5105

FAX COVER PAGE

DATED: 8-27-96

OF PAGES: 5
(including cover page)

TO: U.S. Army Engineer District
Attn: Jane Rinck

FAX NO. (916) 557-7856

FROM: RICHARD L. HARRIMAN

LAW OFFICES OF

FAX NO. (916) 899-5105

COMMENTS:

CONFIDENTIALITY NOTE

THE INFORMATION CONTAINED IN THIS FACSIMILE MESSAGE IS LEGALLY PRIVILEGED AND CONFIDENTIAL INFORMATION INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY NAMED ABOVE.. IF THE READER OF THIS MESSAGE IS NOT THE INTENDED RECIPIENT, YOU ARE ADVISED NOT TO READ THE ATTACMENTS AND YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION, OR COPYING OF THIS TELECOPY IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS TELECOPY IN ERROR, PLEASE IMMEDIATELY NOTIFY US BY TELEPHONE AT (916) 899-5100 AND RETURN THE ORIGINAL MESSAGE TO US AT THE ADDRESS SET FORTH ABOVE VIA THE UNITED STATES POSTAL SERVICE.

THANK YOU.

Law Offices of
Richard L. Harriman

Richard L. Harriman
Timothy J. Carroll
Paralegal

104 East Seventh Street, Suite B
Post Office Box 1118
Hanford, California 93232-1118
Telephone: (209) 584-1515
Telecopier: (209) 584-1822

Chico Office
643 Flume Street
Chico, CA 95928
Telephone: (916) 899-5100
Telecopier: (916) 899-5105

August 27, 1996

Fax Transmission
Fax No.: (916) 557-7856

District Engineer
Attn: Jane Rinck
U.S. Army Engineer District,
Sacramento
1325 J Street
Sacramento, CA 95814-2922

Re: Kaweah River Basin Investigation Feasibility Study, California Draft Environmental Impact Statement (EIS) / Environmental Impact Report (EIR). Comments on behalf of Valley Advocates (VA), Golden State Wildlife Federation (GSWF), and California Natural Resources Foundation (CNRF)

Gentlepersons:

I am writing on behalf of the above-referenced organizations to provide comments concerning the DEIS/DEIR mentioned above. Please include these comments in the formal administrative record, provide copies of your agency's responses, and put my name on your mailing list for written notice of all public hearings, meetings, or workshops concerning this project and the other federal projects referred to in the DEIS/DEIR Cumulative Impacts Analysis, Section 5.2.

1. Cumulative Impacts Analysis (Section 5.2, pp. DEIS 5-1 through 5-6)

At the outset, the most significant defect in the analysis of cumulative impacts is the failure to include the cumulative impacts and effects on vegetation and wildlife in the Tulare Lakebed resulting from previous projects, for which no federal or state environmental review was conducted.

Specifically, because the construction of Friant Dam, Pine Flat Dam, Terminus Dam, and Lake Success were all initiated and completed prior to the adoption of NEPA in 1969 and CEQA in

1970, no environmental impact analysis or review has been conducted on the cumulative impacts of these earlier projects. Similarly, the draining of the historic wetlands in the Tulare Lake basin was conducted without any environmental review whatsoever.

It was surprising (astounding?) not to find the most comprehensive source reference by William L. Preston in your list of references. We request that you review and include Vanishing Landscapes: Land and Life in the Tulare Lake Basin (University of California Press, Berkeley, 1981) in your list of references. Second, it is inconceivable that you would not have the studies prepared by Robert Hansen, Department of Biology, College of Sequoias, Visalia, California in the list of references. They were prepared in 1993-94 for the Kings County General Plan update, approved in June, 1993.

Pursuant to both NEPA and CEQA, the DEIS should provide current studies of the total amount of wetland and other riparian habitats which were destroyed as a result of damming the Kings, Kaweah, and Tule River, along with the Kern River, and the conversion of the Tulare Lakebed to agricultural uses. This cumulative data is necessary, in order to establish a baseline and to determine how much compensatory mitigation is needed within the Lakebed and where it should be located.

In addition, the cumulative impacts associated with the evaporation pond environmental review being conducted by the Central Valley Regional Water Quality Control Board (CVRWQCB) in the Lakebed should be referred to, disclosed, and discussed in the DEIS.

In view of the extremely large area of wetlands (over 1000 square miles, according to Preston) which have been destroyed, it is necessary to have a full and complete overview of all of the past, current, and reasonably foreseeable projects, so that an appropriate wetlands mitigation bank can be established in the Tulare Lakebed. These commentators believe that a more feasible and effective wetland mitigation bank should be established in the lowest portion of the Tulare Lakebed where the wetland habitat could be restored, a wetland mitigation bank established, and additional mitigation land acquired to mitigate future project impacts as they come on line.

These commentators respectfully disagree with the amount of mitigation required. Given the past destruction of such huge amounts of wetland habitats in the Lakebed, 1400 acres of mitigation habitat is grossly inadequate to mitigate the cumulative impacts of the Kaweah Lake/Terminus Dam projects, along with Pine Flat, Lake Success, and the Kern River projects.

Therefore, these commentators urge the U.S. Army Corps of Engineers to require the acquisition of at least 25,000 acres of wetland habitat in the lowest part of the Lakebed for mitigation of this project.

Given the fact that the Tulare Lake was itself a navigable waterway, the Public Trust Doctrine is applicable, and both the State and Federal agencies are required to address the loss of Public Trust values in the Lakebed from the cumulative impacts of all relevant State/Federal projects. [See, p. DEIS 5-29] This needs to be discussed and analyzed in a more thorough manner. A careful review of the 1993 Kings County General Plan update and the Final EIR will demonstrate

that Kings County still needs to identify long-term habitat needs in both the Conservation and Open Space Elements of its General Plan. This was supposed to have been completed by June 1996. It has not been done. Therefore, a joint wetlands mitigation bank should be included as a mitigation measure.

Similarly, the Tulare County Habitat Conservation Plan (HCP) has not been completed or integrated into the Tulare County General Plan. Thus, this is another opportunity to pursue a joint habitat mitigation effort with Tulare County since the majority of all water stored in Kaweah Lake will be used for agriculture, which has caused the major cumulative impacts to vegetation and wildlife.

Consequently, under NEPA, CEQA, and the Public Trust Doctrine, an equitable share of the storage in Lake Kaweah must be specifically designated for fish and wildlife purposes in order to mitigate the cumulative impacts. This has not been adequately analyzed or addressed in the DEIS/DEIR.

2. Alternatives Analysis, Socioeconomics (Section 3.3.2, DEIS 3-11 through 3-16)

This reader could find no cost estimates or analysis of the varying alternatives based upon the cost of the alternatives. In fact, the total cost of construction of all aspects of the project, including compensatory mitigation habitat, was either omitted or not readily accessible to this reader.

Further, no alternatives analysis was performed with comparative cost analyses of the alternative of using the areas susceptible to flooding as permanent open space in Kings County and Tulare County as a part of their Land Use, Open Space, and Conservation Elements, integrated with a long-term HCP. Given the cost of acquisition of conservation or open space easements 25-50% of the fee title price of this undevelopable land, this would very likely be a much less expensive alternative to raising the dam.

Likewise, there was no cost analysis performed regarding spending the same amount for conservation infrastructure and capital improvements to save water used for agriculture. In other words, by spending millions of dollars to save water used by both urban and agricultural water users, the Corps could save more water for less money. However, this is not analyzed.

Furthermore, the alternative of conservation, plus dredging of Lake Kaweah was not analyzed. Here, again, the cost v. benefit analysis is missing, and the DEIS/DEIR fails to analyze or discuss joint project alternatives, such as urban water conservation, plus agricultural water conservation, plus dredging of Lake Kaweah, coupled with the sale of the dredging spoils as sand and gravel aggregate. This joint alternative would be less expensive, save riparian and wetland habitat, avoid air quality impacts from construction and hauling aggregate from far away from the project site.

Alternative wetland mitigation sites in the Tulare Lakebed should be discussed, especially in view of the fact that the proposed site near Corcoran may already be under consideration for

mitigation of the adverse impacts from the Lake basin evaporation ponds under review by the CVRWQCB. If the proposed project is approved, there must be significantly greater wetland habitat provided to compensate for over fifty (50) years of destruction and degradation of Lakebed habitat.

3. Effects on Air Quality (Section 4.8, DEIS 4-32 through 4-40)

This section is completely inadequate. It fails to disclose, discuss, and analyze mobile source emissions from the use of alternative fuel equipment for on-site construction, off-site earth-hauling, employee vehicles, added-agricultural equipment use from additional irrigated acreage, and added emissions from long-range additional municipal and industrial (M & I) uses resulting from more urban development facilitated by this proposed project.

Similarly, the cumulative impacts of air quality from this project, in conjunction with all other similar projects and projected urban growth and development must be disclosed, discussed, and analyzed. [See, Kings County Farm Bureau v. City of Hanford (1990) 221 Cal.App.3d 692, 270 Cal.Rptr. 650]

In conclusion, the cumulative impact analysis of direct, indirect, and secondary mobile source emissions is simply legally incomplete and inadequate. It must be completely revised and re-circulated And, in the revised modeling, Compressed Natural Gas (CNG) and other alternative fuel vehicles should be considered to mitigate mobile source emissions.

Therefore, this DEIS/DEIR must be revised, amended, and the revised Draft EIS/EIR re-circulated to all responsible and trustee agencies. This commentator requests a new review period of 45-60 days, in order to evaluate the cost-benefit analysis of the new alternatives and mitigation measures.

Very truly yours,

Richard L. Harriman

Richard L. Harriman

cc: Clients

TYRRELL MANAGEMENT CO.

August 20, 1996

U.S. Army Corps of Engineers, Sacramento District
1325 "J" Street
Sacramento, CA 95814-2922
Attn: Enviromental Resources Branch

Re: Kaweah River Basin Investigation Feasibility Study

Dear Sir or Ms:

These are my comments to the proposal to raise Terminus Dam on the Kaweah River by 21 feet. I am concerned about the loss of public access to the river itself if the lake level is raised.

Currently, the public has access to the free-flowing Kaweah River near the Holiday hotel and Hwy 198. If the lake is raised, this access will then be only to the lake. Access to the lake is not the same as public access to the free-flowing river. To mitigate the loss of this heavily used river access, the Corps must acquire additional public access to the Kaweah River in its foothill area (below the bridge at the Gateway Motel and above the lake). One can not argue that there is access at Sequoia Park because the nature of the river is very different there. Above the Park boundary the river is a mountain stream, unlike the lower stretches below Gateway bridge.

To mitigate this loss, the Corps must acquire three or four smaller access points to compensate for the loss of the major access point at Holiday. I would suggest one at or immediately below the Gateway bridge, one at or immediately below the Bridge for Dinaly Road, one in the center of Three Rivers (by the school) and one just above th lake's proposed high water mark. Only by providing these additional access points will the Corps truly compensate the public for loss of the current, large river access at Holiday.

Yours truly,

David R. Tyrrell

347 N. "D" Street • Porterville, California 93257 • (209) 784-5870

Individuals

To : David W Gore@PD, James H Taylor@PA
Cc :
:
From : Douglas A Buwalda@IM@SPK
Subject : fwd: TO: Col.John Reese; Attn: SPK-PD-A (Dave Gore)
Date : Monday, July 22, 1996 at 6:51:08 am PDT
Attach : ATTRIBS.BND
Certify : N
Encrypt : N

---

this came in through the web page.

dab

Doug Buwalda
LAN/WAN Administrator
US Army Corps of Engineers, Sacramento
dbuwalda@usace.mil

Original Text
From kbeck@ucla.edu (Keith Beck), on 7/20/96 11:36 PM:
To: <www@usace.mil>
Cc: <72732.401@CompuServe.COM>, <henrie@ix.netcom.com>, <norman@rho.ben2.ucla.edu>, <dinger@mahi.ucsd.edu>, <sWestbrook@msn.com>, <stevew@scn.com>, <tom_gelder@starbase1.caltech.edu>, <charles.foster@trw.com>

Colonel John Reese, District Commander
U.S. Army Corps of Engineers, Sacramento District
Attn: SPK-PD-A (Dave Gore)
1325 J Street
Sacramento, CA 95814-2922

I am writing to comment on the proposal to raise the height of the dam at Terminus Reservoir, and would strongly oppose Options 2 & 3. The reservoir will continue to silt up; raising the dam is therefore not a reasonable solution. You should instead pursue an evaluation of dredging, or of moving the sediment to the bottom and sluicing it out as alternatives.

I would additionally point out that in this climate of fiscal responsibility, federal funding for local flood control is unacceptable. This is even more the case for new irrigation supplies (especially where there is a major problem with irresponsible ground water pumping in the district, as there is in the KDWCD. Downstream beneficiaries should pay the cost if such projects are pursued.

It is mandatory that you conduct a full evaluation of the recreational losses that would result from raising the dam. The loss of Holiday Falls rapid alone is substantial; how much would it cost to reconstruct an artificial version of this rapid downstream of the dam, to replace the loss? What would be the cost of the following to further compensate for the loss of the recreational whitewater: construction of a slalom course downstream; purchase of a public access sites at Gateway and Dinely Bridges; construction of new campgrounds to replace the ones that would be inundated by raising the reservoir?

Thank you for your consideration.

Keith Beck, MD
Associate Professor of Medicine
UCLA School of Medicine
Harbor-UCLA Medical Center
310 222-2467
kbeck@ucla.edu
beck@afp76.humc.edu

Dear Army Corps of Engineers, July 15, 1996

I am opposed to the proposed raising of the spillway on Terminus Dam to increase storage in Kaweah Reservoir. I spend a lot of time boating on the Kaweah River and I do not wish to see any more of the river become lake bottom with the attendant destruction of riparian vegetation and drowning of rapids.

I am also opposed to raising the level of the reservoir because recreational facilities around the lake will be lost - the campground, 2 boat ramps, parking areas, picnic areas - and there is no provision in the proposed increase in storage to replace these facilities They are used by very large numbers of people, and we need more such facilities - not less.

I feel that if further downstream flood protection is wanted, this is not the way to accomplish it. The study says flooding comes from unregulated downstream tributaries: Dry Creek. Raising the spillway does nothing about that. Providing flood protection for Tulare Lake bed is a ridiculous proposition - it is where the water is supposed to go!! It is the ocean for the Kings, Kaweah, + Tule Rivers, and it's highest use is to be FLOODED - too bad for corporate agriculture

growing surplus subsidized crops in a place that is naturally supposed to be underwater. You might as well drain and farm San Francisco Bay with the same logic.

I also feel that flooding is supposed to happen in a flood plain, and building in a flood plain (or lake bed) should be very limited. Kaweah Delta Water Conservation District's interest in this seems to me to really be:

1. Getting more irrigation water storage (water = $$)
2. Generating more electricity to sell (with increased storage to run through the new hydro plant they have at the dam.)

In these days of deficit budgets and widely publicized need to cut government spending on pork barrel projects of very limited public benefit, I am frankly amazed that a project such as this can even be entertained by ~~responsible~~ "responsible" public officials. Those who favor these schemes to spend federal tax dollars should be ashamed of themselves — though I know that all they really care about is themselves — not the general welfare.

Sincerely,

Howell E. Brown, Jr.

40951 Oakridge Dr (Box 1900)
Three Rivers, CA 93271

7-22-96

I am in favor of the
Lake Kaweah Enlargement
Project (including a plan
for a minimum water pool)
Plan 3 because my husband
and I recreate on the lake
throughout the year.

Thank you.
Betty Douglas
& Bill Douglas

7-25-96

I am writing this letter in support for the LOCAL PREFERRED PLAN for the raising of the water level at Lake Kaweah. As a resident of Three Rivers and a recreational user of the Lake, it is important to me + my family to have increased water storage that can be used for recreational purposes.

Again, I am in support of the Local Preferred Plan being considered by the Corps of Engineers for Lake Kaweah.

Sincerely,

Bill Douglas
P.O. Box 898
Three Rivers, CA 93271
Tel. (209) 561-3557

Margaret Austin Hall
1553 Latham Street
Mtn. View, CA 94041
24 July 1996

Colonel John Reese, District Commander
US Army Corps of Engineers
Attn: SPK-PD-A (Dave Gore)
1325 J Street
Sacramento, CA 95814

Colonel John Reese:

Thank you for placing the EIS and FEAS on-line. I'm happy to see the government saving taxpayer dollars.

The proposal to raise Terminus Dam is premature, considering that nobody has yet tried dredging to restore reservoir capacity. In the fall, sand and silt will be easily accessible, and readily used for local construction.

Please evaluate dredging as a specific alternative. I cannot understand why this was not one of the original alternatives. Reservoirs always silt up, and continuing to raise the dam is not a sustainable option. Please also evaluate the specific alternative of pushing sediment to the bottom of the reservoir and sluicing it out through the bottom of the dam over a period of several seasons. Although possibly expensive, such technology would be useful in the years ahead.

For both private boaters and commercial outfitters, the loss of Washing Machine rapid is unacceptable. This rapid is worth over $200,000 in recreational opportunities, and would cost much more than that to rebuild elsewhere.

As mitigation to compensate for the loss of whitewater resources, the following items would need to be provided:
- public access just below Gateway bridge
- public access at Dinely bridge
- an artificial rapid below N Fork bridge to replace Washing Machine
- safety improvements on the class II run downstream

Additionally, a new campground would be needed to replace the one near Horse creek.

As a taxpayer, I feel that new federal funding for flood control and irrigation supplies is wasteful. Downstream beneficiaries should pay the cost. We have already provided 60 year flood control, which should be more than sufficient.

Sincerely,
Margaret Austin Hall

To : Perry L Metzger@PPMD@SPK, David W Gore@PD@SPK
Cc :
Bcc :
From : Jason R Fanselau@PA@SPK
Subject : re: NO on Terminus Dam
Date : Monday, August 26, 1996 at 11:35:48 am PDT
Attach :
Certify : N
Encrypt : N
Forwarded By: Jason R Fanselau@PA@SPK

Comments by : Jason R Fanselau@PA@SPK
Date : Monday, August 26, 1996 11:35:47
Forwarded to : Perry L Metzger@PPMD@SPK,
David W Gore@PD@SPK

Forwarded to: Perry L Metzger@PPMD@SPK
cc: Jason R Fanselau@PA@SPK
Comments by: James H Taylor@PA@SPK
Comments:

Comments by : Lere K Busch@eda@SPK
Date : Monday, August 26, 1996 9:19:18
Forwarded to : James H Taylor@PA@SPK, Walter Yep@PD@SPK
Comments:
I'm forwarding this PUBLIC COMMENT that we (as Webmasters for SPK) received through e-mail from SPK's Home Page on the Internet
Lere Busch

---------- [Original Message] ----------

To : <www@usace.mil>
Cc : <acadirect@aol.com>, <72732.401@compuserve.com>
From : mplvideo@emerald.CyberGate.COM (Micheal Latendresse)
Subject : NO on Terminus Dam
Date : Thursday, August 22, 1996 at 10:36:29 am PDT

To whom it may concern,

I would like to record my opposition to the project proposed to raise the Terminus Dam on the Kaweah River by 21'. My opposition to this project bears several faces.

Primarily, I'm concerned as a taxpayer. In this era of the importance of fiscal responsibility, I find it impossible to support such a project that would cost all of us and benefit so few. I feel the flood control reasons for this higher dam are fictitous. The current dam IS doing it's job. Since the construction of the original Terminus Dam, all flooding in Visalia and surrounding communities has been due to drainages coming in BELOW the dam. Raising Terminus will not stop these flood waters. Dredging/sluicing the silt should be given a more serious look. I believe if ALL the actual costs of raising the dam were to be tabulated, the dredging solution would look much more viable. Just try and rebuild a

replica of Holiday Rapid for only the $195K allotted in the study! Since the Corps isn't required to mitigate such things as recreational loses, these costs aren't figured into the project. They really should be.

ther, the lake WILL silt in again. What do we do then? Build it ıer? Dam it all the way to the headwaters eventually? How much water will it store and divert then? We're just passing on an even more expensive proposition on to our children and then next generations. WE should take care of it now. DREDGE it!

Downstream beneficiaries should pay for these things. NOT the entire country. The landowners, farmers, water companies, irrigators; etc. should pay for the water storage benefits (and the consumers of those goods by higher prices). This would charge those benefiting DIRECTLY (and not all of us INDIRECTLY).

My other concerns rise from my background as a whitewater boater. I have been kayaking and canoeing the Kaweah for over a dozen years. I and other beginning boaters always looked forward to the day we tested ourselves against Holiday Rapid. This rapid is one of the very best Class IV+ rapids in the entire state. It is seldom completely exposed now. It would be even rarer once the dam is raised. Besides the loss of this rapid (and the "Love Canal" rapid above it), we'd also lose our public access at Holiday Rapid. Public access areas to this river are in very short supply now. Why throw another one away?

If we lose this one, we should be re-imbursed with public put-in sites near the Gateway bridge and the Dinely Bridge. We should also be given some sort of take-out site near the upper part of the lake. Likewise, campgrounds and other public sites to be drowned by the proposal should be relocated/mitigated.

M'-heal Latendresse
1 Thunder Ridge Rd.
C .rsegold, Ca. 93614
209 683-8794
mplvideo@cybergate.com

July 25, 1996

District Engineer
U. S. Army Engineer District
Sacramento, Corps of Engineers
1325 "J" Street
Sacramento, CA 95814-2922

I would like to add a few comments to be considered re:
Kaweah River Basin Project.

1. Seismic concerns. If this topic was dealt with, I failed to find it. Would you please provide page numbers?

2. Siltation. I am disturbed by the shrug-of-shoulder responses given to the subject. Your figures indicate that a considerable volume of flood storage is lost to siltation.

   Building aggregate is in very short supply, if the statistics provided by mining interests in the County are looked at. If not now, then well before the population growth for California reverses the current trend, we will be desparate for sand and gravel.

   It would seem that the control of siltation must be carefully studied before this project goes any further. It is common knowledge that grazing of livestock (horses and cows) lets masses of sediment enter the lake basin. Now is the appropriate time to start. I was under the influence of the T.V.A. during my high school and college years. I have watched their practicesfor preventing flooding and siltation over the years. In a nutshell, they keep the water where it hits the ground. More specifically, soil conservation has eliminated flooding in that great system of rivers. I understand that it is done at a small cost of the dams that were built to generate electricity and flood control. The dams were not succeeding until soil conservation practices were introduced. I understand the T.V.A. system has not experienced a major flood since the mid 1940's.

Let's store our water where it does the most for agriculture--in the underground aquifer.

Sincerely,

BARD McALLISTER

Bard McAllister
417 N. KENT STREET
VISALIA, CA 93291

Kyle Knight
3524 Greystone 182
Austin TX 78731
July 21, 1996

Colonel John Reese, District Commander
U.S. Army Corps of Enioneers, Sacramento District
Attn: SPK-PD-A (Dave Gore)
1325 J Street
Sacramento, CA 95814-2922

Dear Colonel Reese:

I am writing to express my opinion on proposed projects on the Kaweah River. As a frequent tourist to the area, I would hate to see such a project dam the river and ruin its excellent recreational opportunities.

Please reconsider this and evaluate pushing the sediment to the bottom of the reservoir basin and sluicing it out through the bottom of the dam over a period of several years as a specific alternative. Federal funding for flood control is unacceptable, as the downstream beneficiaries should pay the cost. Federal funding for "new" irrigation supplies is unacceptable, since the downstream beneficiaries should pay the cost.

Sincerely,

Kyle Knight

Robert Krase, Esq.

SPALLINA & KRASE, Attorneys
132 E. Morton Ave.
Porterville, Ca. 93257

Telephone (209)784-2353
Fax (209) 784-2463

August 19, 1996

U.S. Army Corps of Engineers, Sacramento District
1325 "J" Street
Sacramento, CA 95814-2922
Attn: Environmental Resources Branch

Re: Kaweah River Basin Investigation Feasibility Study

Dear Sir or Ms:

These are my comments to the proposal to raise Terminus Dam on the Kaweah River by 21 feet. First, I am concerned about the loss of public access to the river itself if the lake level is raised. This is mitigation that should be done if the project goes forward. Second, I question whether the project is appropriate at all, since downstream efforts can achieve all of the flood control benefits for less cost and without any detriment.

The Project Is Not Feasible Under
A Cost-Benefit Analysis

The alleged motivation for this expenditure of public money to raise the dam is flood control. However, as your own studies point out, more than adequate flood control can be achieved by downstream channelization and levees. This would cause excess waters during wet winter years to go to Tulare Lake Basin. This is called unacceptable in your proposal without inquiry because it would flood private farming operations conducted on the lake bed. The raising of the dam can not be done with public money if its sole benefit is to improve private lands. After all, the Tulare Lake Basin is a lake and intended to hold excess river water in wet years. Further, putting water into the lake would have added public benefits of re-charging ground water in the San Joaquin Valley and provide added wildlife habitat, especially for waterfowl.

It should be noted that the locally preferred alternative plan would raise the dam by 21 feet and store water for agriculture without flood control considerations. Thus, it is clear that the public support for this project is by big water users for additional water storage, principally for agriculture.

While historical water run-off during wet years can be used to create an argument that additional flood control is necessary, practical experience over the years since the Terminus Dam was built would indicate that no additional control is necessary other than downstream channelization and

levees. The flooding that has occurred since the construction of the dam could have been eliminated with theses cheaper, simpler methods. Raising the dam is not required to create the additional flood protection.

Sedimentation is not a problem for Kaweah Lake, since most of the sediment came in one event soon after the dam on the Kaweah was built. To the extent that yearly sedimentation may occur, dredging would be an easier and more permanent solution.

The issue of the costs involved and who is to benefit are important because the project is not cost effective. According to the Corps' documents, the investment cost is approximately 39 million dollars and the value of the annual benefits is only 3.4 million dollars. Assuming a 10% annual return on investment, this project will never pay for itself. Actually, an investment of this scope should be projected to return at least15% annually.

This project will cause an actual and irredeemable loss of free-flowing river. The damage is virtually permanent even if the dam were to be lowered in the future. California has only a small limited supply of free flowing rivers. Riparian habitat above Kaweah Lake can not be replaced by still water wetlands below the lake. This is not mitigation that worthy of the name. As much of the free-flowing Kaweah as is possible must be left in tact, unless a true public benefit is shown. This is not the case here, since there are cheaper, easier ways to achieve the public benefit. This is a water storage project to benefit a few but to be paid for at public expense and to the public detriment in the loss of the free flowing Kaweah.

The Necessity To Create Additional
Public Access Points To The River

Currently, the public has access to the free-flowing Kaweah River near the Holiday hotel on Hwy 198. If the lake is raised, this access will then be only to the lake. Access to the lake is not the same as public access to the free-flowing river. To mitigate the loss of this heavily used river access, the Corps must acquire additional public access to the Kaweah River in its foothill area (below the bridge at the Gateway Motel and above the lake). One can not argue that there is access at Sequoia Park because the nature of the river is very different there. Above the Park boundary the river is a mountain stream, unlike the lower stretches below Gateway bridge.

To mitigate this loss, the Corps must acquire three or four smaller access points to compensate for the loss of the major access point at Holiday. I would suggest one at or immediately below the Gateway bridge, one at or immediately below the Bridge for Dinaly Road, one in the center of Three Rivers (by the school) and one just above the lake's proposed high water mark. Only by providing these additional access points will the Corps truly compensate the public for loss of the current, large river access at Holiday.

Yours truly,

Robert Kruse

Robert A Lawson
423 S. Hillsdale CT.
Tulare Ca. 93274

July 29, 1996

U.S. Army Corps of Engineers
1325 J St.
Sacramento Ca. 95814

As a tax payer of this fine country I would hope I would have some say in the in the way my hard earned tax dollars are spent. Of the three plans offered the "Locally Preferred Plan" is the best option. The only problem with the plan is it seems to only benefit the flood control and farming issues while recreation is completely left out. The plan is a good start but recreation and a set minimum pool must be included into the project. From speaking with the officials at the public hearing the conditional 12,000 acre-foot pool could be drained down to 0 if the Core decides to do so. Another item that needs to be addressed is the eastern parking lot and launching ramp. As of now parking during the summer months is limited. Late arrivals are forced to park on the busy Hwy. 198. This is extremely dangerous to both the recreational users and Hwy. users. Without the second ramp and parking lot it would be disastrous.

My family and I visit Lake Kaweah at least once weekly to escape from our hectic, busy lives to unwind and regain our sanity. I hope we will still be able to so in the future. Please try to find a way to address the issues mentioned above. Thank you for allowing my opinion on this subject.

Sincerely,

Robert A Lawson

August 21, 1996

U.S. Army Corps of Engineers
Attention: SPK-PD-A (Dave Gore)
1325 J. Street
Sacramento, California 95814-2922

Re: Terminus Dam-Kaweah River Basin Investigation

Dear Mr. Gore,

I am writing in regards to the Kaweah Lake Enlargement Project in which the Terminus Dam's existing spillway will be raised 21 feet.

I am opposed to this solution to the problem that I admit exists in the Kaweah Lake. I feel that dredging out the lake has not been fully investigated to my liking. In the age of government mandated recycling I do not see why the products removed by dredging cannot be recycled in one way or another. The larger boulders can be used for park landscaping and the graduating sizes of debris can be used for home landscaping as well. I would LOVE to get a truck load of highly nutrient rich lake bottom soil for my yard.

The problem is that the Kaweah Lake is filling with sediment no matter what corrections are done. Logically, I feel that a maintenance program of dredging every 10 years will keep up with the demands of Mother Nature. You can't keep raising the spillway to correct the problem but rather dredge the lake bottom to control the problem.

Thank you for your time.

A concerned, taxpaying, United States Citizen,
Karla Edwards Little
Karla Edwards Little
2319 East School Court
Visalia, CA. 93292

Marilyn C. Messa
43205 Sierra Drive
P.O. Box 174
Three Rivers, Ca. 93271

Corps of Engineers
Environmental Resources Branch
Attn: Jane Rinck, District Engineer
1325 J Street
Sacramento, Ca. 95814-2922

RE: Draft Feasibility Report
Draft Environmental Impact/ Environmental Impact Report
Kaweah River Basin

Dear Ms. Rinck,

I am writing to voice my opposition to the raising and widening of the spillway at Terminus Dam for the following reasons.

1.) Siltation and sedimentation is the problem and will continue to occur. Dredging has not been considered as an alternative in this project.

2.) The project proposes to raise the gross pool to add flood storage space.This would be a minimal change in flood velocity to the properties that have been allowed to be developed in flood prone areas.

3.) There will be little change in the base pool left for recreation purposes. All present recreation areas will be inundated and will include the loss of a beautiful hiking area known as the Cobble Knoll Trail. No plans are included in the reports to allow for re- structuring of camping areas or to address these issues.

I feel as there are too many areas not adequatley addresed in these studies to allow the raising of Lake Kaweah for the special interests of an increase to the annual irrigation water supply.

Please add my name to the public notification list for continued review regarding this project.
Sincerely,

Marilyn C. Messa

Marilyn C. Messa

August 23, 1996

U.S. Army Corps of Engineers, Sacramento District
1325 "J" St.
Sacramento, CA 95814-2922
Attn: SPK-PD-A (Dave Gore)

Dear Sirs:

I am writing concerning the proposed project to raise Terminus Dam by 21 feet on the Kaweah River.

As a citizen, I am concerned that the proposed flood protection can more cheaply and efficiently be achieved by means of channelization and creation of levees downstream. Sedimentation of Terminus Dam has significantly occurred and will likely reoccur. If removal of the sediment is not cost effective now, what will we do when the new heightened dam again receives major amounts of sediment build-up? Raise it again?

As a river user, I am concerned that the ONLY PUBLIC RIVER ACCESS to the Kaweah River below Sequoia National Park is now threatened to become **lake access**. Rivers, of the quality of the Kaweah River, are a priceless commodity for fishing, swimming, whitewater, wildlife and scenic beauty. Not only would we be losing a small additional stretch of the Kaweah River, we would be losing our only public river access point. (I am referring to the public river access point immediately west of the Best Western Holiday Motel.)

As a citizen, I am still concerned that raising the dam provides only **temporary** increased flood protection. I would highly recommend that downstream channelization/levees or removal of the sedimentation be reconsidered.

As a river user, I would insist that (if this project were to proceed) additional public river access points be made available. (Recommendations for additional access: Pumpkin Hollow Bridge, Dinley Bridge.)

Sincerely,

Rick Mitchell
P.O. Box 912
Springville, CA 93265

cc: Congressman Bill Thomas
Congressman Cal Dooley

To : David W Gore@PD@SPK
Cc :
Bcc :
From : Jason R Fanselau@PA@SPK
Subject : re: fwd: Response to Kaweah River Basin Investigation
Date : Tuesday, August 27, 1996 at 7:59:53 am PDT
Attach : ATTRIBS.BND
Certify : N
Encrypt : N
Forwarded By: Jason R Fanselau@PA@SPK

Comments by : Jason R Fanselau@PA@SPK
Date : Tuesday, August 27, 1996 7:59:51
Forwarded to : David W Gore@PD@SPK

Forwarded to: Perry L Metzger@PPMD@SPK,Jason R Fanselau@PA@SPK
cc:
Comments by: James H Taylor@PA@SPK

---------- [Original Message] ----------

more input from the taxpayers...

dab

Doug Buwalda
LAN/WAN Administrator
US Army Corps of Engineers, Sacramento
dbuwalda@usace.mil

Original Text
From Bill Pooley <billp@mdhost.cse.tek.com>, on 8/26/96 5:07 PM:
To: <www@usace.mil>

Dear Sir or Ms:

In response to the Corps report recommending the raising of Terminus Dam on Lake Kaweah by 21 feet I submit the following comments. I fundamentally agree with the determination of needed additional flood protection for property downstream of Lake Kaweah in the event of a major catastrophic flood. I disagree with the portion of the proposal that would increase the operating level of the lake to serve irrigation purposes with the benefits limited to only the agriculture business. The cost of gaining additional water supplies has never been appropriately funded by the people directly benefiting from the gain of those resources. I believe if the dam is to be raised it should be based on flood protection only and operated at existing levels during the runoff season. The loss of recreational area on Lake Kaweah and upstream on The Kaweah River during the peak recreation times of May through July is inconsistent with the need for the recreational opportunities provided by the Kaweah River and Lake Kaweah. These recreational uses bene the entire public. Lake levels should only be permitted to go beyond the exiting spillway elevation during a major winter flood. The only portion o Lake Kaweah that presently has river access as opposed to lake access during the majority of the runoff season is the section of the river near Holiday Falls. This area of the Lake complex is a major benefit to the public in

terms of its' recreational value and presents the public with a true exposure to the power and beauty of the Kaweah River. It would be a shame to bury this portion of the river during it's peak summer flow period.

Kaweah River continues to gain popularity as a recreational river with many river runners coming from the local area and areas beyond. There are, I believe, 5 commercial river rafting companies operating on the Kaweah. The Kaweah River is unique in that nearly all land upstream of the lake is privately owned and no real easements are available at the 3 bridges that cross the river upstream of the lake. Public pressure for more river access will increase, not decrease in the coming years and decades. 30 years ago when the lake was new, who would have thought of kayaking or rafting on the Kaweah? But look at the trend. In only the last decade the Kaweah has gone from a river boated by a few local recreational users to one enjoyed by thousands every year.

In mitigation for the loss of the river's recreational value at Holiday Falls I believe the Corps should purchase easements to the Kaweah at three spots upstream of the lake, namely at the community of Three Rivers near the North Fork Bridge, at Dinely Bridge, and at Pumpkin Hollow (Gateway) Bridge in addition to providing a public access point at the new high water point. Public parking to access these points should be provided that allows better access than the few parking spots presently provided at the Holiday Falls trailhead near the Holiday Lodge.

While my permanent residence is presently in Oregon, I am also a property owner on the Kaweah River at 44016 Kaweah River Drive and believe the Kaweah River and Lake Kaweah as a source of recreation is one of the major assets of the entire area. I support the continued and expanded use of the Kaweah R r and Lake Kaweah as a recreational site and believe the operation of the d and the lake needs to support the total recreational uses of the area to the greatest degree possible.

Thank you for your attention and consideration.

Sincerely,

William R. Pooley
5445 SW 190th
Aloha, Or. 97007

Email: billp@mdhost.cse.tek.com

Disclaimer: The above opinions are my own and in no way represent any opinion of my employer, whose computer is being used to send this transmission.

Bill Pooley
Tektronix, Inc.
PO Box 500 (m/s 39-744)
Beaverton, OR 97077-0001

Email: billp@mdhost.cse.tek.com
Voice: 503 627-7330
FAX: 503 627-5587

216 W. Laura Ave.
Visalia, CA 93277
(209) 732-4933

August 26, 1996

Ms. Jane Rinck
U.S. Army Corps of Engineer District,
Sacramento
1325 J Street
Sacramento, CA 95814-2922

Dear Ms. Rinck,

Thank you for the opportunity to review the draft documents for the proposed modification to Terminus Dam. I have provided general comment below and specific comments in Appendix A. I hope this review is helpful in the preparation of the final documents.

SPECIFIC COMMENTS:

DEIS/EIR KAWEAH RIVER BASIN INVESTIGATION

General Comments

My general impression of these documents are that they represent an effort by the irrigation interests to provide additional storage for water. Visalia and most areas outside the floodplain have not experience serious flooding since Terminus Dam was constructed in the 1964. This proposal does nothing to address the issue of flooding caused by flood flows from Dry Creek. On page 6-18 of the Feasibility Report the statement is made "... there will be continued flood risks to the city of Visalia as a result of flood flows from Dry, Mehrten, and Yokohl Creeks, which are unregulated and not affected by improvements to Terminus Dam." It would seem as if this is a very costly project to only reduce the flooding of Tulare Lakebed from about 2.9-year event to a 3.1-year event. That's a very small change in the frequency of flooding.

It would appear to me that the group to benefit the most from this proposal are the non-federal supporters. This project would result in the increased storage capacity in the reservoir for additional irrigation water. In addition, the Kaweah Power Authority (same people) would benefit from additional water for hydroelectric generation. The losers would be the taxpayer and the recreational users of this facility.

<u>Relocation of Horse Creek Bridge</u> - It is my understanding the design and location of the Horse Creek Bridge has contributed to an unusually high accident rate. This is apparently due to the bridge design and location. The bridge is positioned at a low

point in the Horse Creek drainage and is curved as well as inclined. I am concerned that relocation of the bridge 500 feet upstream from the current location may worsen the situation. Has CalTrans approved the proposed bridge relocation? Will the new bridge reduce the risk of automobile accidents?

Moving the Horse Creek Bridge, realigning the highway and moving high voltage and telephone lines is estimated to cost a bunch of money. The exact cost is unclear. It is assumed that these costs would be paid by the taxpayer. How the cost of removing a bridge that still has a useful life of 35 years and replacing it with a new bridge produced a cost benefit of $17 million annually is unclear.

Recreation

What are the legal requirements for the consideration of recreation for a new project of this type? Does there have to be a non-federal sponsor in order for recreation to be considered? Why aren't impacts to existing recreational facilities and use mitigated?

The recreational value at Kaweah Lake was not properly valued or will it be adequately mitigated by this proposal. The approach this proposal has taken toward recreation is discouraging and unacceptable. Facilities paid for by the Federal government will be flooded one out of three years. In addition to the damage to these facilities (which the taxpayer is expected to repair following flooding), three fourths of the recreational facilities, including one of two boat ramps and parking lots, will not be available during the peak recreational use period one out of three years. The majority of the cost for the construction of Terminus Dam was paid for by the taxpayer. The construction cost that was shared by the irrigation interests was also supported by the taxpayer (40 year loan at ZERO percent interest). Impacts to recreational use and investments must be adequately mitigated.

It is unfortunate that recreation was not considered as part of this project. Kaweah Lake provides an important source of recreation to many area residents. It is not fair to state that they can just drive to Pine Flat or Success Reservoirs. Many lake users live only a few miles from the Kaweah Lake and take advantage of the facility after work. To have to drive the additional distance would eliminate the after work recreational option plus increase the cost.

An effort was made by local recreational interests to become a part of this proposed project. This was done because of recent changes to the legislation authorizing new project, recreation, along with flood control and irrigation water storage must be considered. However, the group was unable to raise the matching funded needed for recreation to be included.

The economical value placed on recreation at Kaweah Lake is wrong. The use of the daily value for one recreational day of $4.50 is an embarrassment. The source of this figure was not made clear in this document. Such cost estimates are commonly made and the literature contains numerous studies that demonstrate that the values used in

this study are a farce. The 1991 U.S. Fish and Wildlife Survey of Hunting and Fishing places a value of $32 on a day of fishing (U.S. Department of Interior, 1993). Please use more appropriate techniques to place the true value on Kaweah Lake recreation in the final document.

In 1992, freshwater recreational fishing created $5 billion dollars in personal income and created 1753,849 jobs in California, accounting for 1 percent of the total state economy (University of California, 1994). The U.S. Army Corps of Engineers (COE) estimate in 1993-94 that 475,000 visitor days occurred at Kaweah Lake. It would be helpful if in the final document the visitor use was summarized by category (fishing, boating, camping, etc). Based on the U.S. Fish and Wildlife Service value of $32 dollars per day (although this is for anglers) it would appear that recreational users spend more like $15 million annually. This value does not include the "multiplier effect" resulting from jobs dependent on recreation.

There may be better estimates of this value available. However, this crude estimate of the true value of recreation at Kaweah Lake would raise some question about the $2,632,000 (Appendix C - Economics) used in this document. Please check with the recreation folks at the COE to see if estimates have been made that are different that the seemingly inappropriate technique used in this document.

Given the importance recreation plays in the local economy, it is important that the project have no negative impact on the level of recreation. It would appear that many of the actions proposed by this project would reduce recreation, especially angling from the shore. Access to the shoreline by bank anglers is limited at Kaweah Lake. When the water elevation is high, there is a further reduction of shoreline available to bank anglers due to the steep sides of the reservoir. It would appear that under the proposed alternative, even more of the shoreline will no longer be available to bank anglers. This may translate into an economic loss due to fewer anglers hours. Please address this possible impact in he final document.

If this project proceeds as proposed, the periodic lose of the use of the Kaweah Boat Ramp and parking will have to be mitigated. The boat ramp at Lemon Hill would have to be widened to replace the lost launching facility at Kaweah Recreation site. Increasing the upper end of the Lemon Hill ramp has already been proposed. This alone is inadequate. It would also be helpful if the lower end of the Lemon Hill launch ramp were extended downward. This would allow the launching of boats when the lake level is low.

The expansion of the Lemon Hill parking facility was just completed. Parking has always been a problem at Kaweah Lake. Boaters would have to park along the highway during peak use periods. This will again become necessary if the parking and launching facility at the Kaweah Ramp is periodically flooded. This along with the doubling of the use at the Lemon Hill Ramp during flooding and peak recreational use is a safety issue that must be mitigated.

Sedimentation Pool

I was disappointed with the discussion of the use of dredging as a tool for the re-establishment of at least part of the 8,000 acre-feet sedimentation pool originally part of the project. I do not believe the evaluation of dredging as an alternative to the currently proposed project was fairly evaluated in this document. I would ask the this activity be reevaluated in the final document from the perspective of contracting the work out to a private company. I believe that the removal of sediment from the reservoir is critical to the long term maintenance of flood control capacity of this project There is a need for additional sand and gravel in Tulare County. I believe that dredging of sediments from the reservoir during the winter drawdown period could be done at little or no cost to the COE. I believe this was the conclusion of a similar study by the COE at Success Lake.

If some effort is not made to manage the sediments in Kaweah Reservoir, eventually flood control capacity will diminish. Eventually the reservoir will become a meadow. I would encourage the COE to initiate some sort of sediment management plan. Having sediments removed by a contractor seems to make good sense.

It would be helpful some place early in this document to explain where the 7,000 acre-feet of sediment that has entered the reservoir resides. It is important to understand this sediment is not located in the bottom of the reservoir, but next to the Kaweah Boat Ramp. This is an important point when the subject of removing this sediment is being considered.

It would appear that there are some areas upstream between the boundaries of Sequoia National Park and the Kaweah Reservoir where land use has the potential to increase soil erosion. There should be an evaluation of upstream use and repairs of areas where heavy runoff would result in significant sedimentation of the reservoir. This could be as simple as enforcing county grading guidelines are the development of a new program to assist property owners with erosion control (similar to the California Forest Improvement Program administered by California Division of Forestry).

I do not understand why the sedimentation rate of 120 acre-feet per year is used for calculations in this report. The project was built in 1964 and now contains an estimated 7,000 acre-feet of sediment. My calculations show that this is a rate of 230 acre-feet per year of sedimentation. Please justify the use of the 120 acre-feet figure or recalculate sedimentation figures used in this document.

I am also concerned about the lack of mitigation for the spawning pond in the Greasy Creek. Although small, this pond has occasionally contributed young bass to the reservoir. The pond suffers from frequent flooding due to rapidly rising water levels. The lake elevation frequently rises during heavy runoff only to recede as flows decrease. Under the proposed increase in water storage, the spawning pond would be even deeper in the reservoir and most likely cease to function. The pond has a great deal of wildlife value. This is especially true when water elevation in the lake is low and there is a considerable distance between terrestrial habitat and water in the lake. Many

animals use the pond as source of drinking water. The pond is also used by large numbers of waterfowl due to isolation from the public during low water periods in the fall. Also common to the pond are western pond turtles. This pond was constructed with Tulare County Fish and Game Commission funds. This needs to be mitigated.

Hydro - power

In my view hydropower production was not adequately addressed in this document. The proposed action will have an impact to this project. While the initial impacts are reported to be negative, the long range impacts are most likely positive. The proposed project will have an impact on the hydro-electric facility and this impact should be explained to the decision makers. There should be a clear understanding of the economic impacts to hydropower generation. In addition, please specify who owns this project. They are referred to as the "owners" throughout this document.

Minimum Pool

The established of a minimum recreation pool should be consider as part of the Preferred Alternative (Alternative 3). Tulare County does have a small water right and this was never mentioned in this document.

I am concerned that the "new water" that results from the additional storage capacity of Kaweah Lake as the result of this proposed project will be used to bring additional land into agricultural production. I would like to see a requirement that at least a portion of this new water be dedicated to ground water recharge. This might require developmer of additional percolation ponds or other techniques to recharge the aquifer.

There needs to be clarification of what flood protection is being offered by this propose project. On page 22 of Appendix E of the DEIS the statement I made that Visalia woul still be subject to flooding by uncontrolled flood flows from Dry Creek.

Where are the studies that show that the increased storage in the reservoir are safe. I raising the spillway 21 feet and storing the additional water is so practical, why wasn't this designed into the original project? What are the consequences of a failure of the concrete ogee across the spillway?

Thank you again for the opportunity to comment on these documents.

Sincerely,

Stanley J. Stephens

Stanley J. Stephens

Appendix A - Specific Comments

Page DEIS 1-3, 1st paragraph, sentence - This statement does not accurately describe the hydrological connection with San Joaquin River.

Page DEIS 1-4, paragraph, sentence - Underestimates importance of Dry Creek to downstream flooding.

Page DEIS 1-7, 2nd paragraph, sentence - Isn't there more current data on groundwater overdraft condition than 1975?

Page DEIS 1-8, 1st paragraph, sentence - How will project affect downstream flooding?

Page DEIS 1 -9, paragraph, sentence - Where would the water for the "minimum pool" come from (water right) and who would pay the annual storage fee? What are the likelihood that this water would evacuated from the reservoir during significant flood events? What are the impacts of continued sedimentation on this pool?

Page DEIS 2-4, last paragraph, sentence - The numbers are not correct for actual storage and sedimentation. The original calculated storage was 150,000 acre-feet; but this was never the actual storage. Discussion of dredging costs are incorrect. I believe that dredging of sediments from the reservoir can be done by private contractor and actually result in a profit (check study for Success Reservoir by COE).

Page DEIS 2-7, paragraph, sentence - Relocation of Horse Creek Bridge is a concern. The current bridge design and location (on a curve and at the bottom of a hill) apparently contribute to a high accident rate. Is the relocation of the bridge upstream going to increase the hazards associated with this bridge?

Page DEIS 2-8, 2nd paragraph - Interesting discussion of changes in flood events with project, including paragraph three which states that the 225 year flood event would actually increase downstream flooding.

Page DEIS 3-16, 1st paragraph - Update the discussion of parking availability at Lemon Hill to reflect the completion of the additional parking area recently completed.

Page DEIS 4-3, 4th paragraph - It is incorrect to state that this proposed project will "eliminate" the chance of flooding.

Page DEIS 4-7, last paragraph, 4.2.4 Mitigation - The proposed mitigation downstream for loss of riparian vegetation within the fluctuation zone of Kaweah Reservoir is not acceptable.. Riparian vegetation, especially willow trees, are an important habitat for gamefish, especially young bass and other centrarchids. Grass does not provided the same kind of habitat, especially following evacuation of water from the reservoir. Flooded grasses are killed by being inundated by water. When exposed to air by the

receding water levels, decomposition has rendered the grasses useless as habitat for fish. Mitigation for loss of riparian habitat must be in-kind and in-place.

Page DEIS 4-9, 2nd paragraph, last sentence - It can not be stated that the 30 employees that would not have jobs without this project. This project would hopefully be constructed with at least some skilled labor who may or may not currently be employed. How does this compare to any loss in recreation dependent jobs and for how long a period?

Page DEIS 4-10, 3rd paragraph - It would appear that the loss of motel rooms may go unmitigated.

Page DEIS 4-11, 2nd paragraph - This discussion of the sedimentation pool is not accurate. The discussion needs to include the problems that currently exist with the 8,000 acre-foot sedimentation pool.

Page DEIS 4-12, 1st paragraph - The relocation of recreational facilities should be funded by this project. These are facilities that were paid for by the tax payer. This project would eliminate these few recreational facilities during the peak of the recreational season. It is not fair to blame the failure to move these facilities on the sportsmen who were unable to raise the necessary match funds to be included in this process. Flooding of existing recreational facilities are an impact of this project and need to be fully mitigated.

Page DEIS 4-9, 3rd paragraph - Please check the accuracy of this statement. It would appear to me that at an elevation of 700 feet msl. the Kaweah Recreational facility would not be useable. This would result in a 100% loss of recreational use at this facility at or near the peak recreational season.

Page DEIS 4-9, 4th paragraph - Please check this statement for accuracy. If access to the campground is flooded, it would appear that during the high water period, there would be a 100% loss of recreational use at this site. Has any consideration been given to the development of a new (higher elevation) access road to the campground?

Page DEIS 4-12, 2nd paragraph, 5th sentence - This statement is not entirely accurate. Both Tulare County Boat Patrol and the COE barge are stationed on the lake. It is not normally necessary to launch these craft each time they are used.

How many camp sites are available at the campground? While we support the extension of the ramp at the upper end, consideration should also be given to the extension of the ram at the lower end. At these lower lake levels the ramp is out of the water and only small boats launched from the shore can access the lake. Consideration should be given to the construction of an additional launching facility at the Horse Creek Campground.

Page DEIS 4-12, 2nd paragraph, last sentence - This statement could use clarification.

Page DEIS 4-13, 1st paragraph - How much flooding would occur at Slick Rock? How would flooding at this site affect parking availability?

Page DEIS 4-13, 5th paragraph - There is something wrong with this discussion of winter fishing. There may be a need to include a discussion of the fact that once the water level is below a certain elevation, the lower end of the boat ramp is out of the water and only a few trailer launched boats use the lake. This is a significant decrease in recreational use due to the revised flood control diagram.

There may be some negative impacts to the fish population associated with low water conditions. There can be fish kills resulting from unseasonably warm weather and low water conditions, loss of fish downstream due to low water conditions, or increased predation due to crowding of fish due to low water conditions and the absence of escape cover in the lower reservoir pool.

Page DEIS 4-13, 1st paragraph, last sentence - The meaning of this statement is unclear. It appears the statement is meant to state that the establishment of a 12,000 acre-foot "minimum pool" would not result in an increase in recreational benefits. This would be measured in terms of visitor days. I suspect there would be a slight increase in use, especially by boaters, because the boat ramp would be in the water (it would be out of the water at the 1,000 acre-foot volume or Alternative 2. In addition, under Alternative 3, a fish population would remain in the reservoir, unlike Alternative 2.

Page DEIS 4-14, 3rd paragraph, 4.4.4. Mitigation - We would repeat our comment about the need for recreational facilities to be relocated as a part of this project, and mitigation for lost angler days. One possible way to mitigate would be the purchase of a downstream gravel pit and the development of a recreational facility for bank anglers.

Page DEIS 4-46, Table 4-8 - Separate out wetlands from agricultural land. Was there a reason for combining these two entirely different types of land?

Page DEIS 4-48, 2nd paragraph - This discussion should also include a discussion of the value of the flooded riparian vegetation to fish life.

Page DEIS 4-49, 2nd paragraph - There may be a need to add a discussion here about the impacts of dewatering, or a drawdown to 1,000 acre-feet, on the aquatic resources of the lake, including the fish population.

Page DEIS 4-57, 2nd paragraph, Kaweah reservoir, next to last sentence - It might be helpful to point out that this is trespass grazing. There is no allotment that allows this grazing to occur. Grazing by cattle should not be allowed in this area of the reservoir not only because it is trespass, but because of the negative impact on fish and wildlife habitat.

Page DEIS 4-61, 4th paragraph - What is the basis for the conclusion that no sediment space would remain in the reservoir by the year 2,000? Tulare County owns a small water right. What is this right and wouldn't this water remain in the reservoir. This is a minor point, because the drawdown would result in the lose of the fishery.

Page DEIS 4-61, 2nd paragraph - The statement is made that DFG or local interests could stock gamefish on an annual basis to replace the gamefish lost due to evacuation of water from the reservoir. You are most likely making reference to the same local interests that couldn't raise the $4,000 for cost sharing to have recreation considered as part of this project. They will not provide funding for restocking due to lack of organization and resources. The DFG lacks the manpower or funding to accomplish this task. Fish would have to be removed from other popular fisheries. My experience in the past with such operations (restocking Kaweah Lake following the 1987 chemical treatment) demonstrated that anglers at other reservoirs strongly objected to this action. The other alternative is to purchase fish from private aquaculturist, which is expensive. In addition, with the exception of stocking catchable size trout (a fall/winter activity) an instant fishery can not be established by means of stocking. Several years of reproduction is required to accomplish this task. This all makes a reevaluation of the dredging option look more promising.

Page DEIS 4-63, 4th paragraph, last sentence - Please explain what is meant by the statement that summer conditions would continue to adversely affect the fishery.

Page DEIS 4-64, 1st paragraph, last sentence - It would appear to me you are confusing the terms fishery and fish population. It would appear you are stating that Alternatives 2 & 3 would have no significant effect of the reservoir fish population. Under Alternative 3 winter conditions could be better due to additional water would remain in the reservoir during this draw down period. While most of this may be true, there will be a significant impact to the fishery. Fishery is referring to the recreational fishery. With the flooding of most of the recreational facilities at Kaweah Lake during early summer, access to many popular fishery areas will be eliminated. We there will be a significant impact to the recreational fishery at Kaweah Lake as the result of this project and it should be mitigated.

Page DEIS 5-3, last paragraph, next to last sentence - Consider replacing fish habitat with trout habitat.

Page DEIS 5-11, 3rd paragraph - We are concerned about the relationship of lost habitat within the reservoir and the acreage of replacement habitat. Why was there more of a one-for-one replacement, For example, 70 acres of riparian will be lost, but only 14 acres of this type of habitat will be developed.

Page DEIS 5-11, 4th paragraph, 5.7.1., Riparian scrub-shrub - We believe Greasy Creek is a good area to establish this type of habitat. It appears to be an important area of the lake for young fish. Cattle trespass has been a continuing problem in the area of the lake. The Department had to fence the small spawning pond to exclude

trespass cattle damage to spawning beds. We experienced numerous instances of damage to the fence. The adjacent land owner needs to be informed that this is an important mitigation measure that will not succeed if cattle trespass is allowed.

Page DEIS 5-22, last paragraph, 3rd sentence - This statement appears to be a little misleading. While it may be true that the current standard foundation elevates building above the 100 year flood level, many of the buildings in down town Visalia are near ground level with very low foundations.

Page DEIS 5-24, 1st paragraph, last sentence - The statement is made that the Corps "currently recognizes long-term recreational development as a full-scale project purpose on an equal basis with other established purposes of water resources development." If this is true, then why are recreational facilities and recreation access to these facilities going to be so negatively impacted by the proposed project. There needs to be additional mitigation for the seasonal loss of these facilities.

APPENDIX A

Page 3, last paragraph, 1st sentence - I am concerned about the statement that "all existing woody vegetation...located between the perimeters of the existing and proposed gross pool...would be cleared." The reason for the need to remove this vegetation, "primarily oak," is not clear. This needs to be justified. The DFG would encourage the retention of the oak trees. They have both fish and wildlife values. If a decision is made to remove the oaks, sportsmen should be allowed to cable these trees to the lake bottom to provide fish habitat.

Page 11, Table 1 - To the best of my knowledge white bass are not present in the Kaweah watershed. White crappie are also most likely not present.

Page 12, 4th paragraph, 3rd sentence - We believe the estimate that the remaining 1,000 Acre-feet of sedimentation pool will be filed by 1996 is most likely incorrect. Most of the filling of the sedimentation pool has occurred in years where major runoff has occurred. We would suggested this date be reevaluated. The loss of the remaining 1,000 acre-foot of sedimentation pool would have major consequences to the fishery.

Page 12, 5th paragraph - Another factor which should be added to this discussion is the direct downstream loss of fish from the reservoir. We suspect that once the reservoir reaches a low volume, many of the fish will move downstream with the water. Most of these fish will not be available to anglers (limited access to the waterways) and will eventually be lost when river channels and irrigation ditches go dry.

Page 13, 4th paragraph, vegetation, 2nd sentence - I don't agree with the statement that the duration of the period of inundation of riparian vegetation within the reservoir can be as long as 11 month. Most of this vegetation exists at the upper limits of the fluctuation pool and the period of flooding is shorter than the period stated. We also don't agree that the additional volume stored in the reservoir under the proposed

project will benefit this vegetation. Willows will only withstand a certain number of days flooded. The additional days of flooding may result in the lose of many of these trees, especially in years of heavy runoff.

Page 16, 1st paragraph - The DFG does not have a warmwater hatchery. The DFG is not in a position, either financially or having a source of warmwater gamefish, to allow restocking if the reservoir was dewatered or an extensive fish kill resulted from any significant lake level drawdown. Gamefish purchased from private aquaculturists would be quite expensive.

Page 15, Paragraph 1 - A small amount of rock from the spillway should be placed at strategic location within the fluctuation zone of the lake to improved gamefish habitat.

Page 16, 1st paragraph, last sentence - Carp dramatically increase water turbidy which reduces the depth sunlight is able to penetrate the water. This reduces overall productivity and directly impacts planktonic organisms.

It needs to stated that the loss of vegetation within the fluctuation zone is a loss if fish habitat. This would also translate into a reduction in surface area that result in the production of aquatic insects which are a food source for fish. This is not made as clear for aquatic organisms as it is for terrestrial organisms.

Page 34, 5th paragraph, 2nd sentence - Smallmouth bass, while common upstream in the Kaweah River, are an uncommon component of the reservoir fishery. When the DFG restocked the reservoir following the 1987 chemical treatment, only Florida strain largemouth bass and spotted bass were restocked. The Florida strain largemouth bass were from Upper Otay Reservoir and have since been shown be hybrids between Florida and northern largemouth bass. Spotted bass should be substituted for smallmouth bass as an indicator species.

Page 34, 5th paragraph, last sentence - I do not concur with assignment of lacustrine areas to Resource Category 3. Recreational fishing is very important to the local economy. The demand for this limited resource is expected to increase dramatically in the near future. This habitat should be reclassified to Category 2.

Page 36, 3rd paragraph, 2nd sentence - You should clarify the point that the grazing that is occurring on COE property is trespass grazing by the adjacent landowner. This has been a problem in the past and will continue to be problem in the future unless steps are taken to permanently correct this situation. The DFG had to fence the spawning pond due to damage to bass nests from wading cattle. It was not uncommon for the fence to be cut. The establishment of riparian vegetation and annual grasses (which are also important to young fish) will not occur unless trespass cattle grazing is eliminated. If cattle trespass continues to be a problem, there needs to be a commitment, after reasonable warning to the owner, to have the cattle confiscated by the County Brand Inspector or some similar process.

Riparian vegetation can be established without the need for drip irrigation. While Greasy Creek can be ephemeral in some years, the spawning pond releases a fairly constant flow of water due minor leaking from the dam.

Page 37, last paragraph, 2nd sentence - We would support the development of a warmwater fishery at the Kaweah Gravel site as mitigation for reduced angler access at Kaweah Lake due to increase flooding of key access areas. There is the potential to develop an exceptional fishery at this site and also to limit access to anglers under 16 years of age, trolling motors only, or angling regulations that would result in a high quality warmwater fishery.

Page 41, 7th paragraph, last sentence - We believe that the removal of sedimentation from the reservoir is an option that must be pursued. Given the current and future demand for sand and gravel in Tulare County, we would like to see a better cost evaluation of such an operation. We believe that it is possible to implement such a program with little or no cost to the COE. Such a program is needed or there could be a significant decrease in flood protection ability if one or more major flood events (i.e. 1969) were to occur.

Page 41, last paragraph - The discussion of minimum pool needs to be expanded. This is an important point and must be clearly understood. A minimum pool is an essential part of the development of a dependable fishery at the reservoir. However, a right to this water must be established as well as a commitment to pay for storage within the reservoir.

Page 42, 1st paragraph - Most of the sediment that has entered the reservoir is in the main river channel adjacent to the Kaweah Boat Ramp. This area is exposed when the reservoir is drawn down. Is unlikely that large boulders would be found during any dredging operation. Even if they were, retrieval could be difficult. A better scenario, in my opinion, would be to salvage boulders from the widening of the spillway. These boulders will be trucked to a disposal area downstream of the dam. Some of these boulders could be redirected to areas within the reservoir.

We don't agree that the relatively minor improvements outlined will result in "improve substantially over values expected with-the-project." We assume this is suppose to be without the project. Given the projected demand for a rather limited resources and grater range (and possibly change in timing of water surface level fluctuation), we would not expect such glowing improvements in the fishery.

Page 43, General Recommendations - I was disappointed there were no recommendations concerning possible impacts to the existing recreational use at the reservoir. These impacts would occur both the aquatic resources as well as recreational user.

APPENDIX B - INCREMENTAL ANALYSIS

There is no longer a Category 2 classification. I believe they are now called Species of Special Concern.

Page 2, last paragraph - Why weren't fish included in this discussion? When flooded, vegetation provides important cover for fish.

Page 9, 3rd paragraph, 2.3.3. List of Species to be Surveyed - Why aren't state listed Species of Special Concern included on this list? This would include, but not limited to, California roach, hardhead, etc.

Page 45, 6th paragraph, 3rd sentence - This statement is not accurate. There is a population of Kern brook lamprey upstream from Pine Flat Reservoir. Additional survey for Kern brook lamprey should be conducted upstream and downstream of Kaweah Lake. Historically, Kern brook lamprey were also located in the Kaweah River downstream of Terminus Dam.

Page 52, 5th paragraph, Project Occurrence, western pond turtle - I have observed what appear to be western pond turtle in the spawning pond in Greasy Creek.

APPENDIX E - LAND USE STUDY

Page 14, 5th paragraph, 1st sentence - Is this a valid definition for a desert? A more widely used definition is less than 10 inches of annual rainfall.

Page 14, 6th paragraph, 1st sentence - Is it accurate to state that agricultural water supply was adequate until the recent drought? It seems that agriculture demand for water exceeded the supply many years ago.

Page 16, 3rd paragraph - Please provide support for the statement that without this proposed project "increasingly high costs for water...lands will go out of production."

Page 24, last paragraph - Under Alternative 3 there is a proposed 12,000 acre-foot pool of water that could be available as a minimum pool. However, for this to occur and be a dedicated minimum pool, there needs to be a water right established for this water as well as a right to store this water.

Page 25, 3rd paragraph, last sentence - What assurance is there that additional irrigation water will not result in the development of additional irrigated crops? There should be some guarantee that at least a percentage of this newly stored water is used to restore underground water.

APPENDIX F - RECREATIONAL STUDY

My general opinion of the recreation study is that it is inadequate. Recreational use at Kaweah Lake contributes an estimated $10 million to the local economy annually. This is based a crude estimation. This estimate of recreational value does not include

multiplies which are commonly used in this type of estimate. It is suggested that this study can not be complete unless dollar values are assigned to recreation. The COE recreational use data is broken down by type of recreational use (fishing, boating, camping, etc.).

Page 1, 3rd paragraph, 2nd sentence - Please define a "recreational day." Is this equal to 12 hours of recreational use?

Page 2, 3rd paragraph, last sentence - Please use the 52% figure for this calculation. There is no justification for changing this figure from 52% TO 50% for "ease in calculating..."

Page 3, 1st paragraph - It would be helpful if recreational use during the remainder of the months were included. Impacts to recreation due to flooding of recreational facilities is occurring during the peak recreational use period. What percent of the total recreational use do these figures represent?

Page 4, Estimated Annual Benefit Lost - The calculation of estimated annual benefits lost as the result of the proposed project is an embarrassment. How this evaluation arrived at a value for a unit value (recreational day) at $4.57 is unclear. How or who assigned the point value in Table 3? Please explain or show an example of how this value was arrived at? The estimated average annual recreational benefit lost of $195,000 appears to us to underestimate the actual loss. We are not sure what this figure means.

There are numerous studies that estimate the value of various forms of recreation. The U.S. Fish and Wildlife Service conducts a nationwide hunting and fishing survey every 5 years.

KAWEAH RIVER BASIN INVESTIGATION, CALIFORNIA. DRAFT FEASIBILITY REPORT

Page 2-17, 4th paragraph, next to last sentence - It should make clear that a self sustaining fishery does exist downstream of Terminus Dam. There are areas, from the dam to the Wutchumna diversion, that hold permanent water. In addition there are numerous other downstream areas that hold water year round.

Page 2-19, 2nd paragraph, 2nd sentence - Please correct to indicate the Lemon Hill Parking Lot has been completed and is in operation.

Page 2-27, last paragraph - I believe that conclusion that recreational use at Kaweah Lake is expected to decline without this project is incorrect. The annual loss of the fishery at the lake would affect only the angling section of the visitors (estimated to be about 25% of the users. The population in Visalia is expected to reach 160,000 by 2020. There will be an increasing demand for water related recreation. Much of this

recreation is non-fishing. Given these estimates, we would expect the demand for recreation at Kaweah Lake to increase in coming years.

Page 3-3, 2nd paragraph - It would appear from this summary of historical flooding that no significant flooding of Visalia has occurred since the construction of Terminus Dam. Flooding of Tulare Lakebed has continued to be a problem. However, this was once the largest lake west of the Mississippi.

Page 3-7, 5th paragraph, last sentence - This discussion of sedimentation accumulation in the reservoir is a little confusing. In the 30 years the reservoir has been in operation, over 7,000 acre-feet of sediment has been collected. Most of this sediment is believed to have entered the reservoir during one major flood event (1969). The sedimentation rate has averaged about 220 acre-feet of sedimentation annually. At this rate, by the year 2,000 (4 years away) an additional about 880 acre-feet of additional sedimentation would occur. This would be a total of an estimated 7,880 acre-feet of sedimentation. This means that an estimated 142,120 acre-feet of water storage would remain. The estimates in this paragraph are reasonable. However, we do not agree with the statement in the 4th sentence that the total amount of sediment at that time (the year 2000) would total 9,300 acre-feet. It would appear that accumulated sedimentation would be more like 7,880 acre-feet (150,000 acre feet - (7,000 acre-feet + 880 acre-feet) = 7,880 acre-feet.

All of this makes a good argument for the need of some commitment to a program to reduce the amount of sediment in the reservoir. What happens under the proposed project when sedimentation reaches 8,000 acre-feet. Will there be an upward adjustment in the volume of the sedimentation pool when the spillway is enlarged? One of the selling points of the preferred alternative is the establishment of a "minimum pool." What happens to this minimum pool if there were several years of rapid increase in the sediment stored in the reservoir?

Page 3-8, 4th paragraph, last sentence - Consider changing the statement that it is illegal to park along Highway 190 to it is illegal to park...

We would repeat earlier statements that recreation is not adequately being included in this document. Many of the recreational facilities and opportunities will be lost during peak months without any mitigation. In my view this is a significant impact of the proposed project and needs to be mitigated.

Page 3-9, 3rd paragraph - This discussion of hydropower is incomplete. What are the impacts on hydropower production given the three alternatives. What are the projected increases in annual power production from the power plant on Terminus Dam under the preferred alternative? What is the relationship between the non-federal sponsors of this project and the hydropower owners.

Page 4-7, 3rd paragraph, next to last sentence - I don't understand why the 120 acre-feet per year of sedimentation is used in these calculations. Since the reservoir was

completed in 1964, annual sedimentation has been about 220 acre-feet per year. Why is the assumption made that future sedimentation rate will be half the actual rate?

Page 5-7, 3rd paragraph - We do not believe this an accurate evaluation of sediment removal. Given the projected demand for sand and gravel in Tulare County, we believe that this material could be removed by a willing contractor. Once sedimentation has reached a level that flood protection is seriously compromised, dredging will then become a desirable project. Why not get a jump on the sediment now? Please give dredging a serious cost/benefit analysis from the point of selling the material or at a minimum subsidy for the operation.

Page 5-29, 1st paragraph, last sentence - The use of the $195,000 figure for lost recreational value does not reflect the true worth of this loss (see general comments).

Page 5-29, 2nd paragraph, last sentence - Why were the economic impact to the hydroelectric operation quantified. It would be helpful to the decision makers, and the public, to know what these figures are over the life of the project with and without the preferred alternative.

Page 5-30, Table 5-7 - Why are recreational benefits (a loss) the same for all levels of flooding. Wouldn't fewer recreational facilities be flooded with a 10 foot increase in water levels compared to a 26 foot increase? Also, how the cost of the bridge relocation be seen as a financial benefit?

Page 5-36, Main Features of the Plan, last bullet - Elsewhere in the plan it is stated that the Lemon Hill Boat Ramp would be extended at the upper end and widened. Does this plan call for increasing the width of the boat ramp to compensate for the loss of the Kaweah Boat Ramp due to flooding? As mentioned earlier, under the NED alternative, the boat ramp should be extended to a lower elevation in the lake to allow boat launching at lower pool levels.

Page 5-37, Alternative 3, primary features - I am confused by the 3rd bullet. The current maximum storage during the winter is 1,000 acre-feet, not 7,000 acre-feet. Does this change the 12,000 acre-foot figure? If the 12,000 acre-feet is guaranteed (page 5-38, 3rd paragraph, ;last sentence), then how can flood control capabilities be maintained?

Page 5-37, last paragraph, last sentence - How would this commitment change when additional sedimentation (and reduction) of the reservoir occurs? At 220 acre-feet per year (this has been the sedimentation rate to date) there could be another 15,000 acre-feet of sediment in the reservoir by the year 2064.

Page 5-40, Table 5-11 - I fail to understand how the bridge relocation can be a $17,000 average annual benefit. This is going to cost the tax payers a great deal of money. There is a possibility the bridge could be less safe than the existing bridge. Please add the economic benefits of the hydropower project to this chart.

Page 5-41, Table 5-13, Recreation - The description of impacts to recreation for the NED and Locally Preferred Plan are not accurate. It is not accurate to state that "some recreation facilities would be periodically flooded. It would appear that one out of three years most recreational facilities would be flooded during the peak recreational season. Seventy-five percent of the campsite at Horse Creek Campground would be under water, not to mention the access to these sites. The Kaweah Boat Ramp and parking lot would be flooded and put out of commission. This would significantly increase the use of the Lemon Hill Boat Ramp. Unless some major modifications are made to this ramp, the level of increased use during periods of high water will most likely become a safety issue. Please change these descriptions to indicate major impacts on recreational use during periods of flooding.

Page 6-1, last paragraph, 2nd sentence - Why weren't these other factors included in the benefits analysis?

Page 6-8, 2nd paragraph, 2nd sentence - I remain confused about the reference to the 7,000 acre-foot winter conditional pool. This has been reduced to 1,000 acre-feet under the revised flood control diagram. You again make the same reference in the last sentence of this paragraph. The sedimentation pool was 8,000 acre-feet, 7,000 of which has been reported to be filled.

This entire discussion of the impacts on recreation under estimates the impacts during the peak season. Winter use at the lake is relatively low compared to spring and summer use. Kaweah Lake has limited access by foot traffic. Access is from just east of the Horse Creek Campground to just west of the marina. Many of the areas in-between are not accessible due to lack of parking or steep banks. The most frequency used areas for access to the lake are Slick Rock, Horse Creek Campground, Kaweah Recreational Area and Lemon Hill Recreational Area. It would appear that this proposed project is going to eliminate or greatly reduce access to the lake during the peak use months at three of the four sites one in three years. We would suggest that this concentration of people into one area will result in a safety issue. Will the Corps of Engineers have their budget augmented to deal with these additional problems? What will be the cost to the COE to refurbish the recreational facilities that are damaged by flooding? Will this be paid for by the taxpayers and where does this appear in the cost benefit analysis?

Page 6-8, 3rd paragraph, 5th sentence - Please identify who the "owners" of the hydropower facility are.

Page 6-9, 1st paragraph - It seems very expensive ($17 million) to raise the Horse Creek Bridge 6.6 feet. How high can the lake surface elevation be raised before the bridge has to be raised. Going back to Table 5-7, does the bridge have to be relocated if the elevation were raised 10 feet (table says yes)? How about 15 feet increase?

Page 6-14, 2nd paragraph - It would appear to us that this cost-benefit analysis is inadequate. The value for lost recreation is undervalued (see general comments above). You have not included a large number of costs associated with the PFF. How about the cost to the COE for refurbishing the recreational facilities? You can not do a cost-benefit analysis for this proposed project just considering the two items listed. We fail to understand how the bridge relocation (we assume Horse Creek Bridge) can be considered as an annual benefit. In my view, a properly done cost-benefit analysis would show a ratio of less that 1:1.

Page 6-14, Bridge Replacement - This is amazing logic. Using this same logic, couldn't you estimate the picnic table benefits as a result of relocation. These too could be paid for by the tax payer.

Page 6-15, 4th paragraph - Once again, this description of the impacts from this proposed project are not accurate in my view. The recently completed parking lot at Lemon Hill was built to help alleviate the lack of parking. During the peak recreational months, boaters would launch their boats and then park their vehicles and trailers along highway 190. This is an extremely dangerous highway due to heavy traffic use. If the Kaweah boat ramp and parking area are flooded and not available, this will return the Lemon Hill Recreational Area to the same overcrowding problem that occurred before completion of the new boat ramp. The loss of the Kaweah Ramp and parking needs to be mitigated by this project. This is a safety issue.

Page 6-18, 4th paragraph, next to last sentence - How can the statement be made that it is "equally likely that no sediment will be deposited over the life of the project"? The facts are that since the reservoir began operation (32 years), over 7,000 acre-feet of sediment has entered the reservoir. We also disagree with the conclusion that the average sedimentation rate should be a compromise between what has happened in these 32 years and the assumption that no additional sedimentation will occur within the next 100 years. This is an unrealistic assumption and not justified. Please revise your assumed sedimentation rates to reflect what has happened in the past.

Appendix C - Economics, 3rd paragraph, next to last sentence - I do agree with the conclusion that raising the winter lake level has no recreational benefit. When the lake surface levels gets low in the winter months, the lower end of the boat ramps are out of the water. This means that most boaters can not launch their boats. Only small boats can be launched off the shoreline. Attempts to launch larger boats (i.e. bass boats) often result in vehicles becoming stuck in the mud. When the lake become too low in the winter, this also prohibits the DFG from stocking trout in the lake. There may be reduction in the trout harvest if boaters are not allowed access to the lake. It would be a great benefit to winter recreation at the lake if there was more water in the lake.

Page 47, 2nd paragraph, last sentence - I disagree with the value placed on a visitor day. Please describe how the $4.57 value per visitor day was determined. This far below any figure we have seen and does not represent a realistic figure. The actual value should be much greater. We any multipliers used to determine this value (used to

determine the economic impact of recreation related jobs to the local economy)? Please see the discussion under the general comments of this letter for additional details.

Page 49, Hydropower Benefits - I do not understand why the economics of the hydropower generation were not included in this analysis. We believe that it is important to the decision to be made and we think the inclusion of dollar figures would be appropriate in the final document. Again, there is a failure to identify who the owners of the hydropower project are.

REFERENCES

U.S. Department of Interior. Fish and Wildlife Service and U.S. Department of Commerce. Bureau of Census. 1991 National Fishing, Hunting, and Wildlife-Associated Recreation. U.S. Government Printing Office, Washington DC 1993.

University of California. Commercial and Recreational Fishing in California: Their impacts on the state economy. College of Natural Resources, Berkeley. 1994.

To : <planning@usace.mil>
Cc :
[illegible] :
[illegible] : tut@netcom.com (Bill Tuthill)
Subject : Kaweah EIS and FEAS, SPK-PD-A
Date : Wednesday, July 24, 1996 at 6:53:16 pm PDT
Attach :
Certify : N
Encrypt : N

Colonel John Reese, District Commander
US Army Corps of Engineers
Attn: SPK-PD-A (Dave Gore)
1325 J Street
Sacramento, CA 95814

Colonel John Reese:

Thank you for allowing comments to be submitted electronically.

The proposal to raise Terminus Dam is premature, considering that nobody has yet tried dredging to restore reservoir capacity. In the fall, sand and silt will be easily accessible, and readily used for local construction.

Please evaluate dredging as a specific alternative. I cannot [illegible]rstand why this was not one of the original alternatives. [illegible]rvoirs always silt up, and continuing to raise the dam is not a sustainable option.

Please also evaluate pushing sediment to the bottom of the reservoir and sluicing it out through the bottom of the dam over a period of several years as a specific alternative. Although possibly expensive, such technology would be useful in the years ahead.

For both private boaters and commercial outfitters, the loss of Washing Machine rapid is unacceptable. This rapid is worth over $200,000 in recreational opportunity, and would cost much more than that to rebuild downstream.

As mitigation to compensate for the loss of whitewater resources, the following items need to be provided:
.. public access just below Gateway bridge
.. public access at Dinely bridge
.. an artificial rapid below N Fork bridge to replace Washing Machine
.. safety improvements on the class II run downstream
Additionally, a new campground must be built to replace the existing one near Horse creek.

As a taxpayer, I think federal funding for flood control, and federal funding for new irrigation supplies, are unacceptable. Downstream beneficiaries should pay the cost. We have already provided 60 year [illegible] i control, which should be more than sufficient.

Sincerely,
William S. Tuthill
<tut@netcom.com>

July 22, 1996

Jane Rinck
U.S. Army Engineer District, Sacramento
1325 J Street
Sacramento, CA 95814-2922

Kaweah River Basin Investigation, California

Thank you for giving Three Rivers residents the opportunity to comment on this study.

I would like to address the transportation impact section of this study as it describes the relocation and construction of Horse Creek Bridge. I understand it would be moved upstream (up to 500') with approaches relocated for about 1500' in each direction.

I am not a traffic engineer or bridge expert, but history has shown that the existing design of the bridge and approaches has caused a high number of serious and fatal accidents, and in my opinion, the construction of a new bridge would follow the same general design, and with the approaches at even a greater angle to the bridge surface, could make for even a more hazardous traffic situation.

Some of the problems with the existing design are as follows:

1. The bridge is and curved in both the horizontal and vertical direction and is skewed on the cross section..

2. The bridge is located at the bottom of a hill in both directions. This means that traffic is running faster than if this was not the case.

3. The southbound traffic is subject to a passing lane just before the bridge surface. This is the first southbound passing lane in many miles and with the design (second half of the passing lanes downhill) passing traffic enters the bridge in many cases at excessive speed.

4. The bridge is obscured from northbound traffic on the approach by trees and terrain.

5. There are a number of signs just before the bridge that divert drivers attention.

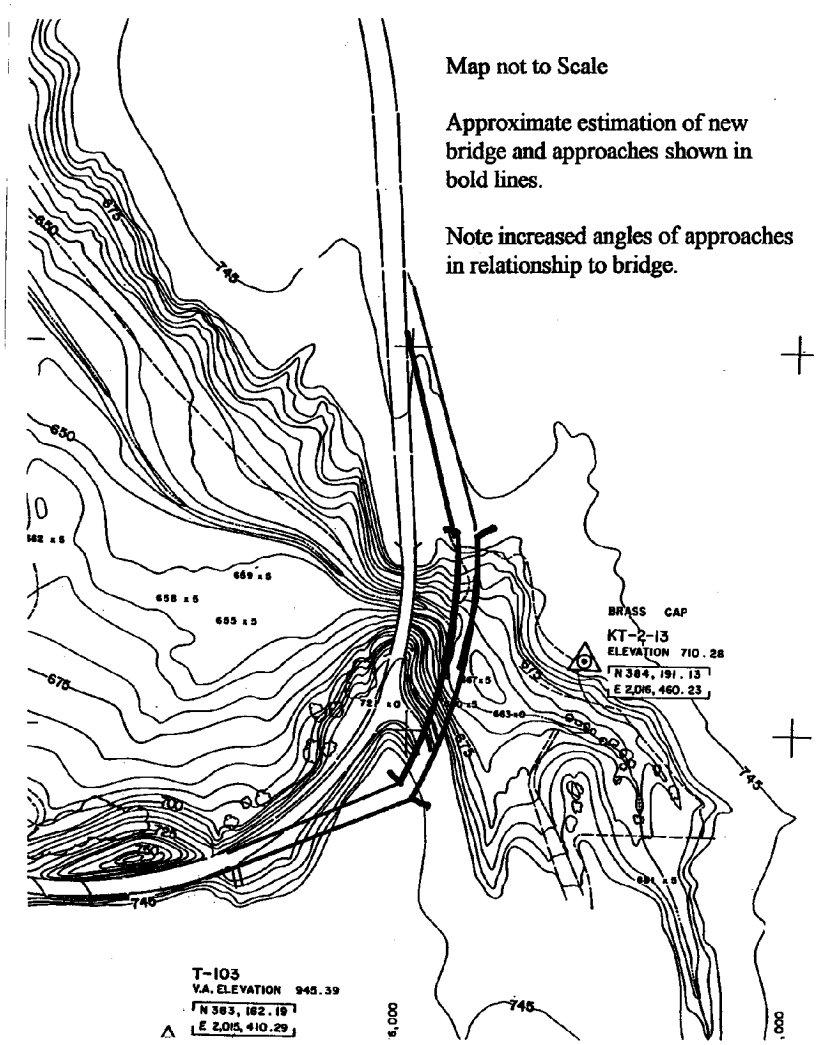
6. The bridge was designed before the high number of oversized recreational vehicles, buses and trucks that use this highway daily. It is too narrow for todays speeds and conditions and traffic counts.

7. With the Lake on both sides of the bridge, there are substantial visual diversions in this area. At full pool there are pedestrians on the bridge with no pedestrian walkway, increasing the hazard.

8. In frosty or icy conditions, the curved and sloped conditions make for a greater chance of loss of control, particularly for drivers who have never encountered this type of bridge before.
While locals knew the bridge would probably never be rebuilt, regardless of how many accidents occurred there, I feel that this should be the time to address this issue. I urge the various agencies involved in this project to not let this aspect of the project proceed without some alternatives to the existing bridge design.

Sincerely,

Pete van Gilluwe
43275 Kaweah River Dr.
Three Rivers, CA 93271


Map not to Scale
Approximate estimation of new bridge and approaches shown in bold lines.
Note increased angles of approaches in relationship to bridge.
BRASS CAP
KT-2-13
ELEVATION 710.28
N 384, 191.13
E 2,016, 460.23
T-103
V.A. ELEVATION 945.39
N 383, 162.19
E 2,015, 410.29
745
650
675
700
658 x 5
655 x 5
669 x 5
663 x 0
721 x 0
691 x 5

Sirs

The first thing befor building the dam higher would be to dredge the existing hole that keeps filling in with sand. That would hold thousands of more gallons of water if you just dredged & it would also save a lot of money right now. Enough people living on the river lost their homes when this dam was built, now you are taking more homes for it.

Dredge

Mrs W Woods
PO Box 44049
Lemoncove
Ca 93244

TRANSCRIPT OF PROCEEDINGS
EIS / EIR PUBLIC MEETING
Visalia, California
July 23, 1996

COPY

TRANSCRIPT OF PROCEEDINGS at the
EIR/EIS PUBLIC MEETING, held at
303 East Acequia, Visalia, California,
commencing at 8:00 p.m., Tuesday,
July 23, 1996, before WENDY A. HANSE,
CSR NO. 11176.

ORIGINAL

8:00 p.m. Visalia, CA

MR. MCFARLAND: Ladies and gentlemen, if everyone will come in and take a seat, we'll get started in just a couple moments. Thank you.

Good evening, ladies and gentlemen. I'm Randy McFarland, and I'm Public Affairs Consultant to Kaweah Delta Water Conservation District, and it certainly is my pleasure to be able to welcome you to this public meeting and hearing on a subject of great importance, and I think everybody knows why we're here tonight, the proposal to enlarge Lake Kaweah.

For the past couple of days, and I can tell just by looking around here, I saw a lot of familiar faces that we saw yesterday at Three Rivers and then earlier today right in the next room here in Visalia at the workshops where hopefully many of your questions about this project have been answered by the Corpss of Engineers and the Department of Water Resources and the Conservation District.

This evening the Army Corpss of Engineers is providing a form to receive testimony on the feasibility study and environmental findings for this project. It's a plan which has been discussed for many years, and it is a subject which I know is of great importance to all of us.

We're going to go right into our session. We have a great deal of information to cover, and I know that many

1 of us want to comment. Our court reporter is with us this
2 evening and will be taking down your statements so we can
3 develop a public record of this, and she asks that you speak
4 clearly and and we'll be holding you to that.
5 My assignment this evening is to serve as your
6 moderator, and as moderator, it's my responsibility to be
7 fair to all parties. My one and only goal here this evening
8 is to facilitate comments from you, the citizens of Tulare
9 and Kings County to the Army Corpss of Engineers and the
10 agencies serving as the local sponsors of this project and
11 to each other.
12 Now, I'd like to take a few moments to review the
13 meetings' agenda and ground rules so everyone knows how
14 we're going to proceed. The Corpss of Engineers has asked
15 for about three minutes for LTC Dan Perron to make an
16 opening statement, and I ask, ladies and gentlemen, for your
17 courtesy and cooperation in permitting his statement without
18 interruption, and the same holds true for all of our
19 speakers, and I would like to press that you do not have to
20 give verbal testimony for your comments to be considered in
21 this process. Your written comments will carry absolutely
22 the same importance as a spoken statement.
23 If you wish to give spoken testimony here tonight
24 and have not filled out one of the blue cards, please do so,
25 and I believe they're still available out on the table
26 outside, and as the fellow who's going to get to introduce

1 everybody, I'll really appreciate if you'll write neatly.
2 For those of you who do wish to speak, you'll be called up
3 one at a time, and when your name is called, please move
4 right up here to the podium in fairness to everyone, and
5 this is really important in fairness to everyone. Please
6 keep your comments to five minutes so we can hear from as
7 many of you as possible. We have a large audience, and I
8 know there are many who would like to comment, and please
9 keep in mind that this session is for comments.
10 We've been answering questions in the workshop
11 sessions. If you have questions afterwards, the Corps of
12 Engineers officials will be here, and they'll be glad to
13 talk with you, but this is to receive your comments for the
14 record.
15 Now, with me is Dennis Keller, who is going to
16 manage our list of upcoming speakers, and Dennis is also our
17 timekeeper, and I know it's difficult when you're speaking
18 to keep track of the time, so we're going to help you.
19 Dennis, show those signs when you have two minutes left,
20 that's what you're going to see. Expire, that's the last
21 card. We know you'll be real good about that, and I know
22 you're going to cooperate so we get everybody in fairness
23 and in great courtesy, the chance to speak. And of course,
24 we'll let you know when your time has expired.
25 Now, comments can be submitted in writing right up
26 to August 27th, and you can find the address at the table

1 out in the hallway.
2 Now, this hearing began rather late this evening.
3 As you know, there's been a long workshop here today. We
4 had a long one and very productive one up in Three Rivers.
5 Hopefully, we have been responding to your questions through
6 the workshop process. Now, we would like to receive your
7 comments. We would like, if at all possible, to wind things
8 up by 10 o'clock this evening, so before we go any further,
9 are there any questions? Hearing none, let's get to work.
10 I'd like to call upon LTC Perron of the Army Corps of
11 Engineers for the Corps' opening statement.
12 LTC PERRON: Good evening. I don't have a
13 blue card, and I hope you don't put up your two-minute
14 warning too quick, but I won't take more than three minutes.
15 I just want to introduce myself, introduce the team of Corps
16 people that we have here. I think you probably got to meet
17 a lot of them. If you weren't here, I'm LTC Perron. The
18 District Engineer, Sacramento District who's unable to be
19 here this evening but if he would have been able he would
20 have been happy to be here. We've got a team of six people.
21 I'd like them to show themselves, and if you could stand up,
22 folks, the Corps people. If I had to take six or seven, how
23 many we have here, of the best people in the district of the
24 thousand other people we have in the Sacramento District, it
25 would be these folks.
26 I would also like to congratulate the Kaweah Delta

1 Water Conservation District, a couple of folks in
2 particular, Bruce George and Jim Sorenson. Jim, I think has
3 come out of retirement and who almost has a permanent chair
4 in our meeting room up in Sacramento, he's done a fantastic
5 job. We've got a tentative plan, of course, which raises
6 the spillway of the Terminus Dam 21 feet. This allows the
7 operation of the reservoir, of course, in a similar manner
8 as we are doing today. The spillway would be widened a
9 hundred and 48 feet. We'd have to relocate, in the plan,
10 Highway 198 branch at Orange Creek. This increases the
11 storage in the reservoir by 42,600 acre feet. It's a
12 significant increase over what we have today, the peek flows
13 and frequencies of flooding what is currently about a 40/60
14 protection. The low of the reservoir comes to about 70
15 years. Project cost is about $35 million, and we're here,
16 of course, we've been here to answer your questions and
17 we'll be here later also, but we're here primarily to listen
18 and congratulate you for coming to this.
19 It's a pleasure to see the people who take the
20 time and interest to come to these public meetings and
21 express their opinions, so thank you for coming, and we'll
22 be here afterwards to answer your questions. I'll turn that
23 over to the moderator. Thank you.
24 MR. MCFARLAND: Thank you. Next, representing the
25 local sponsors of this project, I'd like to call upon the
26 manager of the Kaweah Delta Water Conservation District,

1 Bruce George.
2 MR. GEORGE: Thanks to all of you for being here
3 tonight. I had hoped that we would have a larger crowd than
4 this one small room would handle, but on the other hand, I
5 had dreams about having to get into the ballroom over here
6 because we had people standing in the streets so we're
7 somewhere in between. Thank you for being here. Also,
8 Colonel, I'd like to specifically thank you on behalf of the
9 Conservation District for taking the time to be here today
10 during the workshop and here this evening for the public
11 hearing. Also, I'd like to thank the Corps and staff for
12 their efforts over the last year to bring this feasibility
13 study to completion.
14 Also, thanks to our co-sponsors, Tulare and Kings
15 County and the city of Visalia and also to our participants,
16 the Department of Water Resources and the Tulare Lake Basin
17 Water Storage District. Special thanks to congressmen,
18 Dooley, Radanovich, and Thomas and Senator Boxer, Senator
19 Costa for their continued support. We also appreciate,
20 sincerely, the patients of those landowners whose properties
21 are potentially affected by this project.
22 The Lake Kaweah Enlargement Project is extremely
23 important because of the flood control, water storage,
24 environmental, and racreational benefits it can provide to
25 the people of Tulare and Kings Counties. The Conservation
26 District supports the proposed raise of Terminus Dam

1 spillway, 21 feet as detailed by the Corps Feasibility
2 Study.
3 Just as importantly, we recommend that the
4 enlarged Lake Keweah be operated under the Locally Preferred
5 Plan. The Locally Preferred Plan provides balance to this
6 project. The plan significantly reduces flood volumes, peek
7 flows and their frequency of occurrence. It offers
8 irrigation benefits, but more importantly, the Locally
9 Preferred Plan offers additional security in maintaining
10 environmental fishery and recreation values of the
11 reservoir. The Conservation District makes three requests
12 of the Corps.
13 One, that we proceed to a rapid and timely
14 completion of the feasibility and environmental reports so
15 that preconstruction engineer and design may be started in
16 this fiscal year 1996.
17 Two, the current NED plan operation does not allow
18 for the conditional space to be constant over the life of
19 the project. We request the development of a more
20 reasonable NED plan, one which would allow for conditional
21 space to be constant for the entire project life. This
22 would reflect more accurately the reality of the likely
23 further operation.
24 Three, the final request that we wish to make is
25 to explore all opportunities to bring the flood control
26 benefits under the Locally Preferred Plan to a similar level

as the NED plan without disturbing the 12,000 acre feet of conditional space provided by the Locally Preferred Plan.

After eight years of study and a total of $3 million in study costs, the No Action Alternative is simply not acceptable. The citizens of Tulare and Kings County must have greater flood protection. They need more water for an overdrafted ground water basin. They deserve a project which not only improves flood control and increases water storage but a project which generally improves environmental resources and increases recreational opportunities. That's why the Kaweah Delta Water Conversation District strongly recommends raising the spillway and operating in the future under the Locally Preferred Plan.

In addition, as a representative of the Kaweah and Saint Johns River Water Association, the association endorses the comments that I just made, and on behalf of the District, once again, thank you, very much.

MR. MCFARLAND: Thank you, Mr. George. Our next speaker will be Dennis Speer from the Tulare County Flood Control District.

MR. SPEER: Good evening. On behalf of the Tulare County Flood Control District, I'd like to take this opportunity to officially state that the district thoroughly supports this project, especially the Locally Preferred Plan as proposed.

1 This project would raise the spillway 21 feet.
2 This would increase the lake's storage to over an additional
3 42,000 acre feet. It's estimated that with this the flood
4 protection benefit would increase for a 46 year event to
5 over a 60 year event. This would positively benefit the
6 residents of Tulare County. In addition to the increased
7 capacity, this capacity could be used for increased water
8 supply storage. This could benefit the agricultural
9 industry with increased irrigational water supply. This
10 could also benefit communities that rely on ground water for
11 their domestic water supply needs, in that there could be
12 available in increase of the water foreground water
13 recharge. Further, recreation could very well be a
14 beneficiary of this project because more water could be
15 impounded for longer periods of time.
16 In all, this project continues to address the
17 needs of flood protection and water supply storage. It also
18 promotes other incidental benefits. It, therefore, is a
19 project that actually addresses a wide range of interests,
20 and this particular type of project, because of this balance
21 and because of its effect, particularly with regard to flood
22 control, is a project that can easily be endorsed by the
23 Tulare County Flood Control District. Thank you.
24 MR. MCFARLAND: Thank you, Mr. Speer. Next, we
25 have representing Congressman Cal Dooley, Christina
26 Sundstrom.

1 MS. SUNDSTROM: Thank you. I would just like to
2 read a statement on behalf of the congressman who is unable
3 to be here with you tonight.
4 I strongly support the project to increase the
5 flood control and water storage capability of Lake Kaweah by
6 raising the spillway of Terminus Dam by 21 feet. This
7 simple modification will produce an additional 42,000 acre
8 feet of the badly needed water storage, thus allowing us to
9 make the best and economical use of the facility. Raising
10 and widening the spillway at Terminus Dam will ensure that
11 farmers have more secure water supplies and that the
12 residents of Visalia, Kings and Tulare Counties will have
13 greater securities against floods.
14 I support the Locally Preferred Plan for operating
15 the project because it will provide the greatest benefits
16 for the largest number of parties. It will benefit
17 recreational, fishery, and environmental uses by providing
18 12,000 acre feet of conditional storage for the life of the
19 project. The other alternative would provide only 7,000
20 acre feet that will spring in the future.
21 This project has been in the works for a long
22 time, too long. Studies by the Corps of Engineers began
23 many years ago, and local taxpayers have entrusted more than
24 one and a half million dollars in the feasibility study.
25 This hearing means that we are finally seeing
26 light at the end of the tunnel. Congress is now considering

1 legislation that could authorize construction of the
2 Terminus project but only if the Corps' review of the
3 feasibility study stays on schedule and is finished this
4 year. I urge the Corps to stay on schedule so this project
5 can get under way. It also is important that the Corps
6 begin preconstruction engineering and design of the project
7 during the current fiscal year.
8 Keeping the Terminus project moving forward is a
9 top priority for me and members of Congress from this
10 region. As a result, Congress will provide $1 million for
11 preconstruction work in fiscal 1997. That's $400,000 more
12 than requested by the Corps.
13 The Terminus Enlargement Project has my full and
14 active support and the full and active support of the
15 community. I urge the Corps to make this project a reality,
16 at least. Thank you.
17 MR. MCFARLAND: Thank you. Our next speaker is
18 from Hanford and the Kings County Water District, Don
19 Mills.
20 DON MILLS: Good evening. I'll make it brief.
21 Dennis, don't put the clock on me. My name is Don Mills and
22 I am president of the Board of Directors of the Kings County
23 Water District. I would like to enforce our support for the
24 Lake Kaweah Enlargement Project and the Locally Preferred
25 Plan.
26 We're an overdrafted ground water basin and any

1 increase in our water storage facility would be of great
2 benefit, but for our whole area with the increasing
3 population of our valley cities, we need to explore every
4 opportunity to wisely use the water resources that we have.
5 The additional flood control protection will benefit the
6 Kaweah/Saint Johns rivers flood plane and help protect the
7 periodic flooding that has occurred over the years.
8 The Locally Preferred Plan would increase the
9 recreational benefits for our local fisherman and boaters.
10 The recreation demands will increase with the lines of the
11 areas population.
12 In summary, the Enlargement Plan, that is the
13 Locally Preferred, seems to be a winning concept for all
14 concerned. Agricultural users will have increased storage
15 for all the water users. It will help to further minimize
16 pumping from the ground water basin. There will be longer
17 use of the great lake for recreation, increased flood
18 protection for both cities and farms. We strongly support
19 these concepts and this plan. Thank you.
20 MR. MCFARLAND: Thank you, Mr. Mills. Our next
21 speaker is from Lemon Cove, Roger Disinger, who is with the
22 Three Rivers-Lemon Cove Business Association.
23 MR. DISINGER: The Three Rivers-Lemon Cove group,
24 of which I am president, finds that we cannot support any of
25 the three options whole heartily. We find each of them to
26 be flawed and find it unfortunate the options are as limited

1 as they are. However, as one option must be selected, we
2 find the LPP, the Locally Preferred Plan to be the least
3 flawed.
4 Option one, to take no action results in the
5 continual filling of the lake bed with sediment so that
6 until the year 2000 or so, with undercurrent conditions
7 there will be no space for water in the wintertime. We find
8 this to be totally unacceptable. This will destroy the
9 fishery and winter recreation on the lake and have a
10 negative effect on Three Rivers-Lemon Cove business and
11 their residence.
12 Option two, the NED plan supported by the Corps
13 only delays the destruction of the fishery. It allows a
14 7,000 acre level of water at the inception of the project.
15 It allows to degrade with sediment over the lifetime of the
16 project, and as we've been told, the minimum level for
17 maintenance of the fishery is 7,000 acre feet, so
18 degradation would begin immediately. This option also
19 reduces summer recreation potential by inundating both rent
20 facilities, parking areas, campsites, and eliminates
21 recreational users.
22 In addition, it removes a primary motel in Three
23 Rivers along with several private residences. The effects
24 of the plan are heavily weighted to the water users to the
25 Tulare Lake bed users and provides a limited benefit to
26 flood control, as well. The Three Rivers-Lemon Cove area,

1 and the public at large, are net losers at a time of
2 increasing population and increasing recreation advance.
3 Option three also negatively impacts summer
4 recreation usage and the community in the same manner as
5 option two, the NED plan; however, the Water District and
6 other supporters support the LPP plan and it affords the
7 grace and promise of maintaining a stable and sufficient
8 level of water in the lake bed that would enable winter
9 recreation usage and the continuance of a healthy fishery.
10 We do, therefore, find this plan to be much more preferable
11 than the other two.
12 In the absence of our options, we believe at best
13 that the LPP plans should be selected. Sustaining winter
14 recreation usage and the fishery is a vital interest to our
15 local community, Three Rivers, Lemon Cove, and other parts
16 of the county at this time of year when business is at a low
17 and any business traffic is very much appreciated. Thank
18 you.
19 MR. MCFARLAND: Thank you. Our next speaker is
20 from the City of Visalia, councilman Evan Long.
21 EVAN LONG: Thank you. The City of Visalia
22 supports the project, especially the Locally Preferred
23 Plan. We do not support the No Project Alternative.
24 The city wants a balanced approach that takes into
25 account recreational concerns as well as irrigation water
26 benefits, but the primary concern is to provide Visalia with

1 increased flood protection above present levels. We concur
2 with the prior statement of Mr. Bruce George, manager of the
3 Visalia Water Conservation District. Thank you.
4 MR. MCFARLAND: Thank you, Mr. Long. Next, from
5 the Kaweah Lake Preservation Group, John Nikkel.
6 JOHN NIKKEL: N-i-k-k-e-l. The following are the
7 written comments of the Kaweah Lake Preservation Group on
8 the proposed project presented into public record at the
9 hearing by John Nikkel, president.
10 The Kaweah Lake Preservation Group represents
11 25,000 people in Tulare and Kings County interested in
12 preserving the fishery and recreation aspects of Kaweah
13 Lake. The goal of this group is to assure a water level for
14 Kaweah Lake that would prefer the fishery and recreation
15 uses of the lake for present and future generations.
16 We have reviewed all aspects of the draft
17 feasibility report, and based upon our understanding of the
18 study, we support the raising of the spillway and believe
19 that the LPP plan over the NED plan best meets the
20 recreational needs of this community. This letter will also
21 serve notice that an addendum will be filed by a qualified
22 recreation sponsor to recite the recreation facilities that
23 are not recited in the current study. Thank you.
24 MR. MCFARLAND: Thank you, Mr. Nikkel. Our next
25 speaker is representing Congressman George Radonovich,
26 Deborah Hurley.

1 MS. HURLEY: Good evening. It's a pleasure to be
2 here this evening on behalf of the Congressman to present
3 the following statement.
4 First, I wish to express my strong support for the
5 Lake Kaweah Enlargement Project, which would raise Terminus
6 Dam's existing spillway by 21 feet and widen it by 148 feet,
7 increasing its storage capacity by 42,600 acre feet. Toward
8 that end, I've been successful in obtaining funding through
9 the fiscal year 1996 for completion of the feasibility study
10 and preconstruction engineering and design work.
11 For fiscal year 1997, $1 million has been provided
12 by the House Appropriations Committee, $400 thousand dollars
13 above the Corps' budget request, in order to maintain an
14 optimum schedule for this work, as well as $680 thousand
15 dollars to excel rate completion of the ongoing sizemic
16 analysis.
17 Since it's completion in 1992, Terminus Dam has
18 done much to help control floods while providing storage and
19 control of irrigation water supplies. However, some
20 flooding problems continue to exist, placing in jeopardy the
21 communities of Visalia, Farmersville, Tulare, Ivanhoe, and
22 Goshen, as well as disrupting crop cycles on valuable farm
23 land located downstream from the dam. The enlargement
24 project would help to mitigate these problems, enhancing the
25 current 46 year level of flood protection to approximately a
26 60 to 70 year level, while expanding irrigation storage to

1 allow for more effective management of the area's precious
2 supply of surface water.
3 The Kaweah River Basin Investigation Feasibility
4 Study prepared by the US Army Corps of Engineers describes
5 three alternative plans. Alternative number one, No Action,
6 is clearly unacceptable. The Corps, as well as the local
7 sponsors, have demonstrated a need for action and
8 substantial taxpayer and sponsor funds have been expended.
9 Alternative two, the NED plan, the National
10 Economic Development Plan, while meeting the structural
11 specifications to gain the enhanced flood control and
12 irrigation storage capacity being sought, includes a water
13 control diagram and base and wetness perimeter considered
14 undesirable for recreation uses.
15 Alternative three, the LPP plan. I give my
16 support and recommendation for this operation under the
17 Locally Preferred Plan. Structurally identical to the NED
18 plan, the LPP provides similar flood control and other
19 benefits while providing substantially greater fishery
20 recreation and other environmental benefits. This plan was
21 developed by consensus and has the support of the local
22 sponsors as well as recreation interests.
23 Finally, I emphasize that it is imperative that
24 the Chief's report stay on course to be completed in 1996 in
25 order to meet the criteria for unconditional force in the
26 1996 Water Resources Development Act. Failure to meet this

1 deadline would result in great increased costs to the local
2 sponsors and the federal taxpayers and could jeopardize the
3 future of this important project, which has already
4 experienced several delays and cost overruns. Thank
5 you.
6 MR. MCFARLAND: Thank you. Next, representing the
7 Tulare County Sportsman's Counsel of California, Wild Life
8 Federation, Frank Price. Okay. Then we'll move on to the
9 California Department of Water Resources, Paula Landis.
10 PAULA LANDIS: Good evening. As Bruce George
11 mentioned, the Department of Water Resources has been a
12 participant in this feasibility study, and the state will
13 likely participate in the construction when that time
14 comes. I would like to address the Economic Development
15 Plan and Locally Preferred Plan for the proposed enlargement
16 of Lake Kaweah as described in the Corps of Engineers,
17 Kaweah River Basin Investigation Draft Feasibility Report.
18 The capital cost and the average annual cost are the same
19 for both. The differences between the two plans are the use
20 of conditional winter rain flood storage space and the
21 benefit to cost ratio. The NED has somewhat greater flood
22 benefits or the benefit is only slightly lower and is still
23 greater than one.
24 The department sees additional benefits offered by
25 the LPP. These benefits include significant increases in
26 the quality and quantity of fish and wild life as well as

recreational benefits. There's strong support for the LPP from the local sponsors and surrounding community, and for these reasons and based on the department's experience with the study, we recommend that the Corps actively pursue the LPP. We have committed comments to this effect in writing, and I thank you for addressing this group this evening.

MR. MCFARLAND: Well, we've had a number of folks who are representing someone else. Our next speaker has written down on the record card that he's representing himself and family, Brad Howard of Visalia.

BRAD HOWARD: Good evening. Most of the existing sites at Kaweah Lake experience heavy visitation every year, much over 500 and 70,000 annually. The demand for more recreation is expected to increase in the future with population growth. Population figures show that the population of our area is expected to double by the year 2020, but the proposed plan recreational facilities or visitation would be limited during peek season due to facility flooding. The estimated visitation loss that would occur are estimated at 75 percent during flooding events. The plans would all be destroyed. The fishery at Kaweah Lake experiencing low water levels would be detrimental.

My family and I have lived in Tulare County most of my life. I grew up one mile below Kaweah Lake and enjoyed the many things the lake has had to offer.

In my opinion, none of the proposed options are acceptable as written. Either we do nothing and our lake continues to fill with sedimentation and deteriorate or we increase the storage capacity at public expense for flood control and irrigation and do away with recreational facilities. I feel that this is a grave injustice to the people of the surrounding counties and municipalities. It is not too late to improve on this project. Since the counties and municipalities stand to lose a great deal of revenue due to the restoration, I feel that the leaders of the surrounding cities and counties should meet and put an action plan into writing to relocate and improve the recreation facilities at Lake Kaweah.

The increased storage project would also increase capacity for about 42,600 acre feet based on such an increase. There is no reason why a minimum agreeable pool that would enhance both recreation and the fishery. This project will be constructed at the primary expense of the people. It is not right, and it is not fair that the people and their needs be written out of this project. Thank you.

MR. MCFARLAND: Thank you Mr. Howard. Our next speaker, from Three Rivers, Darrel Hall. While Mr. Hall is making his way up here. Again, if any of you wish to speak and have not filled out these blue cards, you'll find them, I believe they're -- I see some over here. I believe they

1 are just sitting there on the counter. Please fill them out
2 and bring them up here to Dennis so we can work you in.
3 We're going through our list of speakers rather quickly. We
4 appreciate very much in keeping your remarks brief.
5 Mr. Hall.
6 DARREL HALL: Thank you. I really didn't think
7 I'd get a chance. I fought this dam. Maybe some of you
8 know years ago before it was built, and quite a few people
9 in Three Rivers were against it and of all the people that
10 were around at that time, I'm the only one left. So I feel
11 that I'm with the hostile audience tonight because everybody
12 here is judging the project on what the Corps of Engineers
13 has given in the workshop. I went to the workshop yesterday
14 and this gentlemen here took me all the way through it and I
15 thought it was very good -- that's just my cane -- and it's
16 the things that the Corps of Engineers don't tell you that
17 I'm interested in, and I think the people should know more
18 about it, what is going on.
19 When this thing -- when this thing became assured
20 in Congress many years ago, the Corps of Engineers placed
21 several people in Three Rivers to visit, to go to the
22 restaurants, to go to the meetings, to talk to people, and
23 tell them that there would be a beautiful lake in Three
24 Rivers with houses all around the shore, trees, everything,
25 and that kept Three Rivers for the lake.
26 Now, don't laugh at me because I probably know

more about this project than a lot of the men that are working on it today. This project is built for Tulare Lake, and Visalia flood protection is just an added little pickle to make it come forth.

Tulare Lake was taken up gradually, and the State Land Department has admitted this, but the State decided not to do anything about it. The people that took up Tulare Lake bottom, they run a furrow around their property to reclaim it, and then they went to the State Legislature and got their titles okayed. This is what makes it fraud. Now, Tulare Lake basin was originally the greatest wild fowl and game preserve in most of the United States. We ruined that. Kaweah Lake doesn't make up for any of it. There's no wild fowl in Tulare Lake. Tulare/Kaweah Lake is a mud hole, my friends. I go by it every week. It's a mud hole right in the middle of Three Rivers, and it will never be anything else but.

Now, another thing. When we passed the project for the dam, the Corps of Engineers built a spillway that could carry a hundred thousand acre feet, is that right? You should know. A hundred thousand acre feet. After the meeting was over, that meeting was here in Visalia, after the meeting was over I went up to one of the engineers and I said, "Tell me, why did you build a spillway in that lake to carry so many thousands of acre cubic feet?" "Well," he says, "We don't like to tell people about this because it

1 frightens them, but a design flood made by the Corps of
2 Engineers on the drainage basin above Three Rivers would
3 indicate that the dam could be full, and we could have a
4 hundred thousand acre foot flood running over the spillway,"
5 and where would that put Visalia? You might think about
6 this. It was built this way. Now, I knew you were going to
7 do this, but I understand.
8 MR. MCFARLAND: Well, we had agreed that everybody
9 would have five minutes, and we have a number of people who
10 are yet to speak, and so at this point in time, let me put
11 it to the audience here. Would you like Mr. Hall to
12 proceed? Would you grant him a couple more minutes? You
13 have two more minutes, and then we'll have to wind it up.
14 DARREL HALL: I knew this was going to happen
15 because they don't want these things out. Well, another
16 thing that is a reality is that the flood plane around
17 Woodlake shows layers of rocks, sand, boulders, and soil,
18 over and over again have come out of the Kaweah River Basin.
19 Had the Corps of Engineers told you any of these things?
20 You know, every year we break records, every
21 year. Last week they had the 4 inches of rain in Chicago,
22 and they called that a hundred-year flood, and the week
23 after they had fourteen inches. We called that a
24 five-hundred year flood. But these things are going to
25 repeat themselves, you know. These layers of rocks and
26 boulders and sand and dirt are not just one, but they

1 repeated over and over and over.
2 When this dam was put in, the people of Visalia,
3 the officials said, you folks in Three Rivers help us get
4 this dam, and we will help you get flood protection. I just
5 want you to know these things friends. These are things
6 that have gone on that you don't know anything about, but
7 they're worth thinking about.
8 One of these days that dam is not going to give
9 the protection that you are told it will give because it's
10 going to fill up with boulders. It's going to run over the
11 top. Just think of the Mississippi River a couple years
12 ago. The Corps of Engineers had built that river for
13 centuries, and what has happened to it? That's all I have
14 to say. Thank you very much for the opportunity.
15 MR. MCFARLAND: Thank you, Mr. Hall. Our next
16 speaker is from Woodlake, Del Strange.
17 DEL STRANGE: Good evening, ladies and gentlemen.
18 I live in the outskirts of the Woodlake area, and I'm very
19 concerned about the water resources of Tulare County. I'm
20 fully in support of the LPP plan as presented, however, I
21 have three comments to make regarding the Environmental
22 Impact Report.
23 The first comment has to do with sedimentation
24 buildup and dredging in the reservoir. The document
25 indicated that it's not cost effective and therefore was not
26 considered any further. However, I feel strongly that even

1 with the project going on through that this perpetual
2 problem of silt and sediment coming into the reservoir needs
3 to be addressed, otherwise, it will keep on filling up the
4 reservoir.
5 I believe that the materials are being used to the
6 benefit of the people of Tulare County and that there is a
7 long-term solution of mining or dredging so many thousand
8 acre feet or cubic yards of material each year.
9 I urge the Army Corps of Engineers, the Kaweah
10 Water Conservation District, and others to take a closer
11 look at that particular aspect and see if there isn't a way
12 to add that to the overall picture.
13 Second, the water quality issue. During the
14 construction of Horse Creek Bridge and the dam itself, the
15 spillway, one of the issues that was not addressed, is
16 servicing and refueling of the equipment to make sure that
17 there's full containment and that there's no spillage of
18 fuels or lubricants into the lake or into the creeks or the
19 soils. I suggest that this verbage be added to the document
20 that quote, servicing and refueling of all equipment shall
21 be done only inside of a containment structure, end of
22 quote. And this can be added on pages DEIS 44 dash 44 and
23 DEIS 4 dash 45.
24 Fuel and lubricant spillage is a common occurrence
25 at all construction sites. It's going to happen. It's just
26 a matter of time.

1 And the third and final comment has to do with
2 growth inducing impacts. This particular issue was not
3 addressed in the draft environmental impact statement.
4 Adding ground water to the basin by increasing the storage
5 and the reservoir having more surface water is going to
6 reduce pumpage and, therefore, increase ground water
7 storage.
8 Ground water and growth inducing factor. If
9 there's no ground water available for growth, growth will
10 stop. As long as more ground water is available, more
11 development will take place. I think this particular issue
12 should be addressed and the final EIR. Thank you for your
13 time.
14 MR. MCFARLAND: Thank you, Mr. Strange. Next,
15 representing Senator Jim Costa, Alfreda Sebasto.
16 MS. SEBASTO: Good evening. Thank you. I'd like
17 to read the brief statement on behalf of state Senator Jim
18 Costa. The Kaweah Delta Water Conservation District has
19 asked for my support of a Locally Preferred Plan over the
20 National Economic Development Plan for the Kaweah River
21 basin flood control project.
22 As the state senator representing lands in the
23 Kaweah drainage, I want you to know I fully endorse the
24 district's recommendations. Flood control, as well as
25 irrigation benefits, will be obtained through operation of
26 the Locally Preferred Plan. Greater fishery, recreation,

1 and other environmental benefits will also be released at
2 the plans modification.
3 The Locally Preferred Plan provides increased
4 storage capacity over the NED plan and also has the support
5 of the project sponsors and recreation interests. It is my
6 hope that preconstruction engineering design will begin this
7 fiscal year.
8 We will recognize the state must also try to make
9 scarce resources available for the project. I would like to
10 encourage the Corps of Engineers to expedite the project to
11 increase flood control capability and irrigation benefits
12 for the Kaweah River basin. Thank you for your
13 consideration of our request.
14 MR. MCFARLAND: Thank you. And right now, I want
15 to apologize in advance to our next speaker because I'm sure
16 I'm going to take great liberties with his name. From
17 Corsegold, representing the San Joaquin Paddling Club, Mike
18 Latendresse. Get up here and tell me how you really do it.
19 MR. LATENDRESSE: L-a-t-e-n-d-r-e-s-s-e. When I
20 was five years old my mom made me learn that. Mickey Mouse
21 saved my life. You know, I'm a member of the Kaweah
22 Rollers. It is a local white water club. I've been
23 boating the Kaweah River for fourteen years. I'm also a
24 member of the San Joaquin Paddler's Club. It's a little
25 more organized, not quite as many fun hogs, more people
26 interested in access issues.

1 My main concern, as members of those, is use of
2 holiday rapid, but a bigger concern really, as I'm listening
3 to all this and learning is, I'm a taxpayer, and I want to
4 make sure that my money gets spent properly, and it seems
5 like one of these, there's three plans, one of them that's
6 not getting much is dredging. I really think that this has
7 filled up once; it's going to fill up again.
8 Maybe right now cost effectiveness looks better
9 for raising the dam than dredging, but I think that's a
10 little bit due to slight of hand. Some things are really
11 sort of disappearing out there. Costs for certain things
12 such as recreation loss and stuff are included in this.
13 They have to be done by some other source of moneys, not
14 building this, so I'm concerned there.
15 Holiday Rapids itself, as far as white water
16 boaters go, they speak highly of that. It's one of the best
17 recreation rapids for entertainment, for boaters in the
18 state. It is truly fabulous, but those are little things.
19 I really think I'm speaking for the taxpayer. This is going
20 to fill up again. What do we do, build a dam higher next
21 time. I bet Three Rivers objects to that. Sometime or
22 another it's going to impact a little bit higher than a
23 rapid. It can't be built all the way to head waters. There
24 is no more water. I think this dredging should be explored.
25 It should become more efficient. I think the flood control
26 benefits, it has been working for, it's got a 46 year

1 lifetime. Now, it's been working quite well.
2 The flood damage that is happening, I think, is
3 coming in on Dry Creek and some of the other unregulated
4 streams that are coming in below the dam. That's where the
5 present damage is coming from. You make this dam more flood
6 control proof, doesn't matter. It's not happening any way,
7 so that I think is what is really, I think, the biggest
8 improvement and I hesitate to all improvements. It is going
9 to make more water available for some people. Some very few
10 people maybe. Some farmers out in the Tulare Lake basin, et
11 cetera.
12 I'd like them to pay more for it than me because
13 I'm not getting any benefit out of it. The homeowners
14 aren't getting any benefit out of it. I do get benefit, I
15 guess, I'm getting cheaper cotton. I'd like to pay more for
16 that cotton then. That's how I get cost benefits, et
17 cetera. I think that's all I want to say for now. Thank
18 you.
19 MR. MCFARLAND: Thank you. Our next speaker,
20 representing Tulare County supervisor, Bill Sanders.
21 BILL SANDERS: Thank you, very much. I'm Bill
22 Sanders, and I am the supervisor. District One, Lake Kaweah
23 is in my district, so I'm very aware of it, very conscious
24 of all the controversy. I'm pleased to see so many people
25 here tonight who are here expressing their appreciation for
26 the work done by Bruce George and all those involved in the

1 program, and on behalf of the Tulare County Board of
2 Supervisors, I would like to make a comment for the record
3 that we are in favor of the Locally Preferred Plan. The No
4 Action option is not an option for us as far as we are
5 concerned.
6 We've been involved in this thing for quite a
7 number of years. There's a lot of taxpayer money involved
8 in it, and from the comments I've heard tonight, I can tell
9 you that the Locally Preferred Plan will provide the best
10 options for all of us. There was a comment about
11 recreation. I'd like to tell you that as far as I'm
12 concerned if we can get this project built after going
13 through all the hurdles that we have gone through for the
14 last four years and more, I'm sure that we can also come
15 back and do something that will be beneficial for everybody
16 in the county, and I believe, again, that the Locally
17 Preferred Plan is the plan that benefits all of the people
18 of Tulare County, and on behalf of the Board of Supervisors,
19 we'd like to go on record supporting that. Thank you.
20 MR. MCFARLAND: Thank you. Todd Towsley from Etco
21 Marine will be our next speaker.
22 MR. TOWSLEY: It's Towsley. Okay. Good evening.
23 My family owns and operates Etco Marine, and for over 28
24 years our business has provided services to boating and
25 water support. After reviewing the Terminus Dam Feasibility
26 report preferred by the Corps, we want to give our support

1 to the Locally Preferred Plan and will be aggressively
2 confronting state and local officials to support the plan.
3 We will be contacting our customer base of over
4 6,000 families, informing them of this important issue and
5 encouraging them to support the LPP and what they can do to
6 support its completion.
7 Raising the spillway under the LPP will not only
8 provide better flood protection and irrigation for our
9 counties, but will provide new opportunities for the
10 recreational community, and I am looking forward,
11 personally, to working in Tulare county and the other local
12 interests in expanding those recreational opportunities.
13 Thank you.
14 MR. MCFARLAND: From Kings County, Supervisor Joe
15 Hammond.
16 JOE HAMMOND: Good evening. I happen to be a
17 member of the Kings County Board of Supervisors. I
18 represent District Two. I have with me tonight another
19 member of my Board, Brent Madill, representing District
20 Five. The other three board members were unable to attend
21 tonight; however, they are in full support.
22 We're here tonight to show the support of Kings
23 County for the Lake Kaweah Enlargement Project. We believe
24 very strongly that this project needs to be completed.
25 No Action is simply not acceptable. Many years of
26 study have taken place. My Board took action to begin this

1 process on March 22nd, 1973, when we wrote our first letter
2 to the department of 8383 to the Army Corps of Engineers in
3 Sacramento. Your response to us was on April the 22nd,
4 1983, indicating that funds were not available in the
5 budget. However, this was the beginning of this project.
6 For anyone to indicate to you that this project should not
7 proceed because they do not get exactly what they want is
8 irresponsible.
9 We believe that the Locally Preferred Plan can and
10 will afford the best of all proposals. It gives the
11 opportunity through an efficient operation plan to provide
12 the best flood control and improvment in environmental
13 resources, while increasing recreational opportunities and
14 providing larger water storage. This should be a win win
15 situation for everyone.
16 Kings County and its residents are very much in
17 favor of this project. We would like to strongly recommend
18 immediate completion of the feasibility and environmental
19 documents in order that the preconstruction and engineering
20 and design phases can begin in fiscal year 1996. Also, that
21 the Locally Preferred Plan be the criteria used; however,
22 please remember No Action is not satisfactory. Thank
23 you.
24 MR. MCFARLAND: Thank you, Mr. Hammond. Next,
25 from Corcoran, representing the Tulare Lake Basin Water
26 Storage District, Mark Gilkey.

1 MR. GILKEY: Good evening. My name is Mark
2 Gilkey. I'm the assistant manager of the Tulare Lake Basin
3 Water Storage District. The district makes up roughly a
4 hundred and ninety thousand acres in the Tulare Lake bed.
5 Our lands are situated in both Kings and Tulare counties.
6 Our local water supply primary sources is the Kings River.
7 We do get minor amounts from the Tule River. We are the
8 second largest agricultural water contractor for state
9 project water.
10 In brief, the Tulare Lake basin Water Storage
11 District supports the Locally Preferred Plan. The LPP
12 contained in the feasibility study concurs with the
13 statements or the statement presented by Mr. Bruce George on
14 behalf of the Kaweah Delta Water Conservation District.
15 Thank you.
16 MR. MCFARLAND: Thank you, Mark. Our next
17 speaker, representing the Kaweah Marina, will be Dale
18 Mehrten.
19 MR. MEHRTEN: I'm Dale Mehrten. I represent the
20 concession that we have here on Lake Kaweah and have been
21 here for the last 32 years. I was born in the lake bottom
22 and have lived very close and haven't moved very far. In my
23 work, I'm still in the lake and still have a marina there.
24 I went through many years of wind, rain and what
25 have you, and I think most everything that I have to say has
26 been said by the other people, that we need recreation on

1 Lake Kaweah. It's a must to keep it there, and I hope that
2 supervisor of Tulare County and the Water Kaweah Deli, Water
3 District and the City of Visalia comes together and makes
4 some satisfactory recommendation so that we can have
5 recreation there for the future, and I thank you.
6 MR. MCFARLAND: Thank you, Mr. Mehrten, and again,
7 I should tell you we are running down near the end of our
8 list of speakers. We appreciate you keeping your comments
9 short but this is kind of a last call.
10 If any of you do wish to speak and add your names
11 onto the list of speakers, please fill out a blue card and
12 bring it up here to the front so we can work you in before
13 we adjourn, and again, a reminder that if you do have any
14 questions, the members of the Corps of Engineers staff who
15 are present will be delighted to meet with you afterward and
16 answer any questions that you might have and provide any
17 additional information. I think there's still handout
18 material around. Let's continue with our list of speakers
19 right now, and here's another one. I better apologize for
20 in advance, Wesley Perineija, from Visalia representing the
21 Central Valley Bass Masters.
22 MR. PERINEIJA: Thank you, Mr. moderator. Ladies
23 and gentlemen, I didn't know if we'd ever see this day or
24 not, but it's here and we're on our way, thank God.
25 My name is Wesley Perineija, Jr., and for this
26 hearing I represent the Central Valley Bass Masters, an

1 organization of 50 tournament fisherman in Tulare County.
2 In essence we are also representing the interest
3 of several hundred bass fisherman in Tulare and Kings
4 County. Central Valley Bass Master are farmers, ranchers,
5 teachers, carpenters, dentists, government employees, and
6 many different occupations.
7 Central Valley Bass Masters supports the raising
8 of the spillway at Terminus Dam. We are for increased flood
9 protection, and we're for increased water for our area
10 farmers, ranchers. We are for stable supply of the water
11 throughout the year to protect our fishery for the benefit
12 of the entire community. For the past two years, we have
13 been participants in the efforts of the Kaweah Lake
14 Preservation Group to obtain a stable water supply for
15 Kaweah Lake Fishery. We have met with personnel
16 representing the Corps, water user organizations, county
17 supervisor, and congressman. We believe our request for
18 stable water supply for Kaweah Lake fishery be fair and
19 reasonable.
20 We've gone beyond our task and believe the sources
21 we have worked with will agree that our requests have been
22 very reasonable. We have prepared ourselves well in order
23 to understand all the complex issues facing all agencies
24 involved in management of Kaweah Lake water. We believe
25 that we have a good understanding of the information
26 contained in the draft feasibility report.

1 Therefore, the Central Valley Bass Master strongly
2 support the Locally Preferred Plan believe this plan better
3 serves the need of all the people in Tulare and Kings
4 County. Thank you.
5 MR. MCFARLAND: Thank you, Mr. Perineija. Our
6 next speaker representing the Audobon Society from Visalia,
7 Bard McAllister.
8 MR. MCALLISTER: Before I get started, would you
9 give me the privilege of a question to the audience? Well?
10 MR. MCFARLAND: Well, again, as we said at the
11 beginning this is not a question and answer --
12 MR. MCALLISTER: Well, this isn't that kind of a
13 question, and I want to know how many of the people that
14 are here tonight were in these discussions back in 1958.
15 MR. MCFARLAND: Well, that's a fair question.
16 MR. MCALLISTER: Can I see some hands. Were any
17 of you here, except Mr. Howard, in this area in 1950. Well,
18 there are a few people. Thank you very much.
19 There are a few people that have heard these
20 stories time and time again then. My comment is that I
21 don't believe we've come up with an adequate answer over all
22 of these years. To prevent floods I think the best way to
23 do it is to keep the water where it hits the ground, and in
24 the Tennessee valley area, they have succeeded in doing
25 that, not with their big dams but with small dams, and my
26 comment is that maybe we'll get a whole lot further if we

1 stop a minute and not rush into this to get the work started
2 in the coming year, but to really look at why our lake is
3 silting up as somebody said this afternoon.
4 It is not just silt. It gets to big boulders, and
5 it takes the storage space that we have, and nobody seems to
6 be willing to go to the cost of getting rid of the silt, and
7 I would ask the Corps of Engineers to look very, very
8 carefully at what it would cost to prevent floods in this
9 lake basin.
10 MR. MCFARLAND: Thank you, Mr. McAllister. Our
11 next speaker I'd like to call upon is representing this
12 evening the Lakeside Ditch Company R.L. Dick Schafer,
13 Mr. Schafer.
14 MR. SCHAFER: I am Dick Schafer. I'm here
15 representing the Lakeside Ditch Company. The Lakeside Ditch
16 Company has a service area of 55 thousand acres in Kings
17 County along Cross Creek. They have water rights on the
18 Kaweah River and storage in Terminus reservoir. I also live
19 in Visalia. I own property in Tulare County, and I'm deeply
20 concerned about flood protection, particularly on the Kaweah
21 River.
22 We have reviewed the Draft Feasibility Report for
23 the Kaweah River Basin and commend the Corps on a very fine
24 and detailed report. It provides a great deal of history
25 and a lot of background information that will provide all of
26 our libraries with excellent information.

1 I encourage all of you to obtain a report and
2 retain it for future reference. Good information since
3 Terminus Dam and reservoir under existing sedimentation and
4 current hydrology only affords a 1 in 46 year flood
5 protection.
6 The No Action Alternative is acceptable. We are
7 disappointed that the criteria did not result in a
8 hundred-year protection. Dams should provide a hundred-year
9 protection on a stream. There were gentleman here talking
10 about floods on the Kaweah. This gentlemen here talked
11 about Dry Creek. Yes, Dry Creek is a hazard. They looked
12 at Dry Creek carefully but the economics was not there. 23
13 thousand second feet is the flow that potentially can flow
14 down Dry Creek, but without the capability of holding the
15 flows of the Kaweah River in Terminus the flows, downstream
16 would be dramatic. Under existing conditions, we could
17 experience a 43 thousand second foot flow. That's the
18 current hydrology a hundred-year event. I can assure you
19 that that 43 thousand second foot flow would not reach
20 Tulare Lake. It would spread all over Visalia. In fact,
21 I've looked at the hydrology very carefully and to give you
22 an idea at the airport, the depth of the water would be 4
23 feet as it backs up against 99 highway. So the thought that
24 this is flood protection for Tulare Lake is ill conceived.
25 It's flood protection for all of us, right here.
26 We've reviewed both the National Economic

1 Development Plan and the Locally Preferred Plan and
2 recommend the selection, of course, of the Locally Preferred
3 Plan because as others have said, it is a balance. It
4 provides benefits for all. We like the idea of additional
5 irrigation storage, the carryover. The recreations have
6 longer term on utilization of the lake. One benefit that
7 has not been really identified, but we all understand, we
8 will have a dry year again, and to be able to carry over
9 water, irrigation water into next year as a result of having
10 that additional 12,000 acre feet is extremely important.
11 My only concern with the proposed project is the
12 cost. I was rather startled of that of the $38 million of
13 which $4 million is interest during construction. The
14 spillway modification, the construction cost, and the
15 spillway modification was only $14 million, yet the four
16 wild life facilities, 2.4 million. The mitigation cost for
17 the inundation of the repairean habitat that occurs only a
18 few months during three years of ten seems excessive. We
19 encourage the Corps to seriously review such costs as a part
20 of the final project development. We further encourage the
21 Corps continued support of federal funding for the
22 preconstruction engineering and design in 1997 and recommend
23 escalation of the schedule.
24 Three years is a long time to design such a simple
25 project. We believe that you could cut two years off the
26 total engineering and construction time and put the project

on line by the turn of the century. Thank you.

MR. MCFARLAND: Thank you Mr. Schafer. Our final speaker this evening is John Kirkpatrick of Visalia.

MR. KIRKPATRICK: Thank you. I've lost count of the number of times this evening that the transport and deposition of sediment behind the Terminus Dam has been mentioned. It has been suggested that the economic study as provided in the feasibility report is inadequate, and I would certainly add my section to that. I think we need to give much more attention to the possibility that not only is there a cost to removing sediment but there may also be a number of offsetting benefits that have not been considered. Thank you, very much.

MR. MCFARLAND: Well, ladies and gentlemen, that brings this to the end of our list of scheduled speakers. I do want to remind you that the Corps of Engineers staff personnel who are here will be delighted to speak with you. They're going to stick around after the meeting. They'll give you any information you may need, answer your questions. If you would like to submit written comments, they will be given every bit as much weight in this review process as the verbal testimony we've just heard, and the address is available at the table out here, and you have until August 27th to submit your written comments.

I just want to give you my thanks for making my job very easy. Your courtesy that you've extended to each

1 of the speakers and the fairness we've been able to conduct
2 these proceedings with, I think everybody appreciates and
3 because it, let's face it, there's nothing like a good
4 old-fashioned American town meeting to bring different
5 thoughts and opinions together, and that's the way it should
6 be, and with that, on behalf of the Corps of Engineers and
7 the Kaweah Delta Water Conservation District, thank you very
8 much for your attendance and participation and good night.
9 We stand adjourned.
10 (The proceedings concluded at 9:17 p.m.)
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26

STATE OF CALIFORNIA)
) ss.
COUNTY OF TULARE)

I, WENDY A. HANSE, C.S.R. 11176, do hereby certify that the within transcript contains a full, true, and correct transcript of my shorthand notes, and full, true, and correct transcript of the proceedings had in the matter and on the date as set forth on the first page hereof.

DATED: August 9, 1996. Visalia, California.

Wendy A. Hanse
WENDY A. HANSE
C.S.R. No. 11176