Feasibility Report Appendixes

December 1991

# American River Watershed Investigation, California

## VOLUME 1 – APPENDIXES A – E

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# American River Watershed Investigation, California

## FEASIBILITY REPORT

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# American River Watershed Investigation, California

# APPENDIX A

## Pertinent Correspondence

# CHAPTER I - INTERAGENCY COORDINATION PROGRAM

1. General. - To insure that the planning studies addressed all potential problems, the Corps maintained continuous coordination with local sponsors, agencies affected by the project, and agencies directly involved in project studies. Formal coordination included presentations at meetings of the Executive Committee. The most extensive coordination, however, was accomplished through the Study Management Team meetings. The Corps initiated these meetings in February 1988 to discuss study results by the various agencies involved. The meetings encouraged the interchange of ideas and discussion of problems, and provided an opportunity for participation in project planning by the City and County of Sacramento and agencies not otherwise directly involved in the studies.

2. Public Involvement. - The basic objectives of the program are to (1) obtain sufficient information from the broadest practical cross section of concerned citizens, groups, and governmental agencies to identify area problems, issues, needs, priorities, and preferences regarding water resources development, (2) promote full public understanding of the American River Watershed Investigation, and (3) develop a process of interaction and encourage the public to participate and become involved in the studies.

Three public hearings on the draft American River Watershed Investigation Report were held in May 1991. Transcripts of these hearings are available at the U.S. Army Engineer District, Sacramento offices.

3. Agency Involvement. - Representatives of the following Federal and State agencies and local governments have been involved in the Feasibility Study effort by coordinating with the Corps and reviewing Corps studies, attending various meetings, and exchanging extensive correspondence:

California Department of Fish and Game
California Department of Water Resources
The Reclamation Board (State of California)
U. S. Bureau of Reclamation
U. S. Environmental Protection Agency
U. S. Fish and Wildlife Service
County of El Dorado
County of Placer
County of Sacramento
County of Sutter
City of Sacramento
Office of Sacramento Flood Control Planning
American River Authority
Friends of the River
American River Flood Control District

4. Pertinent Correspondence. - Pertinent correspondence received or sent during the Feasibility Phase for the project follow as attachments to this appendix in chronological order. The letters are described in the Table of Contents.

5. Activities. - The following tabulation summarizes the most significant interagency coordination activities through December 1991. Coordination activities are also described at pertinent places in the main report of the Feasibility Study, in the EIS and in the various appendices.

6. Comments and responses. - Comments received addressed nearly every major aspect of the project and are included as a "Comment and Response" Appendix. All comments have been responded to collectively in the text of the main report.

TABLE A-1
INTERAGENCY COORDINATION MEETINGS

| Date | Activity |
|---|---|
| 5 Apr 89 | Informational meeting sponsored by the Greenhaven Homeowners' Association. |
| 18 Apr 89 | Meeting with DWR and State Reclamation Board to discuss proposed agenda for the Executive Committee. |
| 19 Apr 89 | Study Management Team Meeting. |
| 24 Apr 89 | Interview with KCRA's Roy Stearns. |
| 25 Apr 89 | Central Valley Task Force subcommittee created to discuss minimum flow requirements for the American River with the present storage and diversion facilities. |
| 25 Apr 89 | Visit to Department of Transportation, District 3 to discuss State requirements for relocating Highway 49. |
| 26 Apr 89 | Informational breakfast meeting sponsored by the Business and Labor Alliance. |
| 27 Apr 89 | Executive Committee Meeting. |
| 27 Apr 89 | Informational meeting sponsored by the Placer County Supervisors and Auburn City Council. |
| 18 May 89 | Study manager briefed a class at Hydrologic Engineering Center (HEC) on the flood problems in the Sacramento area. |
| 22 May 89 | Study manager presented the argument "Wet versus Dry" to the National Conference of the American Society of Civil Engineers. |
| 23 May 89 | Meeting with Planning and Community Development Department, County of Sacramento to discuss air quality impacts. |
| 5 Jun 89 | Meeting presentation for American River Authority, Auburn, California. |
| 7 Jun 89 | Meeting of Corps Office of Management and Budget with local sponsors and agencies. |
| 27 Jun 89 | Attended meeting of Yolo County Board of Supervisors on flood control concerns. |
| 28 Jun 89 | Study Management Team Meeting. |
| 13 Jul 89 | Meeting with Yolo County Supervisors about levee work on east side of Sacramento River. |
| 13 Jul 89 | Meeting with El Dorado County Planning staff to discuss the project. |
| 14 Jul 89 | Executive Committee Meeting. |
| 18 Jul 89 | Telephone Conversation with National Parks Service to comply with the Wild and Scenic Rivers Act. |
| 21 Jul 89 | Meeting with City of Sacramento staff to discuss cost-sharing recreation features. |
| 28 Jul 89 | Meeting with Department of Water Resources and Reclamation Board regarding CEQA coordination for EIS/EIR. |
| 2 Aug 89 | Meeting with Placer and El Dorado Counties to discuss relocation of Hwy. 49. |

TABLE A-1 Cont.
INTERAGENCY COORDINATION MEETINGS

| Date | Activity |
|---|---|
| 10 Aug 89 | Project presentation to the Sacramento County Interim Open Space Commission. |
| 14 Aug 89 | Executive Committee Meeting. |
| 17 Aug 89 | Coordination meeting with Fish and Wildlife Service. |
| 29 Aug 89 | Meeting with Sacramento County Parks and Recreation and Sacramento City Parks and Recreation to discuss recreation enhancement possibilities. |
| 30 Aug 89 | Study Management Team Meeting. |
| 1 Sep 89 | Project presentation at Auburn Dam Council Meeting, Roseville, California |
| 6 Sep 89 | Meeting with Central Valley Regional Water Control Board to discuss water quality analysis. |
| 11 Sep 89 | Sacramento Area Flood Control Studies Meeting between Environmental Protection Agency and Corps of Engineers. |
| 19 Sep 89 | Meeting with Bureau of Reclamation on risk of failure of Mormon Island Auxiliary Dam. |
| 21 Sep 89 | Recreation Planning Meeting with local agencies. |
| 21 Sep 89 | Coordination meeting with Department of Water Resources to discuss dam alternatives. |
| 25 Oct 89 | Study Management Team Meeting. |
| 26 Oct 89 | Executive Committee Meeting. |
| 13 Dec 89 | Study Management Team Meeting. |
| 20 Dec 89 | Meeting of Parties Active in Studies of the American River. |
| 20 Dec 89 | Telephone conversation with State of California Assembly, Office of Research on reducing cost of expandable dam. |
| 20 Dec 89 | Meeting sponsored by City of Sacramento to bring together agencies that are conducting water supply studies on lower American River. |
| 1 Jan 90 | Telephone conversation with Jennifer Jennings about environmental concerns. |
| 11 Jan 90 | Sacramento Area Flood Control Association (SAFCA) Meeting. |
| 11 Jan 90 | Telephone conversation with Sen. Doolittle's office about flood control alternatives. |
| 12 Jan 90 | Joint meeting of Placer County Board of Supervisors and Placer County Water Agency. |
| 17 Jan 90 | Meeting with Brown and Caldwell Engineering about Lower American River Urban Runoff Study. |
| 23 Jan 90 | Meeting with Reclamation Board and Department of Water Resources to discuss expandable dam alternatives. |
| 25 Jan 90 | SAFCA meeting. |
| 29 Jan 90 | SAFCA meeting. |

TABLE A-1 Cont.
INTERAGENCY COORDINATION MEETINGS

| Date | Activity |
|---|---|
| 31 Jan 90 | Telephone conversation with Fish and Wildlife Service on Coordination Act Report. |
| 2 Feb 90 | Telephone conversation with Jennifer Jennings, Planning and Conservation League, on expandable dam. |
| 5 Feb 90 | SAFCA meeting. |
| 6 Feb 90 | Meeting with Department of Water Resources to discuss expandable dam features and costs. |
| 7 Feb 90 | Telephone conversation with Bureau of Reclamation about the possibility that their Auburn Dam EIS could parallel our American River EIS. |
| 8 Feb 90 | SAFCA meeting. |
| 12 Feb 90 | Meeting with local sponsors to discuss expendability features of the dam and time schedule. |
| 14 Feb 90 | Telephone conversation with Bureau of Reclamation on Disposition of their lands at Auburn under "no Action" alternative. |
| 15 Feb 90 | Telephone conversation with County of Sacramento Parks and Recreation on the use of American River Parkway for environmental impact mitigation. |
| 15 Feb 90 | Briefing of Congressman Nowak of New York on Sacramento area projects. |
| 21 Feb 90 | Meeting with Department of Water Resources and Bureau of Reclamation about methodology in determining impacts to Central Valley Project yields. |
| 22 Feb 90 | Meeting with City and County agencies about recreational aspects of study. |
| 23 Feb 90 | Coordination meeting with Fish and Wildlife Service on environmental impacts. |
| 28 Feb 90 | Study Management Team Meeting. |
| 1 Mar 90 | Executive Committee Meeting. |
| 6 Mar 90 | Meeting with Department of Water Resources, Fish and Wildlife Service, and Department of Fish and Game on CEQA mitigation requirements. |
| 22 Apr 91 | Public Meeting ARWI, West Sacramento |
| 24 Apr 91 | Public Meeting ARWI, Auburn |
| 26 Apr 91 | Public Meeting ARWI, Woodland |
| 29 Apr 91 | Public Meeting ARWI, Sacramento |
| 30 Apr 91 | Public Meeting ARWI, Citrus Heights |
| 1 May 91 | Public Meeting ARWI, Sacramento |
| 2 May 91 | Public Meeting ARWI, Sacramento |
| 6 May 91 | Public Meeting ARWI, Sacramento |
| 7 May 91 | Public Meeting ARWI, Placerville |
| 8 May 91 | Public Meeting ARWI, Sacramento |
| 9 May 91 | Public Meeting ARWI, Sacramento |
| 9 May 91 | Study Management Team Meeting |
| 10 May 91 | Public Meeting ARWI, Sacramento |
| 11 May 91 | Public Meeting ARWI, Rio Linda |
| 13 May 91 | Public Meeting ARWI, Pleasant Grove |

TABLE A-1 Cont.
INTERAGENCY COORDINATION MEETINGS

| Date | Activity |
|---|---|
| 14 May 91 | Public Hearing ARWI, Sacramento |
| 16 May 91 | Public Hearing ARWI, Sacramento |
| 16 May 91 | Executive Committee Meeting |
| 22 May 91 | Public Hearing ARWI, Auburn |
| 17 Sep 91 | Study Management Team Meeting |
| 18 Sep 91 | Study Management Team Meeting |

TABLE A-2
INTERAGENCY COORDINATION CORRESPONDENCE


| Date | Activity | PAGE |
|---|---|---|
| 26 Jan 88 | Transmittal letter for Reconnaissance Study, American River Watershed Investigation. | 15 |
| 25 Feb 88 | Request from Assistant Secretary of the Army to forward review copy of the Reconnaissance Report to Office of Management and Budget. | 15 |
| 17 May 88 | OMB concurrence for start of Feasibility Study ARWI. | 16 |
| 31 May 88 | Secretary of Army approval for start of feasibility Study ARWI. | 16 |
| 8 Jun 88 | Office of Chief of Engineers approval for initiation of Feasibility Study for ARWI. | 17 |
| 17 Jun 88 | FCSA signed by the District Engineer, Director, Department of Water Resources, and President, California Reclamation Board. Witnessed by City of Sacramento, Counties of Sacramento, Placer, and Sutter, Reclamation District 1000, and American River Flood Control District. | 18 |
| 25 Jun 88 | Bureau of Reclamation's response to request by City and County of Sacramento to evaluate alternatives to provide at least 100-year level flood protection to the areas adjacent to the Lower American River and the estimated cost range. | 21 |
| 25 Aug 88 | Placer County Department of Public Works meeting of the Study Management Team and Work Order Request PD-88-01 that describes the Corps' efforts re: ARWI. | 22 |
| 28 Oct 88 | Assemblyman Tim Leslie's support of multipurpose Auburn Dam. | 23 |
| 6 Dec 88 | Proposal to California Department of Parks and Recreation to prepare a Programmatic Agreement (PA) to define cultural resources responsibilities for the American River Watershed Investigation. | 24 |
| 6 Dec 88 | Corps Notice of Initiation to Department of Parks and Recreation of a feasibility study along the lower American River. | 25 |
| 5 Jan 89 | Sutter County Board of Supervisors' appointment of Barbara LeVake as its representative on the Study Management Team. | 25 |
| 17 Jan 89 | Public Information Meeting and Scoping Workshops for ARWI, California, and Folsom Dam and Reservoir Reoperation Investigation, California. | 26 |
| 20 Jan 89 | DWR provide appropriate background material for the ARWI's Study Management Team to Supervisor Barbara LeVake. | 26 |
| 31 Jan 89 | Friends of the River response to Corps briefing of the flood control future of Sacramento. | 27 |

TABLE A-2
INTERAGENCY COORDINATION CORRESPONDENCE


| Date | Activity | PAGE |
|---|---|---|
| 1 Feb 89 | American River Flood Control District concerns on the Third Phase Sacramento River Bank Protection Project. | 28 |
| 7 Feb 89 | Corps and the Bureau of Reclamation's initiation of consultation with California to develop MOU to Advisory Council. | 28 |
| 10 Feb 89 | The Reclamation Board non-Federal sponsor of the feasibility phase of the Sacramento Metropolitan Area investigation. | 29 |
| 17 Feb 89 | EPA request for NEPA review of the DEIS for the ARWI. | 30 |
| 24 Feb 89 | Friends of the River comments on scoping proceedings ARWI. | 31 |
| 7 Mar 89 | DWR draft revision of the FCSA between The Reclamation Board and the Corps. | 32 |
| 17 Mar 89 | The Reclamation Board's concurrence with the need amend the FCSA for additional study funds. | 32 |
| 24 Apr 89 | Corps response to Friends of the River's input to the scoping process for the ARWI. | 33 |
| 24 Apr 89 | Corps request to U.S. Fish and Wildlife Service for a list of endangered and threatened species present in the ARWI project area. | 33 |
| 27 Apr 89 | Amendment to FCSA between the U.S. Government, The Reclamation Board, and the Department of Fish and Game for the ARWI. | 34 |
| 27 Jun 89 | Department of Transportation to Corps regarding traffic handling alternatives and related bridge alternative for construction of a flood control dam on the American River at Auburn. | 35 |
| 17 Jul 89 | Department of Fish and Game's willingness to review development of recreational facilities in conjunction with the ARWI, but no financial involvement. | 36 |
| 25 Jul 89 | Friends of the River's hope that the Bureau of Land Management will receive an appropriation in FY 90 to assess potential of establishing a National Recreation Area on the American River. | 37 |
| 31 Jul 89 | Department of Parks and Recreation clarification of its commitment to participate in the development of Federal recreation facilities in connection with the ARWI. | 38 |
| 4 Aug 89 | County of Sacramento (Parks and Recreation) interest in the phased development of a multipurpose trail parallel to the Garden Highway. | 39 |
| 7 Aug 89 | Placer County's support for the creation of recreation facilities in the ARWI area. | 39 |

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INTERAGENCY COORDINATION CORRESPONDENCE


| Date | Activity | PAGE |
|---|---|---|
| 7 Aug 89 | The Reclamation Board's Notice of Preparation of a draft EIR for the ARWI. | 40 |
| 5 Sep 89 | Resolution R-89-741 in support of a multipurpose Auburn Dam. | 41 |
| 5 Sep 89 | American River Flood Control District comments to the Notice of Preparation of draft EIR, ARWI. | 41 |
| 5 Sep 89 | San Joaquin County Department of Public Works to DWR expressing interest in contributing to the preparation of the Draft EIS, ARWI. | 41 |
| 28 Sep 89 | The Reclamation Board's adoption of Resolution No.89-14 clarifying the Board's position on flood protection for the greater Sacramento area. | 43 |
| 12 Dec 89 | Association of Sacramento County Water Districts support of a multipurpose Auburn Dam project. | 44 |
| 31 Jan 90 | Congressman Fazio's support of a multipurpose Auburn dam. | 45 |
| 8 Feb 90 | Sacramento Area Flood Control Agency Resolution No. 90-002 ARWI Project Consensus. | 227 |
| 30 Mar 90 | U.S. Fish and Wildlife Service revised estimates for funding needs during FY 1990. | 50 |
| 16 Apr 90 | U.S. Fish and Wildlife Service ARWI project information needs. | 50 |
| 16 Apr 90 | State Lands Commission - California's Public Trust Responsibilities in Water Allocation Decisions | 51 |
| 23 Apr 90 | Corps request for comments or supplemental information to the American River Coalition on draft Working Paper for the ARWI. | 53 |
| 30 Apr 90 | SAFCA 4d Feasibility Study Cost Increase for the American River Watershed Investigation. | 53 |
| 7 May 90 | Corps to DWR to explain the increase and requirement for a modification to the FCSA for the ARWI. | 55 |
| 7 May 90 | Corps to The Reclamation Board to explain the increase and requirement for a modification to the FCSA for the ARWI. | 56 |
| 10 May 90 | Yolo County Board of Supervisors proposed concept of utilizing the Yolo Bypass as a Federal/State-managed waterfowl refuge. | 57 |
| 11 May 90 | City of Sacramento to Corps comments on the April 1990 Draft Working Paper, ARWI. | 57 |
| 14 May 90 | DWR to Corps to provide a draft copy of the proposed amendment to the FCSA. | 58 |
| 21 May 90 | Sacramento District to South Pacific Division-Revision of Study Cost Estimate for the Northern California Streams, ARWI. | 59 |

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INTERAGENCY COORDINATION CORRESPONDENCE


| Date | Activity | PAGE |
|---|---|---|
| 29 May 90 | Placer County Department of Public Works comments on the ARWI Main Report. | 60 |
| 29 May 90 | U.S. Fish and Wildlife Service transmittal of acceptance copies increasing funding for the ARWI. | 61 |
| 21 Jun 90 | U.S. Department of Agriculture Farmland Conversion Impact Rating - ARWI project. | 61 |
| 26 Jun 90 | The Reclamation Board to Corps outlining its local sponsor responsibility for operations, maintenance, repair, replacement, and rehabilitation of the proposed Auburn flood control dam. | 62 |
| 27 Jun 90 | The Reclamation Board's draft financing plan for the ARWI project. | 63 |
| 6 Jul 90 | The Reclamation Board approved study cost increases for the ARWI. | 64 |
| 11 Jul 90 | The Reclamation Board draft letter of intent as a local sponsor for the flood control project of the American River Watershed Investigation. | 64 |
| 16 Jul 90 | Congressman Fazio's joint (with Cong.Matsui) letter sent to SAFCA regarding feasibility and desirability of establishing a National Recreation Area at the Auburn Dam site. | 65 |
| 24 Jul 90 | U.S. Fish and Wildlife Service intent to work with the Corps in mitigation, restoration, and enhancement for the American River Project. | 66 |
| 24 Jul 90 | SAFCA to American River Coalition debate on design and construction of the expandable features of the flood control dam. | 67 |
| 26 Jul 90 | Placer County Department of Public Works to Caltrans District 3 regarding recommendation for the relocation of Highway 49 connecting the existing high level bridge over the North Fork American River to the Community of Cool. | 69 |
| 27 Jul 90 | Corp's review of Bureau of Land Management draft report on the American River National Recreation Area Feasibility Study. | 70 |
| 13 Aug 90 | National Wildlife Federation key concerns on flood damage reduction. | 71 |
| 14 Aug 90 | U.S. Fish and Wildlife Service itemized list of anticipated tasks and funding needs for additional work on the ARWI. | 86 |

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| Date | Activity | PAGE |
|---|---|---|
| 17 Aug 90 | DWR requesting additional information regarding the design and construction of Corps proposed roller compacted concrete alternate. | 87 |
| 17 Aug 90 | Department of Transportation District 3 to Placer County Department of Public Works analysis on the proposed relocation of Highway 49. | 87 |
| 20 Aug 90 | U.S. Fish and Wildlife Service to Corps to develop and acceptable mitigation plan for the ARWI project. | 88 |
| 27 Aug 90 | Corps to the State Reclamation Board identifying information needed from the State to revise and complete draft Feasibility Report and EIS for ARWI. | 91 |
| 26 Sep 90 | Placer County Water Agency Resolution No. 90-37 revising Resolution No 90-4 relating to Auburn Dam. | 92 |
| 16 Nov 90 | Corps to Department of Interior transmitting issue paper regarding the proposed flood control project for the American River. | 93 |
| 28 Nov 90 | HQS USACE Feasibility Review Conference. | 94 |
| 21 Dec 90 | U.S. Environmental Protection Agency to HQS USACE comments on the draft ARWI Project Guidance Memorandum (PGM) and Issue Paper. | 98 |
| 10 Jan 91 | HQS USACE to South Pacific Division confirming requirement for emergency low level outlet gates on the flood control dam. | 99 |
| 22 Jan 91 | California Transportation Commission to DWR regarding relocation of Route 49. | 100 |
| 23 Mar 91 | EPA summary of issues regarding ARWI study. | 101 |
| 4 Apr 91 | HQS USACE to National Wildlife Federation Evaluation of the Environmental Defense Fund Critique of the Flood Control Analysis for the American River. | 108 |
| 5 Apr 91 | ARWI Draft Feasibility Report and EIS/EIR available to public for review in local libraries. | 115 |
| 5 Apr 91 | ARWI Draft Feasibility Report and EIS/EIR forwarded to South Pacific Division and EPA for filing. | 115 |
| 5 Apr 91 | Corps and The Reclamation Board's notice TO ALL INTERESTED PARTIES for review and comment on the draft Feasibility Report and joint EIS/EIR for ARWI. | 116 |
| 22 Apr 91 | U.S. Department of Transportation (Coast Guard) review of draft Feasibility Report and EIS for the ARWI. | 117 |
| 10 May 91 | The Reclamation Board to the City of Sacramento draft proposal of Amendment II to the State/Local cost sharing agreement for the ARWI. | 117 |

TABLE A-2
INTERAGENCY COORDINATION CORRESPONDENCE


| Date | Activity | PAGE |
|---|---|---|
| 21 May 91 | Reclamation District No. 1001 to Corps expressing concerns that changes outlined in draft Feasibility Report should not discriminate or jeopardize facilities and/or level of protection afforded landowners within RD 1001. | 118 |
| 28 May 91 | Placer County Board of Supervisors opposition to Corps' proposal of dry dam in ARWI Feasibility Report. | 118 |
| 28 May 91 | FEMA to SAFCA requesting a description of the steps that the SAFCA would take to ensure that adequate progress is made toward completion of the necessary levee restoration and raising and reauthorization of Folsom Reservoir for additional flood storage. | 119 |
| 29 May 91 | HQ USACE analysis of EPA comments on the ARWI regarding the relationship between the 404(b)(1) Guidelines and the Principles and Guidelines. | 120 |
| 31 May 91 | SAFCA's recommendation of 200-year flood control dam near Auburn. | 122 |
| 3 Jun 91 | U.S. Department of Commerce comments on the Feasibility Report and DEIS. | 123 |
| 6 Jun 91 | State of California (DFG) Memorandum to Annalena Bronson providing review of draft ARWI SCH 89080710 for El Dorado, Sacramento, Sutter, Placer, and Yolo Counties. | 124 |
| 11 Jun 91 | Neumiller & Beardslee, Attorneys and Counselors, Special Counsel to the Board of Supervisors of San Joaquin County comments on Part II of the ARWI DEIS. | 126 |
| 11 Jun 91 | El Dorado County Board of Supervisors' comment on the draft American River Watershed Investigation. | 131 |
| 11 Jun 91 | Department of Health and Human Services comment on Draft EIS for potential adverse impacts on human health on behalf of the U.S. Public Health Service. | 132 |
| 12 Jun 91 | City of Sacramento to SAFCA expressing support of SAFCA's effort at obtaining a 200-year or greater level of protection while minimizing political and environmental oppositions against the project. | 133 |
| 12 Jun 91 | Sacramento Metropolitan Water Authority comments on the ARWI draft Feasibility Report Parts I and II. | 136 |
| 12 Jun 91 | Placer County Water Agency to Corps opposition to the "flood control only" project. | 138 |
| 13 Jun 91 | El Dorado County to comments on the American River Watershed Investigation Draft EIS/EIR. | 139 |

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INTERAGENCY COORDINATION CORRESPONDENCE

| Date | Activity | PAGE |
|---|---|---|
| 13 Jun 91 | State Lands Commission review comments on draft Feasibility Report EIS/EIR ARWI. | 146 |
| 13 Jun 91 | EPA detailed comments on Draft Feasibility Report. | 148 |
| 14 Jun 91 | State Water Resources Control Board recommendations on draft Feasibility Report EIS/EIR for the ARWI. | 179 |
| 14 Jun 91 | Environmental Defense Fund comments on the Corps' analysis of flood risk to Sacramento area and alternative options for reducing/avoiding potential damage to the area resulting from flooding. | 181 |
| 14 Jun 91 | The Resources Agency coordinated review comments on the draft Feasibility Report and EIS/EIR ARWI project. | 186 |
| 21 Jun 91 | U.S. Department of the Interior review comments on ARWI draft EIS/EIR; concerns that no environmentally acceptable alternatives are presented. | 190 |
| 24 Jun 91 | SAFCA's Resolution Nos. 91-008 and 91-011 approved recommendations regarding the components which should be included in the overall plan for flood protection along the American River. | 200 |
| 28 Jun 91 | The Reclamation Board's adoption of Resolution No. 91-10 in support of high levels of flood protection and consideration of a locally preferred plan the ARWI Feasibility Report. | 204 |
| 12 Jul 91 | Congressmen Fazio and Matsui to Dr. Dickey, DA, Civil Works concerns on the criticisms from Federal agencies and the State of California regarding Corps draft Feasibility Study and EIS for ARWI. | 207 |
| 30 Jul 91 | Corps to Advisory Council on Historic Preservation review draft Programmatic Agreement. | 209 |
| 20 Aug 91 | County of Sacramento to Corps letter of intent as the non-Federal sponsor for the recreation facility development portion of the Natomas East Main Drain flood control project. | 209 |
| 28 Aug 91 | South Pacific Division concurrence to Sacramento District's request that an exception be granted for deviating from the NED Plan. | 210 |
| 23 Sep 91 | City of Sacramento to Corps letter of intent as the non-Federal sponsor for the development of the recreation portion of the Natomas East Main Drain flood control project. | 210 |

TABLE A-2
INTERAGENCY COORDINATION CORRESPONDENCE


| Date | Activity | PAGE |
|---|---|---|
| 26 Sep 91 | HQS USACE to South Pacific Division - review and consideration of request to deviate from NED plan. | 211 |
| 27 Sep 91 | County of Sacramento to Corps to endorse the participation of the Dept of Parks and Recreation as the non-Federal sponsor for the Natomas East Main Drain Flood Control Project (recreation element). | 211 |
| 4 Oct 91 | The Reclamation Board intent to be joint sponsors (with SAFCA) for the ARWI project. | 212 |
| 22 Nov 91 | Supplemental Biological Assessment on threatened valley elderberry longhorn beetle (VELB) in ARWI. | 213 |
| 27 Nov 91 | Fish and Wildlife Service to Corps request for consultation pursuant to Section 7 of the Endangered Species Act. | 217 |
| 29 Nov 91 | U.S. Fish and Wildlife Service transmittal of detailed report and substantiating reports on the effects that proposed flood control alternatives for the ARWI would have on the fish and wildlife resources. | 221 |
| 5 Dec 91 | Corps to U.S. Fish and Wildlife Service clarifying issues in the Biological Opinion and Coordination Act Report. | 222 |
| 13 Dec 9 | U.S. Fish and Wildlife Service to Corps outlining mitigation requirements and recommendations pursuant to the Endangered Species Act of 1973, as amended, and the Fish and Wildlife Coordination Act. | 223 |
| 16 Dec 91 | The Reclamation Board and SAFCA letter of intent to be the non-Federal sponsors for the ARWI flood control project. | 224 |
| 16 Dec 91 | Advisory Council on Historic Preservation to Corps Programmatic Agreement regarding the implementation of the American River Watershed Project. | 225 |

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO CALIFORNIA 95814-4794

REPLY TO ATTENTION OF
CESPK-PD-S (1105-2-10a)

26 January 1988

MEMORANDUM FOR: Commander, South Pacific Division

SUBJECT: American River Watershed Investigation, California, Reconnaissance Report

1. Reference:

a. CESPD-PD-P multiple letter dated 15 April 1987, Subject: SPD Feasibility Study Program Management Milestone System,

b. EC 1105-2-168 (Procedures for Two-Phase Planning).

2. In accordance to the referenced direction, enclosed for your review and approval are 15 copies of the subject report. Also, five copies are being sent to both DAEN-CWP and BERH for concurrent review. This submittal is in partial fulfillment of Milestone R5.

3. The currently estimated total feasibility phase study cost is $2.5 million. We anticipate that the State of California Department of Water Resources and The Reclamation Board will be the non-Federal sponsors. Representatives of each have informally indicated their willingness to provide a letter of intent to sign a Feasibility Cost Sharing Agreement (FCSA). The FCSA with accompanying letter of intent will be submitted in the near future (within the 3-month period following the original Milestone R5 date of 4 January 1988).

4. The report summarizes studies of alternative measures and plans for flood control in the American River Watershed, principally along the lower American River and the Natomas area of Sacramento. Several plans, each of which would provide a minimum 200-year level of protection, have been identified and coordinated with the anticipated non-Federal sponsors for feasibility studies. For mainstem American River, the plans include construction of a single-purpose dam and reservoir or creation of space for flood control in a new multiple-purpose dam and reservoir upstream from Folsom Lake. For the Natomas area, the plans include construction of a gated/pump structure at the mouth of the Natomas Cross Canal and/or channel and levee improvements around the Natomas area.

Encl (15 cys)

WAYNE J. SCHOLL
Colonel, CE
Commanding

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DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

25 FEB 1988

MEMORANDUM FOR THE DIRECTOR OF CIVIL WORKS

SUBJECT: American River, Sacramento, California

The Office of Management and Budget (OMB) has requested an opportunity to review the Reconnaissance Report on the American River, California. Accordingly, when you receive the report from the field, please furnish this office a copy so that any coordination between Army and OMB can occur concurrently with the Office of the Chief of Engineers's certification process.

Robert W. Page
Assistant Secretary of the Army
(Civil Works)

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

MAY 27 1998

Honorable Robert W. Page, Sr.
Assistant Secretary of
the Army (Civil Works)
Room 2E570 - Pentagon
Washington, D.C. 20310-0103

Dear Mr. Page:

Thank you for sending us a review copy of the Army Corps of Engineers reconnaissance report of the American River Watershed, California. We do not object to the initiation of the feasibility phase of planning. However, the treatment of the "sunk costs" associated with the Auburn Dam site will require attention in the next phase.

For plan formulation purposes, the Principles and Guidelines for project planning indicate that these sunk costs should be excluded from the evaluation of alternative plans. This is so stated in the report, but Summary Display 16 appears inconsistent with this principle.

Following selection of the recommended plan, a cost allocation is routinely prepared in order to assess the proper non-Federal cost sharing. At that time, a determination of the appropriate amount of the sunk costs that should be included in this financial analysis will have to be made.

Sincerely,

Robert K. Dawson
Associate Director
for Natural Resources,
Energy and Science

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310

31 MAY 1998

MEMORANDUM FOR THE DIRECTOR OF CIVIL WORKS

SUBJECT: American River Reconnaissance Report

This office has no objection to proceeding to the feasibility phase of the subject study. The enclosed letter from the Office of Management and Budget (OMB) highlights the need to clarify in the feasibility phase how the Corps proposes to treat sunk costs associated with the Auburn Dam site. I concur in OMB's observation.

Robert W. Page
Assistant Secretary of the Army
(Civil Works)

Enclosure

CECW-B

3 JUN 1993

MEMORANDUM FOR: Commander, South Pacific Division, ATTN: CESPD-PD

SUBJECT: American River Watershed Investigation, California; Feasibility Cost Sharing Agreement (FCSA) - Reconnaissance Phase

The subject reconnaissance report, including the negotiated FCSA and letter of intent from the local sponsor have been reviewed as requested and are certified to be in accordance with current policy and priorities. Comments provided by CWR are attached for your information and should be appropriately addressed during the feasibility phase. Upon receipt of the signed Feasibility Cost Sharing Agreement in HQUSACE (ATTN: CECW-P) and a request for funds to initiate the feasibility phase to HQUSACE (ATTN: CECW-B) funds will be released.

FOR THE COMMANDER:

/s/
James B. Davidson
for: DAN M. MAULDIN
Chief, Planning Division
Directorate of Civil Works

Attachments

CF:
CESPK-PD

Best Available Copy

FEASIBILITY COST SHARING AGREEMENT
BETWEEN
THE UNITED STATES OF AMERICA
AND
THE CALIFORNIA STATE RECLAMATION BOARD
AND
*THE CALIFORNIA DEPARTMENT OF WATER RESOURCES*
FOR THE AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

THIS AGREEMENT, entered into this 17 day, of JUNE, 1988, by and between the United States of America (hereinafter called the "GOVERNMENT"), represented by the Contracting Officer executing this Agreement, and the CALIFORNIA DEPARTMENT OF WATER RESOURCES AND THE RECLAMATION BOARD FOR THE STATE OF CALIFORNIA (hereinafter called the "Sponsors").

WITNESSETH, that

WHEREAS, the Congress has authorized the Corps of Engineers to conduct a study of Northern California Streams pursuant to the Flood Control Act of 1962 (Public Law 87-874, dated October 23, 1962) Title 2, Section 209 and supplemented by the 1987 Appropriations Act; and

WHEREAS, the Corps of Engineers has conducted a reconnaissance study of alternative means of providing flood control for the American River Watershed, predicated on the assumption that an Auburn Dam as previously authorized will not be constructed, and has determined that further study in the nature of a "Feasibility Phase Study" (hereinafter called the "Study") for the American River Watershed is required to fulfill the intent of the study authority and to complete the determination of the extent of the Federal interest in a flood control project along the river and in the Natomas area; and

WHEREAS, the Sponsors have the authority and capability to furnish the cooperation hereinafter set forth and are willing to participate in study cost sharing and financing in accordance with the terms of this agreement; and

WHEREAS, the Sponsors and the Government both understand that entering into this agreement in no way obligates either party to implement a project and that whether a project is supported for authorization and budgeted for implementation depends upon the outcome of this feasibility study and whether the proposed solution is consistent with the Principles and Guidelines and with the budget priorities of the Administration and that at the present time, favorable budget priority is being assigned to projects providing primarily commercial navigation and flood or storm damage reduction outputs; and

WHEREAS, THE Water Resources Development Act of 1986 (P.L. 99-662) specifies the cost sharing requirements applicable to the study;

NOW THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS

For the purposes of this Agreement:

a. The term "Study Cost" shall mean all disbursements by the Government pursuant to this Agreement, whether from Federal appropriations or from funds made available to the Government by the Sponsors, and all Negotiated Costs of work performed by the Sponsors pursuant to this Agreement. Such costs shall include, but not be limited to: labor charges; direct costs; overhead expenses; supervision and administration costs; and contracts with third parties, including termination or suspension charges; and any termination or suspension costs (ordinarily defined as those costs necessary to terminate ongoing contracts or obligations and to properly safeguard the work already accomplished) associated with this Agreement.

b. The term "Study Period" shall mean the time period for conducting the Study, commencing with the issuance of initial Federal feasibility funds following the execution of this Agreement, and ending when the report is submitted to the Office of Management and Budget (OMB) by the Assistant Secretary of the Army for Civil Works (ASA(CW)) for review of consistency with the policies and programs of the President.

c. The term "Negotiated Cost" is the fixed fee for a work item to be accomplished by the Sponsors as in-kind services as specified in the Scope of Studies Incorporated herein and which is acceptable to both parties.

ARTICLE II - OBLIGATIONS OF PARTIES

a. The Sponsors and the Government, using funds contributed by the Sponsors and appropriated by the Congress, shall expeditiously prosecute and complete the Study, currently estimated to be completed in 40 months from the date of this Agreement, substantially in compliance with Article III herein and in conformity with applicable Federal laws and regulations, the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, and mutually acceptable standards of engineering practice.

b. The Government and the Sponsors shall each contribute, in cash and in-kind services, fifty (50) percent of all Study Costs, which total cost is currently estimated to be $2,500,000, as specified in Article IV herein; provided, that the Sponsors may, consistent with applicable Federal statutes and regulations, contribute up to 25 percent of the Study Costs as in-kind services; provided further, the Government shall not obligate any cash contribution by the Sponsors toward Study Costs until such cash contribution has actually been made available to it by the Sponsors.

c. The award of any contract with a third party for services in furtherance of this Agreement which obligates Federal appropriations shall be exclusively within the control of the Government. The award of any contract by the Sponsors with a third party for services in furtherance of this Agreement which obligates funds of the Sponsors and does not obligate Federal appropriations shall be exclusively within the control of the Sponsors, but shall be subject to applicable Federal statutes and regulations.

d. The Government and the Sponsors shall each endeavor to assign the necessary resources to provide for the prompt and proper execution of the Study and shall, within the limits of law and regulation, conduct the study with maximum flexibility as directed by the Executive Committee as established by Article V, herein.

e. The Government will not continue with the Study if it determines that there is no solution in which there is a Federal interest or which is not in accord with current policies and budget priorities unless the Sponsors wishes to continue under the terms of this Agreement and the Department of Army grants an exception. If a study is discontinued, it shall be concluded according to Article XII and all data and information shall be made available to both parties.

f. The Sponsors may wish to conclude the Study if they determine that there is no solution in which they have an interest or which is not in accord with their current policies and budget priorities. When such a case exists the study shall be concluded according to Article XII and all data and information shall be made available to both parties.

ARTICLE III - SCOPE OF STUDIES

Appendix A, the Scope of Studies, is hereby incorporated into this Agreement. The parties to this Agreement shall substantially comply with the Scope of Studies in prosecuting work on the Study. The following modifications, to be approved by the Executive Committee, shall require an amendment to this Agreement:

a. any modification which increases the total Study Cost (see Appendix A, table 1);

b. any modification in the estimated cost of a Study work item or of any obligation for a Study work item, which changes the total cost of that work item by more than 15 percent (see Appendix A, Table 1);

c. any extension of the completion schedule for a Study work item of more than thirty (30) days (see Appendix A, Table 2);

d. any reassignment of work items between the Sponsors and the Government (see Appendix A).



ARTICLE IV - METHOD OF PAYMENT

a. The Government shall endeavor to obtain during each fiscal year the appropriation for that fiscal year at least in the amounts specified in the Scope of Studies incorporated herein. Subject to the enactment of Federal appropriations and the allotment of funds to the Contracting Officer, the Government shall then fund the Study at least in the amounts specified in the Scope of Studies herein.

b. The Sponsors shall endeavor to obtain during each Government fiscal year the cash contribution for that Government fiscal year at least in the amounts specified in the Scope of Studies incorporated herein and, once it has obtained funds for a cash contribution, shall make such funds available to the Government. The Government shall withdraw and disburse funds made available by the Sponsors subject to the provisions of this Agreement.

c. Funds made available by the Sponsors to the Government and not disbursed by the Government within a Government fiscal year shall be carried over and applied to the cash contribution for the succeeding Government fiscal year; provided, that upon study termination any excess cash contribution shall be reimbursed to the Sponsors after a final accounting, subject to the availability of appropriations, as specified in Article XII herein.

d. Should either party fail to obtain funds sufficient to make obligations or cash contributions or to incur Study Costs in accordance with the schedule included in the Scope of Studies incorporated herein, it shall at once notify the Executive Committee established under Article V herein. The Executive Committee shall determine if the Agreement should be amended, suspended, or terminated under Article XII herein.

ARTICLE V - MANAGEMENT AND COORDINATION

a. Overall study management shall be the responsibility of an Executive Committee consisting of the District Engineer for the Sacramento District Corps of Engineers; Director for the California Department of Water Resources; President of The Reclamation Board and Chief of the Planning Division for the Sacramento District Corps of Engineers. Representatives from the Sponsor's cost sharing partners (Sacramento, Sutter, and Placer Counties; the City of Sacramento; Reclamation District 1000; and the American River Flood Control District) are exofficio, non-voting members of the Executive Committee.

b. To provide for consistent and effective communication and prosecution of the items in the Scope of Studies, the Executive Committee shall appoint representatives to serve on a Study Management Team.

c. The Study Management Team will coordinate on all matters relating to prosecution of the Study and compliance with this Agreement, including cost estimates, schedules, prosecution of work elements, financial transactions and recommendations to the Executive Committee for termination, suspension, or amendment of this Agreement.

d. The Study Management Team will prepare periodic reports on the progress of all work items for the Executive Committee.

ARTICLE VI - DISPUTES

a. The Study Management Team shall endeavor in good faith to negotiate the resolution of conflicts. Any dispute arising under this Agreement which is not disposed of by mutual consent shall be referred to the Executive Committee. The Executive Committee shall resolve such conflicts or determine a mutually agreeable process for reaching resolution or for termination under Article XII herein.

b. Pending final decision of a dispute hereunder, or pending suspension or termination of this Agreement under Article XII herein, the parties hereto shall proceed diligently with the performance of this Agreement.

ARTICLE VII - MAINTENANCE OF RECORDS

The Government and the Sponsors shall keep books, records, documents and other evidence pertaining to study costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total Study costs. The Government and the Sponsors shall maintain such books, records, documents and other evidence for inspection and audit by authorized representatives of the parties to this Agreement. Such material shall remain available for review for a period of three (3) years following the termination of this Agreement.

ARTICLE VIII - RELATIONSHIP OF PARTIES

a. The parties to this Agreement act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

b. To the extent permitted by applicable law, any reports, documents, data, findings, conclusions, or recommendations pertaining to the Study shall not be released outside the Executive Committee or the Study Management Team; nor shall they be represented as presenting the views of either party unless both Parties shall indicate agreement thereto in writing.

ARTICLE IX - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or other elected official, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE X - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the local Sponsors agrees to comply with all applicable Federal and state laws and regulations, including section 601 of Title VI of the Civil Right Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.11 issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, 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."

ARTICLE XI - COVENANT AGAINST CONTINGENT FEES

The local Sponsors warrant that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bonafide employees or bona fide established commercial or selling agencies maintained by the local Sponsors for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

ARTICLE XII - TERMINATION OR SUSPENSION

a. This Agreement shall terminate at the completion of the Study Period; provided, that prior to such time and upon thirty (30) days written notice, either party may terminate or suspend this Agreement without penalty.

b. Within ninety (90) days upon termination of this Agreement the Study Management Team shall prepare a final accounting of Study Costs, which shall display disbursements by the Government of Federal funds, cash contributions by the Sponsors, and credits for the Negotiated Costs of the Sponsors. Subject to the availability of funds, within thirty (30) days thereafter the Government shall reimburse the Sponsors for the excess, if any, of cash contributions and credits given over fifty (50) percent of total Study Costs. Within thirty (30) days thereafter, the Sponsors shall provide the Government any cash contributions required so that the total Sponsors share equals fifty (50) percent of total Study Costs.

United States Department of the Interior

BUREAU OF RECLAMATION
MID PACIFIC REGIONAL OFFICE
2800 COTTAGE WAY
SACRAMENTO, CALIFORNIA 95825-1898

IN REPLY
REFER TO MP-720
520.

JUN 15 1988

Mr. Melvin H. Johnson
Director of Public Works
City of Sacramento
915 I Street, Room 207
Sacramento, CA 95814

Mr. Douglas Fraleigh
Director of Public Works
Sacramento County
827 Seventh Street, Room 304
Sacramento, CA 95814

Gentlemen:

This responds to your joint letter of May 16, 1988 requesting that the Bureau of Reclamation study and evaluate alternatives that would give areas adjacent to the Lower American River at least 100-year level flood protection as required by the Federal Emergency Authority (FEMA). We have scoped out the necessary work items and have estimated the time and costs involved to study the identified alternatives and determined the related impacts for the alternatives you requested us to evaluate.

Following the execution of an appropriate Memorandum of Agreement, we estimate that approximately 3 months would be required to complete the necessary work items with an estimated cost ranging from $65,000 to $70,000. These costs would include pertinent evaluations associated with providing the additional interim flood control storage at Folsom Reservoir along with obtaining feasibility cost estimates for two options for rebuilding the Auburn cofferdam.

If the estimated cost range is appropriate, we would appreciate receiving your concurrence to proceed with the study evaluations. We would be pleased to further work with the staffs of both Sacramento City and County to prepare a Memorandum of Agreement. Please contact Mr. Jim Denny (978-4967) of my staff to further discuss the study aspects and to initiate the preparation of a Memorandum of Agreement.

Sincerely,

DAVID G. HOUSTON
REGIONAL DIRECTOR

cc: Colonel Wayne D. Scholl, District Engineer
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

PLACER COUNTY

DEPARTMENT OF PUBLIC WORKS

JACK WARREN Director
JAN WITTER Assistant Director
LARRY ODDO Deputy Director
ALAN ROY Deputy Director

OPERATING DIVISION
Administration
Engineering
Building Maintenance
Road Maintenance
Solid Waste
Surveying
Transit Service

August 25, 1988

Merritt Rice
U.S. Army Corps. of Engineers
Sacramento District
650 Capitol Mall
Sacramento, CA 95814-4794

Subject: AMERICAN RIVER WATERSHED STUDY/WORK REQUEST PD 88-01

Dear Merritt,

Reference is made to the meeting of the Study Management Team of August 24, 1988, and to Work Order Request PD 88-01 that describes the direction of the Corps' efforts underway at this time.

I am concerned about the omission of the minimum pool concept since it was included and, specifically, identified in a reconnaissance report and has a lot of significance for Placer County. I am requesting that the work order be modified to address the minimum pool, and that it be done at no additional cost to the local agencies since it was previously included in your scope of work.

I am also interested in reconsideration of the assumed 400,000 acre feet of flood control space in Folsom Lake, and suggest that 300,000 acre feet be used, as suggested by the Bureau of Reclamation.

In regard to the Highway 49 crossing of the American River, please be advised that on August 11, 1988 Placer County appeared before the CTC and submitted a recommendation that relocation of Highway 49 over the River be included in the State's Transportation Improvement Plan, and that the route utilize the existing high bridge over the north fork, and that a new high level bridge be constructed over



the south fork connecting Auburn Foresthill Road to Highway 49 near the community of Cool.

We have done some preliminary estimates for this highway relocation and have arrived at a rough cost of $100 million. This particular route has been endorsed by a local Citizens Advisory Committee, the Placer County Transportation Commission, and the Board of Supervisors.

I look forward to discussing these issues with you at the next meeting of the Study Management Team on October 19, 1988, at 9:00 a.m.

Very truly yours,

COUNTY OF PLACER
DEPARTMENT OF PUBLIC WORKS

JACK WARREN, DIRECTOR

JW/gh

cc: Board of Supervisors
Don Lunsford
Rich Gresham
Jan Witter
Alan Roy
Larry Oddo

STATE CAPITOL
P.O. BOX 942849
SACRAMENTO CA 94249-0005
(916) 445-8435

DISTRICT OFFICE
1000 MILLER LANE, SUITE 101
ROSEVILLE CA 95678
(916) 783-3600
(916) 783-3600
(916) 924-0100

ADVISORY PANELS
STATE ADVISORY COUNCIL
ON ECONOMIC DEVELOPMENT

# Assembly
# California Legislature

COMMITTEES
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HUMAN SERVICES
SELECT COMMITTEE ON YOUTH
& DRUG ABUSE PREVENTION

MEMBER
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JUDICIARY
PUBLIC SAFETY
SELECT COMMITTEE ON NEIGHBORHOOD
VIOLENCE & PREVENTION
JOINT SELECT TASK FORCE
ON THE CHANGING FAMILY
ASSEMBLY HIGH TECHNOLOGY
CAUCUS
LEGISLATIVE WOMEN'S CAUCUS

TIM LESLIE
ASSEMBLYMAN FIFTH DISTRICT

October 28, 1988

Mr. Gordon Van Vleck, Secretary
Resources Agency
1416 9th Street, Room 1311
Sacramento, CA 95814

Dear Gordon:

The construction of a multi-purpose Auburn Dam is at a critical juncture. The American River Authority has approved a proposal to raise $700 million to share the water storage and hydroelectric generating costs of the Auburn Dam's construction. This proposal has resulted in renewed interest by federal, state and local agencies in the completion of the dam. A "dry dam" is not a viable, cost-effective alternative, especially now that strong financial support exists for a multi-purpose dam that will pay for itself. Therefore, I am requesting your immediate assistance in delivering this important message to our elected officials.

In a span of three short years, Northern California has been devastated by the harsh extremes of drought and flood. We know construction of the multi-purpose dam at Auburn would have ensured a balance between adequate water supplies in drought conditions, and protecting our homes and property from excessive rains like those of 1986.

A single-purpose "dry dam" provides only one benefit -- flood control. The cost of a single-purpose dam would be borne by the taxpayers, but it could never deliver any financial return on our investment. On the other hand, a multi-purpose dam provides not only flood protection, but generates revenue with the sale of water and clean hydroelectric power. Folsom Dam originally cost $90 million; to date it has returned over $300 million to the taxpayers from water and electricity revenues.





A multi-purpose dam that will store surface water and generate clean hydroelectric power is essential to meet the needs of the population projected for our area before the turn of the century -- only 11 short years from now. Without the Auburn Dam, the quality of life in our area may rapidly deteriorate as we fail to meet the demand of a growing population. In addition, the wildlife and fisheries along the American River and in the Delta may suffer irreparable damage.

A multi-purpose Auburn Dam is essential to the future of our quality of life. All city, county, state and federal elected officials in our area must make construction of the multi-purpose dam a priority. If we work together, the Auburn Dam will be built. Your support in this effort is imperative.

Sincerely,

TIM LESLIE
Assemblyman, Fifth District

December 6, 1988

Environmental Resources Branch

Mr. William Monaghan
Regional Director
California Department of Parks & Recreation
Inland Region
Post Office Box 1450
Lodi, California 95241-1450

Dear Mr. Monaghan:

We have initiated a feasibility study of providing additional flood protection to areas along the lower American River by modifying the flood control operation at Folsom Dam and Reservoir. The objective is to provide interim flood protection during the period that a more comprehensive flood control project is being developed. The modified operation could result in reserving as much as 100,000 additional acre feet of storage space for control of flood waters in the winter months — 400,000 acre feet are now reserved. Major emphasis of the study will be on the identification of the water supply, hydropower, recreation, environmental (including archeological), social, and financial impacts of such a change in the project operation.

Federal historic preservation laws and regulations require that we address the potential impacts to cultural resources, i.e. prehistoric and/or historic sites, which may be affected by any of our undertakings. In order to meet our responsibilities in this area, we will need to know which archeological sites would possibly be impacted by our activity, the current status or condition of such sites, and which, if any, sites are eligible for the National Register of Historic Places.

Please furnish our Planning Archeologist, Ms. Sandie Osborn, with copies of any applicable documents pertaining to the cultural resources at Folsom Reservoir which might assist us in completing our compliance activities. These would include but not be limited to maps showing site locations, site records, reports prepared by previous investigators, assessment of inundation impacts, evidences of vandalism or destruction due to exposure, and management recommendations. In addition, any recent written and photographic records of sites currently exposed by the lowered reservoir pool would be of particular value. All site locational information will be kept strictly confidential in accordance with federal and state procedures for safeguarding such data.

In addition, we will be contacting you about recreation resource impacts and others of interest to you in the near future.

Thank you for your assistance. Please feel free to contact Ms. Osborn at (916) 551-1855 if you have any questions.

Sincerely,

Jack A. La Coyer
Colonel, Corps of Engineers
District Engineer

December 6 1988

Environmental Resources Branch

Ms. Kathryn Gualtieri
State Historic Preservation Officer
California Department of Parks & Recreation
Post Office Box 942896
Sacramento, California 94296-0001

Dear Ms. Gualtieri:

As discussed previously with Dr. Hans Kreutzburg of your office, we propose to prepare a Programmatic Agreement (PA) to define our cultural resources responsibilities for the American River Watershed Investigation. An Auburn Dam alternative and flood control measures in the Natomas area are being investigated. We hope to provide the public with a signed PA in the Draft Environmental Impact Statement which is currently scheduled for circulation in the Spring of 1990. In order to facilitate our internal review and approval process it is necessary to complete the majority of all project related text and coordination by the Fall of 1989.

To assist us in developing this document, we have obtained the services of Dr. Brit Storey, formerly of the Advisory Council on Historical Preservation and now with the Bureau of Reclamation in Denver, Colorado. Dr. Storey has indicated that he would be available to meet in Sacramento either the week of January 23, January 30, or February 13, 1989. We would like to arrange his visit to correspond with your schedule so that your office can most conveniently contribute to the process of drafting the compliance document. In addition to Dr. Storey, two of our District archeologists, Ms. Sannie Osborn and Ms. Patti Johnson, and Dr. James Wear from the Sacramento Office of the Bureau of Reclamation, will be involved in the document preparation.

Please contact Ms. Osborn of this office at (916) 551-1655 for additional information and to advise us of your availability.

Sincerely,

Walter Yep
Chief, Planning Division

Dr. James West, Regional Archeologist, Bureau of Reclamation, Mid-Pacific Region, 2800 Cottage Way, Sacramento, CA 05925
Advisory Council on Historic Preservation, Western Division of Project Review 730 Simms Street, Suite 450, Golden, Colorado 80401

A-25

# BOARD OF SUPERVISORS
## COUNTY OF SUTTER

SUTTER COUNTY OFFICE BLDG
YUBA CITY, CALIFORNIA 95991

463 SECOND STREET
(916) 741-7156

January 5, 1989

American River Watershed
Study Management Team
3251 S Street, Room 110
Sacramento, CA 95816

Gentlemen/Mesdames:

Please be advised that the Sutter County Board of Supervisors at its regular meeting of January 3, 1989, appointed Barbara LeVake as its representative on the Study Management Team. Supervisor LeVake is the newly elected Fifth District Supervisor, replacing the former Supervisor of that district, Robert Gallagher. Her district will be most significantly impacted by the decisions of the Study Management Team, and she, therefore, is the appropriate choice for representing Sutter County's interests. Your organization is very important to Sutter County and we are very interested in its operations.

Please provide Supervisor LeVake with appropriate background material and recent information. Information should be addressed to:

Supervisor Barbara LeVake
Sutter County Administration Building
463 Second Street
Yuba City, CA 95991

I believe you will find Supervisor LeVake to be very perceptive, conscientious, and a real asset to the Executive Committee.

Very truly yours,

Joseph A. Benatar
Chairman
Sutter County
Board of Supervisors

MEMBERS OF THE BOARD

| | | |
|---|---|---|
| LARRY MONTNA | DISTRICT 1 | COUNTY ADMINISTRATOR |
| JOE BENATAR | DISTRICT 2 | LARRY T. COMES |
| TOM PFEIFER | DISTRICT 3 | |
| RON SOUTHARD | DISTRICT 4 | CLERK OF THE BOARD |
| BARBARA LeVAKE | DISTRICT 5 | LORNA SMITH |

REGULAR MEETINGS ARE HELD TUESDAY OF EACH WEEK

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO CALIFORNIA 95814-4706

REPLY TO ATTENTION OF

January 17, 1989

Environmental Resources Branch

TO ALL INTERESTED PARTIES

PUBLIC INFORMATION MEETINGS AND SCOPING WORKSHOPS FOR AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA AND FOLSOM DAM AND RESERVOIR REOPERATION INVESTIGATION, CALIFORNIA

The Corps of Engineers, in conjunction with the California Department of Water Resources and The Reclamation Board, is conducting a study for the purpose of identifying feasible methods of increasing the level of flood protection to the lower American River and Natomas areas of the Sacramento metropolitan area. The study is examining various flood control dams below the confluence of the North and Middle Forks of the American River near the town of Auburn. In the Natomas area, the study will investigate modification of the present levee and channel system, construction of various cross levees, and pumping plants. This study is being performed under the authority of the American River Watershed Investigation.

The Corps of Engineers is also conducting a separate study of interim measures to increase flood protection in the short-term until a permanent solution can the implemented. These alternative measures would specifically include examining the reoperation of Folsom Reservoir in order to increase the level of flood protection to downstream areas adjacent to the lower American River.

An environmental impact statement (EIS) will be prepared for each study. In order to identify all potentially significant social and environmental impacts, the Corps will conduct a series of public information meetings. All agencies, organizations, and individuals interested in the projects are invited to participate in the scoping process.

The first three meetings will be public information meetings to define the problems and describe the range of alternative plans to increase flood protection. Questions and comments will be welcome. The public information meetings will be followed by two scoping workshops for the specific purpose of obtaining your concerns and questions.



STATE OF CALIFORNIA — THE RESOURCES AGENCY — GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF WATER RESOURCES
CENTRAL DISTRICT
3251 S STREET
SACRAMENTO
95816-7017

JAN 20 1989

Supervisor Barbara LeVake
Sutter County Administrator's Building
463 Second Street
Yuba City, CA 95991

Dear Supervisor LeVake:

We have received Chairman Benatar's letter of January 5, 1989 requesting that we provide you with appropriate background material for the American River Watershed Investigation's Study Management Team.

Attached are copies of the following:

- Cost sharing agreement between the United States Army Corps of Engineers, the California State Reclamation Board and the California Department of Water Resources.
- Cost sharing agreement between the State and local agencies.
- Information Paper "American River Watershed, California" November 1987.

The Corps' Reconnaissance Report, "American River Watershed Investigation, California", dated January 1988 is currently out of print. A second printing will be available in about six weeks and a copy will be sent to you when it is available.

If you desire a briefing or further information please contact Merritt Rice, Chief, American River Basin Branch of the U. S. Army Corps of Engineers at (916) 551-1244 or me at (916) 322-6230.

Sincerely,

Original Signed By
Hal Higgins

Hal Higgins, Acting Chief
Central District

Best Available Copy



FRIENDS
OF THE
RIVER

January 31, 1989

Colonel Jack LeCuyer
Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel LeCuyer:

We appreciated your briefing on the Corps' plans and perceptions of the flood control future of Sacramento. Providing for the high level of protection sought for this area will ultimately require community consensus and the willingness to spend significant resources.

We want to reiterate on several points. One is that it is flood control which is the community concern about which the Army Corps has expertise. We believe that focusing on water supply questions should remain out of the scope of what the Corps seeks to accomplish. Another federal agency can provide its own level of expertise on the question of water and power supply. For the Corps to do so as well only adds to the level of community controversy.

We noted with regret the lack of emphasis (or even attention, perhaps) to alternatives for providing flood protection utilizing improvements along the Lower American and by lowering the spillway at Folsom Dam. In order for this community to make an informed decision, complete information is needed about the level of protection and the accurate environmental cost of levee improvements in the lower river and at Folsom. To proceed without making that information available puts us all at risk of further delays. If the lower river improvements are really as onerous as you seem to believe, upstream structures will become only more desirable.

While we are not completely satisfied with the Corps' direction, we have been pleased to work with your staff, particularly Walter Yep and Rick Meredith. While your entire staff has been accessible and helpful, the interactions we have had with Walter and Rick have been uniformly positive and constructive.

909 12th Street, Suite 207 • Sacramento, CA 95814 (916) 442-3155 • S.F. Office: Fort Mason Center, Building C, San Francisco, CA 94123 (415) 771-0646



We hope that you will keep us informed of plans you even [illegible] problems you encounter when we can be of assistance. We believe it is increasingly important that environmental concerns be heard and we hope to be able to communicate freely and openly with you and your staff.

Sincerely,

Fran Cooley

Fran Cooley, Ph.D.
Conservation Director

cc: Congressman Vic Fazio
Congressman Bob Matsui
Charles Washburn, Mother Lode Chapter, Sierra Club
Jerry Meral, Planning and Conservation League

AMERICAN RIVER FLOOD CONTROL DISTRICT

2390 VENTURE OAKS WAY, SACRAMENTO, CALIFORNIA 95833

(916) 925-5550

February 1, 1989

Col. Jack A. LeCuyer
U.S. Army Corps of Engineers
Sacramento District
Environmental Resources Branch
650 Capitol Mall
[illegible], California 95814-4794

Attention: Mr. Mike Welch

Dear Col. LeCuyer:

I am writing on behalf of the American River Flood Control District concerning the "Third Phase - Sacramento River Bank Protection Project". We wish to call to the attention of the Corps of Engineers [illegible] to evaluate the stability and condition of the south bank of the American River in the vicinity of the River Park neighborhood in the City of Sacramento. The bank area in question would lie generally between the "H" Street bridge and the Business 80 highway bridge. This bank area has [illegible] exhibited an excessive tendency toward erosion during high flows. The erosion mechanism generally has been to undercut trees on the bank area which then fall in to the river leaving large holes at the toe of the bank. Subsequent high flow erosion has, on at least three prior occasions, caused significant damage either to the bank or the bank and levees.

There is at present no specific location exhibiting any obvious [illegible] of bank erosion or potential bank erosion. However, the general condition of the bank and levee along this entire reach should be reviewed by the Corps as a part of their Third Phase Bank Protection Project to determine whether or not there is likely to be significant bank erosion requiring repair or rehabilitation over the next several years.

On behalf of the District, I would like to express my appreciation for your consideration of this potential problem area as the bank protection project proceeds. If there are any questions regarding this item or if Corps staff wishes to review this area in the field with American River Flood Control District personnel please call me at 925-5550.

Sincerely,

Ronald W. Smith

Ronald W. Smith
Assistant District Engineer

A-28

February 7, 1989

Environmental Resources Branch

Mr. Robert Fink
Director, Western Office of Project Review
Advisory Council on Historic Preservation
730 Simms Street, Suite 401
Golden, Colorado 80401

This is to inform you that the Corps of Engineers has been directed to undertake the American River Watershed Investigation on California in order to determine means of protecting the Sacramento Metropolitan area from flooding. This undertaking may result in the Corps or the Bureau of Reclamation being directed to undertake work which may affect historic properties.

The Corps and the Bureau of Reclamation, in consultation with the California State Historic preservation Officer (SHPO), have determined that resulting work may affect historic properties eligible for inclusion in the National Register of Historic Places. In accordance with 36 CFR 800.5(e), this is to notify you that the Corps and the Bureau of Reclamation are initiating consultation with the California SHPO with the objective of development of a Memorandum of Agreement for submission to the Advisory Council for review and acceptance.

If there are any questions, please contact Ms. Sunnie Osborn at the above address or by telephone at (916) 551-1856.

Sincerely,

Walter Yep
Chief, Planning Division

Copies furnished:

Ms. Kathryn Gualtiere, State Historic Preservation Officer, Department of Parks and Recreation, Post Office Box 942896, Sacramento, California 94296-0001

Dr. G. James West, Regional Archeologist, Bureau of Reclamation, 2800 CottageSALLADAY Way, Sacramento, California 95825

STATE OF CALIFORNIA, RESOURCES AGENCY — GEORGE DEUKMEJIAN, Governor

THE RECLAMATION BOARD
1416 Ninth Street, Room 455-6
Sacramento, CA 95814
(916) 445-9454

February 10, 1989

Colonel Jack A. Le Cuyer
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel Le Cuyer:

This is to inform you that The Reclamation Board intends to be the nonfederal sponsor of the feasibility phase of the Sacramento Metropolitan Area investigation.

The Reclamation Board also concurs with and approves of the transfer of a portion of the study area into the feasibility phase of the American River Watershed Investigation. In meetings between members of our staff and the Corps of Engineers, Corps personnel indicated that flood control alternatives (evaluated in the reconnaissance study) involving modifications to the Fremont Weir and Yolo Bypass near the weir would primarily benefit the Natomas area. These alternatives could influence the scope of alternatives developed in the American River Watershed investigation to achieve higher levels of flood protection for Natomas. In particular, work at the Fremont Weir could potentially reduce the extent of, or, possibly the need for a gated structure and pumping facility at the mouth of the Natomas Cross Canal, bridge replacements and modifications on the Natomas Cross Canal and Pleasant Grove Creek Canal, and levee raising on the Sacramento River downstream of the Natomas Cross Canal. Since local entities that would benefit most from these alternatives, particularly the City and County of Sacramento and Reclamation District 1000, are already providing funds toward the feasibility phase of the American River Watershed Investigation, we feel it is appropriate to make this transfer. We also understand that the transfer of a portion of the study area to the American River Watershed Investigation could increase the costs of that feasibility study and involve other local interests.

In the remaining Sacramento Metropolitan study area, local interests have expressed a reluctance to be involved in a regional solution that includes a dry dam or multi-purpose facility at or near the Auburn Dam site. These interests have agreed to provide funds to the Sacramento Metropolitan



feasibility study based on the transfer of this study area. The alternatives that would remain in the Sacramento Metropolitan Area Investigation and in which the Board, the City of West Sacramento, and Reclamation Districts 900, 537 and 811 are interested in pursuing include levee improvements for the West Sacramento area and modifications to the Sacramento Weir and Bypass. The Yolo County Flood Control and Water Conservation District is also interested in participating as a local agency. They are concerned with the west levees of the Yolo Bypass and particularly those levees creating the Willow Slough Bypass, which is an integral feature of the District's comprehensive drainage program. In addition, it is understood that the Corps will continue to evaluate the levee system for the south Sacramento area, although there appears to be ample freeboard for major flood events based on current hydrologic information.

The preliminary cost estimate for the modified Sacramento Metropolitan Area feasibility study provided by the Corps, is about $300,000. The Board realizes that this is only an estimated cost that will be further defined in the Scope of Study. As nonfederal sponsor, the Board intends to be responsible for providing 50 percent of the feasibility study cost which will be outlined in the Feasibility Cost Sharing Agreement, and will coordinate with the Corps and interested local agencies to meet that requirement.

For further information concerning the project, please call Ray Barsch, General Manager, at (916) 445-9454.

Sincerely,

WALLACE McCORMACK
President

cc: (See attached list.)

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IX
215 Fremont Street
San Francisco, Ca 94105

Colonel Jack Le Cuyer
District Engineer
Sacramento District
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

11 FEB 1989

Dear Colonel Le Cuyer:

The Environmental Protection Agency (EPA) has received the Notice of Intent to Prepare a Draft Environmental Impact Statement for the project entitled American River Watershed Investigation, California.

Our NEPA review is based on the Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500-1508). Our detailed comments are enclosed for your consideration.

We appreciate the opportunity to comment on the proposed project and request that four copies of the Draft Environmental Impact Statement (DEIS) be sent to this office at the same time it is filed with our Washington, D.C. office. We also request notification of any meeting(s) to be held regarding this project so EPA may provide timely assistance as needed. If you have any questions, please contact Mr. Tim Vendlinski, (415) 974-7763 (FTS 454-7763) or Ms. Laura Fujii (415) 974-7539, (FTS 454-7539).

Sincerely yours,

Jacqueline Wyland, Chief
Office of Federal Activities

Enclosure (7 pages)

FRIENDS
OF THE
RIVER

February 24, 1989

Colonel Jack LeCuyer
Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Comments: Scoping proceedings
American River Watershed Study

Dear Colonel LeCuyer:

Friends of the River has an acute interest and concern about flood control for Sacramento. We have been participating in Watershed Management Team meetings since their onset and find that there are several issues which are not receiving adequate consideration.

First, as indicated in our January 31, 1989 letter, the Army Corps' jurisdiction and expertise in this local area extends to flood control. Therefore, assumption of responsibility for water and power supply options is, and should remain, outside the scope of what the Corps seeks to accomplish. Another federal agency can provide its own level of expertise on the question of water and power supply. For the Corps to do so as well only adds to the level of community controversy.

Of greatest significance to us is the issue of flood control alternatives. Our opposition to the Auburn Dam issue has always centered on the unnecessary destruction of many miles of the North and Middle Forks of the American River (and subsequently of the Lower American River because of the stimulus for completion of the Folsom South Canal). While providing adequate flood protection for Sacramento is a goal we sincerely share, we are very much aware that there are a number of alternatives which do not involve the destruction of river miles. Any permanent inundation of the American River canyons is unacceptable to us.

Environmentally responsible flood control solutions are available. We believe it is the Army Corps' responsibility to assure that, to the greatest extent possible, the environmental costs of any flood control project are minimized.

With regard to alternatives, we have noted with regret the lack of attention to alternatives for providing flood protection utilizing improvements along the Lower American and by lowering the spillway at Folsom Dam. In order for this community to make an informed decision, complete information is needed about the level of protection and the accurate environmental cost of levee improvements in the lower river and at Folsom. To proceed without making that information available puts us all at risk of further delays. If the lower river improvements are really as onerous as you seem to believe, upstream structures will become only more desirable.

[illegible]





Focusing on the high level of protection (200 years), without adequate investigation of the lower levels (100-150), is a political decision, one not based on technical analysis or even national or regional standards.

With the opportunity for making some significant improvements in levee design, we strongly encourage consideration of setting back levees wherever possible in order to allow for river meandering. Particularly along the Sacramento, but also potentially valuable for the Lower American, levee setbacks would allow restoring some of the natural relationships between the rivers and their floodplains. There would very likely be an enhancement of riparian vegetation, a factor not to be overlooked in this process. At any rate, there should be no diminution whatsoever of riparian vegetation or habitat as the outcome of any project.

An issue that speaks to federal financing and the level of protection to be addressed is that of stimulation of windfall profits on land which would become developable with flood protection. Particularly important in the Natomas area, a flood control project must not protect, at the taxpayers' expense, more than the residents and structures already existing in the floodplain. A question that arises in this context is: how will the benefits be split between "levee fixes and dam fixes?" Or will the entire project be shouldered by an entire benefit assessment district, regardless of the type of fix or the actual benefit to be derived?

It will be important for the Corps to address the seismic concerns involved for an upstream storage structure. While the odds of reservoir-induced or other seismic activity occurring during a flood are probably very small, concerns about safety of the sites upstream of Folsom Reservoir continue to haunt the community. Earlier resistance to acknowledgment of design limitations has led to mistrust of federal intent with respect to safety of residents of the floodplain.

Reoperation of Folsom Reservoir, either as an interim measure or as part of the ultimate project, is an issue which carries with it significant opportunity for misunderstanding. It is imperative that the costs and benefits are clearly and accurately delineated so that the public can make an informed decision.

Thank you for the opportunity to make our concerns known. We will continue to participate in these proceedings and will be helping to form the public perception of these issues.

Sincerely,

Bea Cooley

Bea Cooley, PhD
Conservation Director

cc: Congressman Vic Fazio
Congressman Bob Matsui

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) 445-9748

March 7, 1989

TO DISTRIBUTION LIST:

Attached for your review is a revised draft of the cost-sharing agreement between The Reclamation Board and the seven local participating agencies for the Sacramento Metropolitan Area Feasibility Study. The draft includes a payment schedule that reconciles availability of funds with the Corps' estimated expenditure flow for the study. The Corps expects to begin work on the study in late June or early July.

Also attached is a revised draft of the Feasibility Cost Sharing Agreement between the Corps and the Board. In particular, note Article V, Management and Coordination, which discusses the makeup and responsibility of the Executive Committee and Study Management Team. Note also that while the Board's President will execute the FCSA as study sponsor, the local participants' representatives will also formally sign as witnesses.

Please review both drafts at your earliest convenience, and bring any comments to the meeting scheduled for March 16, 1989 at 9 a.m. in Room 455-1 of the Resources Building, 1416 Ninth Street, Sacramento. Your comments on the Corps' draft Scope of Studies (handed out at the February 16 meeting) would also be appreciated at the March 16 meeting.

If you have any questions, please contact me at (916) 445-8984.

Original signed by

George Qualley, Program Manager
Flood Control Activities Under
Reclamation Board Authority

STATE OF CALIFORNIA — GEORGE DEUKMEJIAN, Governor

THE RECLAMATION BOARD
1416 Ninth Street Room 455-6
Sacramento CA 95814
(916) 445-9454

MAR 17 1989

Colonel Jack A. Le Cuyer
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Le Cuyer:

We have reviewed your letter dated March 7, 1989 which explained the increase in study costs for the American River Watershed Investigation, and the requirement for a modification to the Feasibility Cost Sharing Agreement.

The Reclamation Board, at its March 17 meeting, concurred in the need for additional funds to complete this important study. This includes the increased costs for the work identified in the FCSA executed in June 1988, as well as the work shifted over from the Sacramento Metropolitan Area study. The 1989-90 Governor's Budget includes sufficient funds to cover the State's share of the net change in study costs (decrease on Sac Metro; increase on American River), and the local participants have expressed their willingness to fund their share of the increased cost.

Staff to the Board will work with your staff to resolve details such as the extent of in-kind services. However, we see no substantive problems with amending the FCSA, and will be ready to execute the amendment later this spring. We are concurrently drafting an amendment to the State/local cost sharing agreement which must, of course, be executed prior to (or concurrently with) signing the FCSA amendment.

If you need further information, please feel free to contact me at (707) 374-5711 or Ray Barsch at (916) 445-9454.

Sincerely,

WALLACE MC CORMACK
President

Best Available Copy

April 24, 1989

[illegible] American River Basin Branch

Dr. Pea Cooley
Conservation Director
Friends of the River
909 12th Street, Suite 207
Sacramento, California 95814

Dear Dr. Cooley:

Thank you for your letter of February 24, 1989, providing input to the scoping process for the American River Watershed Investigation. You raised several important issues that are integral to developing a community consensus for providing urgently needed flood control in the Sacramento metropolitan area. To foster this goal, I wish to respond to your concerns.

First, you indicated that consideration of water and power supply options should remain outside the scope of the American River Watershed Investigation. As you know from your participation on the study management team, we are focusing on flood control. However, as specifically directed in the authorization for the investigation and as directed in regulations applicable to all Federal water resource development agencies, we are also assessing other potential benefits including local water supply, power, and recreation, but only on an incidental basis within the American River Basin. The potential for water supply and hydropower will be evaluated for the upstream storage alternatives, which include (1) a coordinated operation of the peak flow flood control facility at the Auburn Dam site with Folsom Dam and Reservoir, (2) a peak flow dam with a permanent minimum pool, and (3) a peak flow facility including features that would not preclude future expansion to a multiple-purpose facility by others.

You stated your opposition to any permanent inundation of the American River canyon. I understand that the minimum pool and the expandable dam alternatives are likely inconsistent with your position. However, the area of compromise seems to be a project with the potential for some water resource benefits for the upstream communities. Accordingly, I believe the full range of alternatives which bridge the gap between the large multi-purpose Auburn project and a flood control only dam must be evaluated and reported on before any unified community position can be reached.

April 24, 1989

Environmental Resources Branch

Mr. Gail Kobetich
Field Supervisor of Endangered Species
Fish and Wildlife Service
2800 Cottage Way, Room E-1823
Sacramento, California 95825

Dear Mr. Kobetich:

It is requested that you provide us a list of endangered and threatened species that may be present in the American River Watershed Investigation Project area. You provided us a list of endangered and threatened species in a letter dated August 6, 1987. Since then, the Yolo Bypass has been added as an area to consider in the project. The project boundaries in the Sacramento area (Enclosure 1) are: the Yolo Bypass from the Fremont Weir to its confluence with the Sacramento River north of Rio Vista; the North and South Natomas Area; Dry Creek; Arcade Creek; and the lower American River from Nimbus Dam downstream to the confluence with the Sacramento River. Project boundaries in the Upper American River (Enclosure 2) include the North and Middle Forks of the American River from the proposed Auburn Dam site upstream to approximately Shirttail Canyon and Duncan Point, respectively.

With the exception of the Yolo bypass, brief descriptions of project alternatives for each area are enclosed. In the Yolo bypass, the Corps is considering modification (lowering) of the Fremont Weir. This would allow flood waters to be diverted from the Sacramento River into the Yolo bypass at lower river stages, possibly resulting in more frequent and larger portions of inundation within the bypass during the winter.

The various flood control alternatives may affect endangered or threatened species in several ways. Lowering of the Fremont Weir will probably not adversely impact terrestrial plant or animal species, as it is the bypass, but altered bypass flows and [illegible] activities associated with levees in the Natomas and lower American River areas may impact existing waterways and result in the loss of some riparian habitat. Impacts occurring in the upper American River area would be caused by inundation of any species occurring along the North and Middle Fork slopes to an elevation of approximately 950 feet.

The endangered species information we are requesting from you will assist us in complying with the Endangered Species Act, as amended, and in our continued studies for the project. If you have any questions concerning this matter, please call Mr. Dave Sugge at (916) 551-1860. We would appreciate a reply within 30 days.

Sincerely,

Walter Yep
Chief, Planning Division

AMENDMENT
FEASIBILITY COST SHARING AGREEMENT
BETWEEN
THE UNITED STATES OF AMERICA
AND
THE CALIFORNIA STATE RECLAMATION BOARD
AND
THE CALIFORNIA DEPARTMENT OF WATER RESOURCES
FOR THE AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

THIS AGREEMENT, entered into this 27th day of April, 1989, by and between the United States of America (Government) and the California State Reclamation Board and the California Department of Water Resources (Sponsors) is an amendment to the original Feasibility Cost Sharing Agreement (FCSA) for the American River Watershed Investigation (Study), executed between the Government and Sponsors dated June 17, 1988.

WITNESSETH, that

WHEREAS, the estimated cost for the study identified in the original FCSA was $2.5 million; and

WHEREAS, the recent study efforts have identified a need to enlarge the scope both of work tasks and the area of study identified in the original FCSA ; and because of this increase in scope, the study cost is increased by an amount not to exceed $800;000; and the allocation of efforts within the study tasks have changed greater than 15 percent; and

WHEREAS, descriptions of the study effort, increase in total cost and task cost change are included in supplemental Scope-of-Study attached as Appendix A; and

WHEREAS, the estimated change in study cost will not change the completion schedule described in the original FCSA.

NOW THEREFORE, the parties have read and agree to the study changes described in Supplement to Appendix A and Tables 1 and 2 attached hereto and made a part of this amendment by this reference.



IN WITNESS WHEREOF, the parties hereto have executed this Amendment to the FCSA as of the day and year first above written.

THE UNITED STATES OF AMERICA

BY _____
Colonel, Corps of Engineers
District Engineer
Contracting Officer

Approved as to legal form and sufficiency:
Asst. Chief Counsel, DWR

STUDY SPONSORS

BY _____
Mr. Wallace McCormack
President, California
Reclamation Board

_____
Mr. David N. Kennedy
Director, California
Department of Water
Resources

AS WITNESSED BY

The County of Sacramento

By _____

The County of Sutter

By _____

The County of Placer

By _____

The City of Sacramento

By _____
CITY MANAGER

Reclamation District 1000

By _____

The American River Flood Control District

By _____

FORM | POLICY | BUDGET

Department of General Services
APPROVED
OCT 25 1989
By ELIZABETH YOST
Chief Deputy Director

State of California-Transportation Agency GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF TRANSPORTATION
District 3
P.O. Box 911
Marysville, CA 95901
TD Telephone 916-741-4501

Telephone 916-741-4245

June 27, 1989

03-ED, Pla-49
Auburn Dam

Mr. Walter Yep
Chief, Planning Division
American River Basin Branch
Department of the Army
Sacramento District Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Mr. Yep:

This letter is in response to your recent letter regarding traffic handling alternatives and related bridge alternative for construction of a flood control Dam on the American River at Auburn. As discussed with members of the Corps staff when they were here on April 20, 1989, Caltrans would not be in favor of retaining the existing bridge and thereby being subject to periodic flooding. We also do not favor a new low level bridge built above elevation 715 that would have the probability for flooding on a five to seven year cycle.

Since receiving your letter I have had time to do some research on the question of flooding the existing or a new low level bridge. The data that you provided indicate that the maximum flood that could happen would be approximately 285' over the existing bridge, some 165' higher than the backwater in 1986, or with a minimum pool storage of 127,000 AF it may reach elevation 904. A review of these possible backwater elevation with a Caltrans Geologist indicates that there is a good possibility of slope failure in the same location as the failure we experienced in 1986. In addition, there is a strong possibility of reactivating an old slide in this same area. This old slide goes almost to the top of the ridge and any major slip here could preclude the possibility of ever being able to rebuild the highway in it's present location. The Geologist also indicated that a flood of the magnitude indicated in your letter would jeopardize the highway on the Auburn side of the river as well.



In 1986, the slip out created a hardship for many of the people living in the Cool and Georgetown areas. This area is currently experiencing a rapid growth rate and with the passing of time these hardships would only become worse and effect a larger number of people. Diverting traffic through the Folsom area will become more and more difficult as time goes on. Folsom and the Route 50 corridor are experiencing very rapid growth and, with the limited roadways available, traffic congestion can be expected to worsen. Therefore a diversion through the Folsom area would be unacceptable. A detour across the flood control dam using access required for construction is possible but the road would require Caltrans standards and an acceptable design criteria. This design criteria would have to be high enough to have the capacity to accommodate traffic for a prolonged period of time. This means the design standards of a permanent highway.

Your letter discussed the alternatives of flooding the existing bridge, a new low level bridge, constructing a road on the crest of the flood control dam, or building a new high level bridge. Naturally the high level bridge is Caltrans preference.

From our investigation we have concluded that a highway bridge and highway subject to flooding is unacceptable. Our conclusion is that the first time it is flooded, the roadway may very well fail and reconstruction may not be possible. Considering a roadway over the Dam or a new bridge downstream, with the steep canyon walls it is extremely difficult to design a roadway with adequate standards needed to accommodate today's traffic not to mention a roadway that would handle future traffic needs. I anticipate that any relocated roadway would need at least four lanes with the addition of truck climbing lanes at certain locations.

You requested an estimate for the costs associated with the options for periodically closing Highway 49. I am sorry that I cannot commit staff to the time necessary to come up with any kind of meaningful cost figure at this time. As your study progresses, if these estimates become an important element, please let me know and I will plan for the studies needed to make good estimates.

In summary Caltrans recommends the high level bridge alternative and I strongly urge the Corps to label the alternatives using the existing bridge or a new low level bridge as being unacceptable.

Very truly yours,

Bob Everitt
Deputy District Director
Project Development

STATE OF CALIFORNIA—THE RESOURCES AGENCY GEORGE DEUKMEJIAN, Governor

DEPARTMENT OF FISH AND GAME
1416 NINTH STREET
P.O. BOX 944209
SACRAMENTO, CALIFORNIA 95811-2090
(916) 445-3531

July 17, 1989

Mr. Walter Yep
Chief, Planning Division
Department of the Army
Sacramento District Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Mr. Yep:

Thank you for the opportunity to discuss our involvement in development of recreation facilities in conjunction with the American River Watershed Investigation.

I would suggest you contact the Wildlife Conservation Board (WCB) as they are responsible for funding improved recreational facilities which increase the public's access to fish and wildlife resources.

As for conceptual plans, we do not have any formal plans but would support development which protects and enhances habitats essential for fish and wildlife, such as riparian or wetland areas. For example, levees can be set farther back from the river channel to allow development of natural meanders with a subsequent increase in the riparian vegetation.

We are willing to continue to be involved in the review of development of recreation facilities but do not currently have the funds necessary for financial involvement. Please contact Mr. John Schmidt at the WCB for this type of information. His address is 1416 Ninth Street, Room 1335, Sacramento, CA 95814.

Sincerely,

Pete Bontadelli
Director

FRIENDS
OF THE
RIVER

July 25, 1989

Supervisor Jim Streng
700 H Street, Suite 2450
Sacramento, CA 95814

Re: June 29, 1989 letter from Walter Yep regarding recreation studies.

Dear Supervisor Streng:

The Army Corps of Engineers flood control feasibility studies provide a unique opportunity to improve and enhance river-related recreational facilities in Sacramento. I hope the County will take advantage of the opportunity and will participate in planning and development, especially of facilities along the Sacramento and American Rivers.

With the increasing popularity of close-to-home, river greenbelt recreation, there is a pressing need for enhanced access to bike trails, and additional fishing and swimming beaches, raft and boat launching sites. Increased parking at appropriate locations and, in many cases, restrooms would greatly enhance the enjoyment of Sacramentans of their river resources. There is also a safety issue involved. Where access points across the levee are missing, cyclists and walkers cut their own paths, often leaving bare ground to erode away, weakening levees. Sufficient formal points of access can reduce that problem.

The Army Corps prides itself on its attention to recreational facilities in conjunction with its projects. The agency has the expertise and the desire to help plan significant improvements and the hope of federal money certainly should stimulate some interest on the part of the County.

For the upper American River canyons, it is our hope that the Bureau of Land Management will receive an appropriation in next year's federal budget to assess the potential of establishing a National Recreation Area on the American River. That agency will certainly evaluate existing facilities and assess the carrying capacity of all the canyons for recreation. The study will consider the recreation and facilities that would be suitable for the canyons, including with a dam at the Auburn site. If a flood control dam is built, there will be opportunities for enhancing access to the river and to Folsom Reservoir and it is our hope that the counties involved will participate in the establishment of facilities that will ultimately enhance their economies.

909 12th Street, Suite 207 • Sacramento, CA 95814 (916) 442 3155 • S.F. Office: Fort Mason Center, Building C, San Francisco, CA 94123 (415) 771 0400





A point I would like to make very clear: neither the [illegible] study or an ACoE study of recreation improvements is in conflict with or in lieu of a flood control project and providing appropriate flood control for Sacramento. I urge the County's support.

Sincerely,

Bea Cooley

Bea Cooley, Director
American River Coalition

cc: County Board of Supervisors
Walter Yep, Rick Meredith
Jim Jones

STATE OF CALIFORNIA - THE RESOURCES AGENCY
GEORGE DEUKMEJIAN, Governor
DEPARTMENT OF PARKS AND RECREATION
P.O. BOX 942896
SACRAMENTO 94296-0001
(916) 445-2358

JUL 5 1989

Mr. Walter Yep, Chief
Planning Division
Department of the Army
Sacramento District Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Mr. Yep:

American River Watershed Investigation

Thank you for your letter of June 29, 1989 regarding this Department's willingness to participate in the development of federal recreation facilities in connection with the subject investigation.

As you are probably aware, this Department, in conformance with the California Public Resources Code, Section 5094.4 and U.S. Public Law 89-161, has made a substantial commitment to provide for the planning, development and operation of public recreation facilities from Nimbus Dam to the upper reaches of the Auburn Reservoir Project. The details for this commitment are set forth in the document titled "Auburn Reservoir Project - Folsom Lake State Recreation Area General Plan, 1978".

If the Corps of Engineers' Flood Control Project supplants the Bureau of Reclamation's Auburn Reservoir Project, we would assume that the Department could transfer its previous commitment, with appropriate modifications, to the new project.

A formal commitment of intent to participate in such a venture will have to come from the Secretary of the Resources Agency, with the approval of the Director of Finance and upon specific authorization by the Legislature.

The Department feels that additional recreation proposals outside of our current jurisdiction should be handled by existing federal and local agencies which already have vested interests in those areas.



If you have any further questions, please contact me or Mr. [illegible] Manager, State Parks System Planning at (916) 322-8700.

Sincerely,

Henry R. Agonia
Director

# COUNTY OF SACRAMENTO
## DEPARTMENT OF PARKS AND RECREATION

RECREATION & PARK AND FISH & GAME COMMISSION

ROBERT J. BASTIAN
Chairman
JOHN W. ANDERSON
GEORGE DURRAY
ANN M. KOHL
DR. A.C. URALDE, JR.

COUNTY SERVICE AREAS

#1 Rio Linda/Elverta
#4A Wilton/Cosumnes
#4C Delta
#4D Herald

GENE W. ANDAL
Director

RICK CARUSICHIO
Assistant Director

RON SUTER
Chief, Administration and Leisure Services

ARLAN HICKEL
Chief, Planning & Development

August 4, 1989

Colonel Jack LeCuyer
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Colonel:

Re: Sacramento River Flood Control - Garden Highway

I have learned that the Corps of Engineers is proposing a levee improvement project on the Sacramento River from Discovery Park upstream to the Cross Canal. Further, that the method of strengthening the levee includes placement of earthened fill at the base of the levee, approximately seven feet high and twenty feet wide.

The County of Sacramento would be very interested in the phased development of a multi-purpose trail on top of the fill and parallel to the Garden Highway running from Discovery Park to Elkhorn Boat Launching Park where Interstate 5 crosses the Sacramento River. I would like to discuss this concept further with you and your staff. Fred Kindel and I have briefly discussed it.

If such a trail is possible, it would be expeditious to include public trail uses in the easements that will soon be negotiated.

Sincerely,

Gene W. Andal
Director

# PLACER COUNTY COMMUNITY DEVELOPMENT DEPARTMENT

HEIDI ESCHWEIN, Director — Administration — 11414 B Avenue — Auditorium, CA 95603 — (916) 823-4691
ED JOSEPHS, Chief Inspector — Building Division — 11422 B Avenue — Auditorium, CA 95603 — (916) 823-4687
FRED YEAGER, Planning Director — Planning Division — 11414 B Avenue — Auditorium, CA 95603 — (916) 823-4570
WM. A. SCHULZE II, Dist. Office Supervisor — Tahoe Office — 565 W. Lake Blvd. P.O. Box 1909 — Tahoe City, CA 95730 — (916) 581-6260

August 7, 1989

Walter Yep - Chief, Planning Division
Environmental Resources Branch
Department of the Army
Sacramento District Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Mr. Yep:

In response to your letter of June 29, 1989, I am pleased to be able to indicate Placer County's support for the expansion of recreation opportunities in conjunction with the American River Watershed Investigation. Through the County's cooperation with the California State Parks Department we would hope to plan new recreation facilities including trails, campgrounds, day-use areas, etc. There is a definite willingness on behalf of the County to participate in the creation of such new recreation opportunities.

As you know, many issues surrounding the Auburn Dam project have not been resolved, therefore planning for such facilities has not been actively pursued by the County. However, as the project plans move along, we will welcome the opportunity to look at various ways that the County can participate in the development of Federal recreation facilities.

Thank you for keeping us informed and involved in this long range project.

Sincerely,

FRED YEAGER
Planning Director

NOTICE OF PREPARATION

TO: INTERESTED PARTIES

FROM: The Reclamation Board
1416 Ninth Street
Sacramento, CA 95814

SUBJECT: Notice of Preparation of a Draft Environmental Impact Report

The Reclamation Board is a nonfederal sponsor and will be the lead Agency under the California Environmental Quality Act for the American River Watershed Investigation Project. The U. S. Army Corps of Engineers and the Board will prepare a joint Draft Environmental Impact Statement/Environmental Impact Report for the proposed project. A Notice of Intent to prepare a Draft Environmental Impact Statement was published by the Corps of Engineers on November 28, 1988, in the Federal Register.

We need to know the views of your agency as to the scope and content of the environmental information which is germane to your agency's statutory responsibilities in connection with the proposed project. Your agency will need to use the EIR prepared by our agency when considering your permit or other approval for the project. The project description, location, and the probable environmental effects are contained in the attached materials.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date, but not later than 30 days after receipt of this notice. Please circulate this document to other departments and/or divisions of your agency that may wish to comment.

Please send your response to:

Annalena Bronson
Department of Water Resources
P. O. Box 942836
Sacramento, CA 94236-0001

Office of Planning and Research (copy)
1400 Tenth Street, Room 101
Sacramento, CA 95814

Project Title: American River Watershed Investigation.

Date _____ Signature _____

Title General Manager

Telephone (916) 445-9454

Reference: California Administrative Code, Title 14, Sections 15082(a), 15103, 15375.

A-40

BEFORE THE BOARD OF SUPERVISORS OF THE SAN JOAQUIN COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT,
STATE OF CALIFORNIA

R-89-1141

RESOLUTION OF THE BOARD OF SUPERVISORS OF SAN JOAQUIN COUNTY
FLOOD CONTROL AND WATER CONSERVATION DISTRICT,
IN SUPPORT OF A MULTIPURPOSE AUBURN DAM

- - - - - - -

WHEREAS, there is a critical need for additional surface water within San Joaquin County due to an overdraft of the County's groundwater basin; and

WHEREAS, San Joaquin County has historically been identified to receive American River water through the Auburn-Folsom South Canal Project; and

WHEREAS, the construction of an Auburn Dam consistent with the potential of the American River to meet the water supply needs of San Joaquin County and others, to preserve and enhance the riparian and fishery benefits along the lower American River at the same time providing the required flood control, would best serve the needs of this County and of California.

NOW, THEREFORE, THIS BOARD OF SUPERVISORS does hereby find that public welfare and necessity require the construction of a multipurpose dam on the American River.

PASSED AND ADOPTED this SEP 05 1989 by the following vote of the Board of Supervisors, to wit:

AYES: BARBER, WILHOIT, SOUSA, SIMAS, COSTA

NOES: NONE

ABSENT: NONE

EVELYN L. COSTA

EVELYN L. COSTA
Chairman of the Board
of Supervisors
County of San Joaquin
State of California

ATTEST: JORETTA J. HAYDE
Clerk of the Board of Supervisors of the County of San Joaquin, State of California

By Caroline Junco
Deputy Clerk

SEAL

C 9H24LWRN1

AMERICAN RIVER FLOOD CONTROL DISTRICT
2590 VENTURE OAKS WAY, SACRAMENTO, CALIFORNIA 95833
(916) 925-5550
FAX: (916) 921-9274

BOARD OF TRUSTEES
DISTRICT ENGINEER
Donald W. Smith
ASST. DISTRICT ENGINEER
Walter C. Pennington

September 5, 1989

Ms. Annalena Bronson
Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

RE: AMERICAN RIVER WATERSHED INVESTIGATION - COMMENTS TO THE NOTICE OF PREPARATION OF D.E.I.R.

Dear Ms. Bronson:

The American River Flood Control District believes it would be beneficial for the following items to be addressed in the Draft Environmental Impact Report for the proposed project:

1. Right of Way problems resulting from raising the levees;

2. The possibility of channelization and or channel clearing; and

3. Urban interference with levee maintenance (i.e., vegetation clearing, etc.)

The American River Flood Control District fully supports the American River Watershed Investigation Project. If there are any questions or comments, please do not hesitate to call.

Sincerely,

Walter C. Pennington

Walter C. Pennington
Assistant District Engineer

RWS/ro

A-41

HENRY M. HIRATA

COUNTY OF SAN JOAQUIN
DEPARTMENT OF PUBLIC WORKS
P.O. BOX 1810 STOCKTON, CALIFORNIA 95201
(209) 468-3000

DIRECTOR OF PUBLIC WORKS
Richard C. Payne

September 5, 1989

Ms. Annalena Bronson
Department of Water Resources
Post Office Box 942836
Sacramento, California 94236-0001

SUBJECT: AMERICAN RIVER WATERSHED INVESTIGATION

Dear Ms. Bronson:

San Joaquin County has a pressing and urgent responsibility to its citizens to provide an adequate water supply, to meet the needs of a growing population and economy in a manner consistent with the protection of its natural resources. San Joaquin County is fully developed in regard to water use and overly dependent on a rapidly depleting groundwater source. The salt water intrusion into our basin and the relentless decline in water basin levels must be curtailed. These are serious environmental problems which must be addressed.

Historically, San Joaquin County has looked to the Auburn-Folsom South Canal Project to provide it with necessary supplemental surface water. Due to delays and other complications in developing the project, the County has been forced to investigate other potential sources of water. Our efforts, to date, have met only with limited success. There is still a substantial need for American River water. San Joaquin County's dependence on American River water has been brought about by the actions of the State and Federal government over many years.

We, therefore, must receive a water supply from the completed Auburn-Folsom South Canal Project and oppose any project that would limit the ability to construct a multipurpose project.

To demonstrate the County's concern and commitment to a multipurpose Auburn Dam Project, our Board of Supervisors has passed and adopted a Resolution in support of a multipurpose Auburn Dam. A copy of this Resolution is enclosed.

power and recreation for the County at the Auburn project site--a site which has been recognized for its potential for a multipurpose dam and reservoir project. The County is one of the fastest growing counties in California and demands for water service are rapidly outstripping the ability of water purveyors to satisfy those demands.

(b) This alternative, during high flows, would temporarily (1 to 12 days) store between 600,000 and 700,000 acre-feet of water. The DEIR should address the impact of this alternative on hydrology, water quality, fisheries, wildlife, and vegetation. Resources lost or uses preempted should be closely examined. Temporary water storage could inundate portions of State Highway 49 causing disruption of traffic flows. Construction of a high bridge and realignment of Highway 49 has been suggested as mitigation for this potential significant impact. This response would create growth pressures in the Pilot Hill/Cool/Georgetown area due to the creation of a more direct access between the County and major employment centers in Placer and Sacramento counties. Existing water supplies in this area may be insufficient to satisfy the increased demands from resultant population growth.

2. Expandable Dam. (a) This alternative would not preclude the future development of water supply, hydroelectric power generation, and recreation at the Auburn project site. Nevertheless, there is a potential that development will not occur if this alternative is selected.

   (b) Supra.

3. Minimum Pool. (a) This alternative could be designed to provide water supply and hydroelectric power generation to the County--most notably for the Pilot Hill/Cool/Georgetown area.

   (b) The DEIR should address the impact of this alternative on hydrology, water quality, fisheries, wildlife, and vegetation. Resources lost or uses preempted should be closely examined.

4. Others. (a) Any alternative which may include a permanent increase in the flood storage allocation in Folsom Reservoir must address several potential significant impacts, including, but not limited to: reduction in water supply,





flow and temperature impacts on fisheries in lower American River, recreation in Folsom Lake, and reduction in hydroelectric power generation.

5. No Action. This alternative ignores flood control, water supply, hydroelectric power generation, fisheries and recreation needs of Sacramento, Placer and El Dorado counties. Consideration should be given to the without-project future in the tri-county area for the basis of comparative economic, environmental, and engineering studies.

The above represents the views of the Agency as to the scope and content of the environmental information which is germane to our statutory responsibilities. The Agency is an interested party to the preparation of a DEIR for the American River Watershed Investigation project and appreciates the opportunity to comment on the Notice of Preparation.

Thank you for your consideration.

Sincerely,

Robert J. Keeb

ROBERT J. KEEB
Manager, El Dorado County Water Agency

TE OF CALIFORNIA—RESOURCES AGENCY
ARTMENT OF WATER RESOURCES
E RECLAMATION BOARD
– 9th Street, Room 4554
ramento, CA 95814
445-9454

GEORGE DEUKMEJIAN *Governor*

SEP 2 8 1989

Colonel Jack A. Le Cuyer
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Le Cuyer:

The Reclamation Board adopted Resolution No. 89-14 on September 15, 1989, a copy of which is attached.

This resolution updates and clarifies the Board's position on flood protection for the greater Sacramento area. More specifically, the Board supports a 200-year level of flood protection as an absolute minimum acceptable for Sacramento. It also supports a facility at the Auburn Dam site as the only practical method to achieve the 200-year or greater level of flood protection.

If you have any questions concerning the Board's position on Resolution No. 89-14, please call me at (916) 445-9454, or have your staff call Pete Rabbon at (916) 445-8984.

Sincerely,

RAYMOND E. BARSCH
General Manager

Attachment

cc: (See Attached List.)



STATE OF CALIFORNIA
THE RESOURCES AGENCY
THE RECLAMATION BOARD

Resolution No. 89-14

WHEREAS, the City of Sacramento and the areas adjacent to the American River face a very serious flood threat that must be dealt with as soon as possible; and

WHEREAS, additional storage capacity for floodwaters of the American River is urgently needed and each flood season which passes without additional storage poses a serious risk to the City of Sacramento and areas adjacent to the American River; and

NOW, THEREFORE, BE IT RESOLVED that this Board believes a 200-year level of flood protection is the absolute minimum that is acceptable for a highly developed urban area such as Sacramento; and

BE IT FURTHER RESOLVED that this Board will support financially only a project which provides this level of protection; and

BE IT FURTHER RESOLVED that this Board believes that alternatives calling for higher flows and corresponding higher stages of longer duration and at higher velocities on the levees along the American River could create unacceptable risks due to levee failures; and

BE IT FURTHER RESOLVED that the Board has determined that the only practical method to achieve 200-year or greater flood protection is through upstream storage at the Auburn Dam site; and

BE IT FURTHER RESOLVED that the Board reaffirms its strong support for the construction at the Auburn Dam site to proceed at the earliest possible date.

Dated: September 15, 1989

THE RECLAMATION BOARD of the State of California

By _____
President

By _____
Secretary

A[illegible]SSOCIATION OF SACRAMENTO COUNTY
WATER DISTRICTS

December 12, 1989

Sacramento County
Board of Supervisors
700 H Street
Sacramento, CA 95814

The undersigned Districts and Companies are water purveyors within Sacramento County, dependent, either directly or indirectly, upon the American River. These water purveyors, who serve more than 250,000 people and the business and agricultural economy within Sacramento County, urge that Sacramento County strongly and actively pursue the development of further storage of water on the American River and we stand ready to support that development.

Flood control is recognized as an immediate need, and we are encouraged by the supportive position of the City and County on that issue. Growth within Sacramento County, and particularly among our own customers, however, must also be recognized for those areas dependent upon the American River.

Historically, our agencies have believed that the U.S. Bureau of Reclamation would have adequate water from Folsom Dam to supply our needs. Given the obvious and proper desire to enhance the flows in the lower American River, as embodied in the proposed judgement in the EBMUD action, it is now obvious that the water supplies needed in this area, together with the water needed to sustain the American River flow, cannot be accomplished without additional upstream storage.

A dry dam, without possibility of conservation, is irresponsible. Merely providing for a possible future enlargement to conserve water is not adequate. A minimum of 850,000 acre feet of storage is essential at this time for the water which we will need for our future development.

Several areas are out of water, and other areas cannot grow without additional firm water supplies. Much of the Sacramento area is currently over-drafting groundwater and must have a surface water supply. Without further storage, a building moratorium will be a necessity. A building moratorium based on the flood threat is recognized as damaging to the economic well being of this community. A building moratorium based on lack of water is equally damaging to the economy.

A multipurpose Auburn Dam project will assure the desired instream flows, provide protection for the fish, enhance recreation at Folsom Reservoir, while assuring adequate water supplies for our future. None of this can be achieved without storage to provide greater control of our limited water resources.

We are currently examining the various options available to us to pay for this protection. The additional cost to our customers of a firm supply of stored water is well justified as an investment in our future.

SACRAMENTO WATER AGENCIES

Director

ARCADE WATER DISTRICT
Director

CARMICHAEL WATER DISTRICT
Dir. Dir. E.

CIRTUS HEIGHTS IRRIGATION DISTRICT
President of the Board of Directors

DEL PASO MANOR WATER DISTRICT
Director

FAIR OAKS WATER DISTRICT

GALT IRRIGATION DISTRICT
President

NORTHRIDGE WATER DISTRICT
President

OMOCHUMNE-HARTNELL WATER DISTRICT
Mgr/Bd Secty Treas.

ORANGEVALE WATER CO.
President

RIO LINDA WATER DISTRICT
Director

SAN JUAN SUBURBAN WATER DISTRICT

Director
[illegible] WATER DISTRICT

A-44

NORMAN D SHUMWAY
[illegible]
COMMITTEES
[illegible]

# Congress of the United States
## House of Representatives
## Washington, DC 20515

January 31, 1990

[illegible]
CHRISTOPHER DUGAN
ADMINISTRATIVE ASSISTANT
[illegible]
JOHN DOE
DISTRICT REPRESENTATIVE
[illegible]

The Honorable Vic Fazio
2113 Rayburn House Office Building
House of Representatives
Washington, DC 20515

Dear Vic:

As the debate on how to achieve flood protection for Sacramento moves forward, I want to make certain that my views on this issue are clear since the alternative solutions being discussed are to be located within my Congressional District and will have a daily impact on the lives of my constituents.

I unequivocally support -- as do the overwhelming number of my constituents -- a multi-purpose Auburn Dam to provide flood control for Sacramento; to provide water and power to Placer, El Dorado, Sacramento and San Joaquin counties; and to provide for fisheries and recreational enhancement at Folsom Lake and along the main stem of the lower American River. I view this as the only long-term regional solution to the various and sometimes competing American River resource needs.

Since the February 1986 flood, Sacramento officials have expressed skepticism toward the viability of a multi-purpose project as the resolution to the flood problem. The cost of the project, the need for non-federal cost sharing partners to pay for the water and power, and the estimated high price of the water yield have repeatedly been cited as obstacles to completion of the multi-purpose project which could not be overcome. At the same time, a small but vocal environmental faction has adopted an anti-multi-purpose-project-at-any-cost agenda based purely on extreme ideological grounds.

As a result, many Sacramento officials have moved toward the Army Corps of Engineers non-multi-purpose flood control options (generically referred to hereafter as "dry dam options") in an attempt to strike some sort of political middle ground. Those inclined toward any one of these options -- defined in the December 1989 Corps of Engineers report as either the flood control only detention dam (dry dam), the expandable dry dam, or





the minimum pool semi-dry dam -- have argued that they represent the only chance of achieving a community consensus on the issue.

As I will outline in some detail in this letter, I believe the premise for selecting any of the three Corps of Engineers dry dam options has been demonstrated in recent months to be flawed on two counts: First, it is becoming clearer and clearer that the community at-large supports a multi-purpose Auburn Dam and not the Corps of Engineers dry dam alternatives. And second, the notion that there is little or no present interest in water from an Auburn Dam, or that the project is not economically viable, has been dispelled with recent expressions of financial interest for Auburn Dam water by water districts and other area public entities.

An objective examination of the area's American River needs and the benefits and costs of the alternatives available to meet these needs, together with an unbiased assessment of the community's preference, leads to only one rational conclusion -- the best choice and the community consensus is to complete construction of a multi-purpose Auburn Dam:

1) A large multi-purpose project will provide more flood protection than any of the dry dam alternatives proposed by the Corps of Engineers.

The Army Corps of Engineers December 1989 alternatives study indicates that the multi-purpose project is the only alternative that can provide 250 year protection. Quoting from the report, "When operated with Folsom Reservoir, it could provide in excess of a 250-year level of flood protection to the Sacramento area." The dry dam alternatives proposed can achieve only 200-year protection, a level which is considered adequate but still less protective of lives and property than guaranteed by the multi-purpose project.

2) Construction of the multi-purpose Auburn Dam can actually provide Sacramento with the FEMA-required 100 year flood protection quicker than the dry dam alternatives.

If the cofferdam for the multi-purpose Auburn Dam is constructed as a separate facility, the multi-purpose project can provide 100-year protection -- thereby relieving the area from FEMA restrictions -- by mid 1995.

On the other hand, because the dry dam alternatives would use different design specifications, and because such a dam would be constructed from roller compacted concrete which takes longer, the Corps has projected that the dry dam can provide 100-year protection -- thereby relieving the area from FEMA restrictions -- by mid-1996.

The multi-purpose project, therefore, can deliver 100-year FEMA protection up to a year earlier than the dry dam alternatives.

3) The total flood control costs and the corresponding local share of flood control costs are actually less for the multi-purpose project than for the expandable dry dam.

The Office of Management and Budget has stated that the treatment of sunk costs should be the same for the dry dam options and the multi-purpose alternatives. A breakdown of flood control costs for the expandable dry dam vs. the multi-purpose dam illustrates that flood control provided by a multi-purpose dam is considerably less expensive.

The total flood control cost for the Corps of Engineers expandable dry dam option is $824 million, including sunk costs. The multi-purpose flood control cost is $600 million, nearly $225 million less! The 25% local share for flood control is $206 million for the expandable dry dam and $150 million for the multi-purpose dam.

On the other hand, if you compare the flood control costs for the expandable dry dam and the multi-purpose dam without the prorated sunk costs, the expandable dry dam costs $550 million and the corresponding multi-purpose flood control allocation costs $500 million. The 25% local share for flood control is $135 million for the expandable dry dam and $125 million for the multi-purpose dam.

Either way you calculate it -- with or without sunk costs -- the multi-purpose project costs less for flood control than the expandable dry dam, both in terms of total cost and local share.

4) The counties in the American River Basin clearly need an additional water supply to meet their future needs -- and despite past pronouncements by opponents to the multi-purpose dam, water districts are willing to financially commit for this water supply.

Placer and El Dorado counties already have water rights and contracts for more than 300,000 acre/feet of American River water. Other water users within the basin, including water users from Sacramento County, have, within the last three years, made requests to the Bureau of Reclamation for more than 610,000 acre/feet of new American River water.

Even the Corps of Engineers December 1989 dry dam alternatives report flatly states that projections show a water shortage of up to 66,000 acre/feet for El Dorado County, 215,000 acre/feet for Sacramento County, 270,000 acre/feet for San



Joaquin County and the need to deliver 215,000 acre/feet to Placer County.

Every qualified water agency in California, including the Bureau of Reclamation and the State Department of Water Resources, has forecast the need for additional water supplies to meet the State's future needs, including Delta water quality, fisheries and recreation enhancement, municipal and industrial needs and irrigation supply. A multi-purpose Auburn Dam would ensure that while these priority State requirements are met, the American River counties will continue to have the resources available to meet their own area needs.

It is also important to note that Sacramento County water districts do not view the Sacramento River as the answer to their future water needs. The water quality of this supply is significantly less, and the cost of delivery is considerably higher.

The twelve Sacramento County water districts, the American River Authority and the San Joaquin County Board of Supervisors have all expressed the willingness to financially commit to the multi-purpose project at this time. These water users are willing to sit down with Bureau of Reclamation officials now and negotiate binding agreements. There is no need for further delay based on the saleability of the water.

On the other hand, local water users are not interested in paying the $100 million or more needed to ensure that a dry dam option is expandable. They get no certain benefit out of this proposed investment since the second, multi-purpose stage would have to be separately authorized by Congress at a later date, the likelihood of which they recognize to be somewhere between extremely difficult and impossible. Also, why would water districts spend an extra $100 million just for stageability features on a dry dam when they are willing to commit now for water from a multi-purpose dam? This added and quite unneeded expense for the expandable features on a dry dam makes the expandable dry dam proposal unrealistic.

The regions we represent are among the fastest growing areas in California, and the need for more water is obvious. We experienced drought years in 1987 and 1988. We are presently facing another sub-standard winter of snowfall in the Sierras. Already the prospect for water rationing this summer is being discussed throughout much of California. In fact, the Bureau of Reclamation has just announced that if present precipitation conditions persist throughout the remainder of the winter and the spring, summer deliveries will be reduced by as much as 50% in many areas. Our constituents, particularly the next generation, deserve that we plan for the future so their legitimate needs are

met.

5) Only with completion of a multi-purpose Auburn Dam can the Wild and Scenic lower American River be protected to preserve fisheries, recreation and aesthetic values.

The above outlined area water needs clearly indicate that the pressure to meet municipal and industrial (M&I) water demand will have a severe environmental effect on the Wild and Scenic lower American River which is so vital to the City and County of Sacramento and its American River Parkway.

Even the Corps of Engineers dry dam alternatives report recognizes that the recent Judge Hodges decision in the East Bay MUD case demonstrates the need for additional water supplies in the Wild and Scenic lower American River to protect fisheries and recreation.

The Corps report states that the only way to provide for all of these competing water needs is with a multi-purpose project: "Since the Auburn Dam project has not moved forward, even D-1400 minimum flows are unlikely. Accordingly, there is a need for greater summer flows in the American."

The Corps report further states: "With the multi-purpose Auburn Dam, the average summer flows in the American River will be enhanced over expected future conditions without the project. As mentioned, average summer flows will likely be reduced in the future without the multi-purpose project as more water is withdrawn from the river."

Some environmental opponents of the multi-purpose Auburn Dam are counting on continued political pressure and the recent Judge Hodges decision to provide long-term protection for the lower American. Even if downstream diversions to Sacramento County are restricted to protect the river, nothing will stop Placer and El Dorado counties from diverting water upstream pursuant to their water rights. Without a doubt, fisheries and recreation will diminish in the lower American if Auburn Dam is not built.

With the multi-purpose project, however, flow guarantees such as those proposed in my legislation, HR 2429, can protect the lower American River year-round as an operating condition of the project.

6) Only with completion of a multi-purpose Auburn Dam can Folsom Lake's level be stabilized to provide for consistent, year-round recreation.

Folsom Lake is the State Department of Parks and Recreation's most widely used recreational facility. The



benefits to the area and the State are significant. The only way to protect the recreational integrity of this facility is to build a multi-purpose Auburn Dam.

According to the Bureau of Reclamation, "the operation of a multi-purpose Auburn Reservoir would substantially improve the flexibility of the American River facilities and would result in improving recreation use at Folsom Lake."

"The full-sized multi-purpose Auburn Reservoir would enhance recreational values at Folsom Lake by stabilizing water surface elevations during the summer recreation season, improving downstream temperatures, and providing the needed increased flows in the lower American River for fishery and recreation purposes."

On the other hand, "with only Folsom Reservoir, and as the demands on the CVP increase to provide additional water for various objectives, including in-stream flows, Delta water quality, benefits for fish and wildlife, domestic and irrigation use, and additional flood control, there will be a continuing decrease in CVP operational flexibility."

The California Department of Water Resources has stated that the multi-purpose Auburn Dam "would restore Folsom Reservoir levels during the recreational season to nearly historic conditions. Consequently, Auburn Reservoir would be credited with benefits for improving both the quantity and quality of Folsom Reservoir recreation."

To illustrate how the multi-purpose project would stabilize Folsom Lake, the Bureau of Reclamation has calculated that had the project been in place prior to both the 1986-1987 and 1987-1988 drought years, "Folsom Lake would have would have been above the 600,000 acre/foot storage level for the entire year thereby enabling greater recreation use and particularly year-round operation of the Folsom Lake Marina at Brown's Ravine." Without Auburn, the Folsom Lake Marina was open for only 5 months in 1986-1987, and closed the entire water year of 1987-1988.

7) Extreme environmental organizations are the only identifiable opposition to the multi-purpose project, and their only remaining argument is based solely on preserving the canyon.

The only real opposition to the project is from certain environmental groups who have indicated that they do not support the inundation of the canyon for any reason.

Originally, environmentalists argued against the project based on the earthquake safety issue. Fears of earthquake safety have since been dispelled by findings made by Secretary Andrus of

the Carter Administration.

Environmentalists then argued that the project was too costly and there was no real need for the water. The Bureau of Reclamation has documented that the environmentalists' cost projections were greatly exaggerated. Moreover, as already stated in this letter, the need for the water has been demonstrated and local water districts recognize that the price of the water is as reasonable, if not actually less, than possible alternative supplies.

Environmentalists also argued against the project stating that it would make more American River water available for delivery and, therefore, threaten flows in the lower American River. What they don't acknowledge is that the demands for American River water will increase regardless of whether the multi-purpose Auburn Dam is built, and that with the legislative protection for the lower American River in my bill, HR 2429, the Wild and Scenic lower American flows will actually be enhanced.

Although they sometimes persist in asserting these arguments, the true position of opponents can be reduced to a single issue: extreme environmentalists do not support dams, per se, and they do not want to see the American River canyon inundated. They hold this position despite the fact that the notion that this project will destroy some virgin recreational area is a fallacy. With hundreds of millions of dollars worth of foundation work already done, the canyon is already significantly scarred; and the river is already highly regulated.

This opposition represents a very small, but very vocal minority of the entire American River region. Their position is not based on long-term planning for the good of the community, but on blind ideology.

No one supports damming every river and flooding every canyon. But these extremists won't support any water development for the area if means building a dam. This position is so far out of step with the needs and wishes of the community that it should be viewed in practical terms as irrelevant.

As elected officials we must make decisions based on whether a proposal, on balance, benefits the community and constituents we serve. Most of the time we must make trade-offs; we can't afford to ignore the need to develop resources at the expense of future generations.

Where we would we be today if the same kind of vocal minority had existed back when Folsom Dam was being proposed, and if they had prevailed in blocking that project? The answer, quite literally, is either under water or in a desert. Sacramento





would have been flooded in 1986. In non-flood years, the lower American River would be nothing more than a trickle in summer months and there wouldn't be enough water to meet area needs. If we don't go forward with the multi-purpose Auburn Dam now, in twenty to thirty years it will be a decision that comes back to haunt the community.

8) By contrast, the overwhelming majority of area organizations and residents clearly support completion of a multi-purpose Auburn Dam. The community consensus that many have been waiting for now exists in favor of completing the multi-purpose Auburn Dam.

The recognition by communities in Sacramento, Placer and El Dorado counties of the area's rapidly increasing water needs is growing quickly, as is their support for completing the multi-purpose Auburn Dam.

In Sacramento County, the Sacramento Municipal Utility District (SMUD), the Arcade Water District, the Carmichael Water District, the Citrus Heights Irrigation District, the Clay Water District, the Del Paso Manor Water District, the Fair Oaks Water District, the Galt Water District, the Northridge Water District, the Omochumne-Hartnell Water District, the Orangevale Mutual Water Company, the Rio Linda Water District and the San Juan Suburban Water District all support construction of a multi-purpose Auburn Dam. The twelve water districts have taken steps to jointly form a Joint Powers Authority to make financial commitments to purchase Auburn Dam water.

These districts have a long-term responsibility to provide water and power to their customers; they are the local experts on what their needs are and what they will be in the future. They are absolutely convinced that any of the dry dam alternatives would be a grave mistake, and that the hundreds of thousands of customers they serve also support the multi-purpose project.

In addition, an impressive array of Sacramento area business and labor groups support the multi-purpose Auburn Dam, including the Sacramento Chamber of Commerce, the Sacramento-Sierra Building and Construction Trades Council, the Sacramento Builders' Exchange, and the Sacramento Building Industry Association, the Sacramento Association of Realtors, the Sacramento County Policy Planning Commission, Lukenbill Enterprises, the Natomas Real Estate Company, Butler and Associates Insurance Agency, Browns Ravine Marina, the Sacramento Urban League, the Sacramento Farm Bureau, Palisades Development, the Vanguard Group, Inc., Mother Lode Savings Bank, Laborers Union #185, the Spink Corporation, Roebbelen Engineering, the Sacramento Sea Ray Boat Club, Raymond Vail Engineering, Teichert Construction, Teneco Tractor, Inc., Wise Insurance Agents/Brokers

and Winncrest Homes.

In the other affected counties, the Placer County Board of Supervisor, the Placer County Water Agency, the El Doardo County Board of Supervisors, the El Dorado Irrigation District, the Auburn Dam Council, the League of Placer County Taxpayers, the Placer County Board of Realtors, the El Dorado County Taxpayers Association, the Roseville Chamber of Commerce, the Citrus Heights Chamber of Commerce, the Auburn Area Chamber of Commerce, the Roseville Telephone Company, and the San Joaquin County Board of Supervisors have long supported completion of the multi-purpose project.

On a statewide basis, the Almond Growers Association, the California Farm Bureau, the Associated General Contractors of California, the Association of California Water Agencies, the California Central Valley Flood Control Association, the Rice Growers Association of California, and the California Chamber of Commerce all support completion of the multi-purpose Auburn Dam.

These organizations, agencies, businesses and associations are just part of the long list of support for this multi-purpose project. They reflect the broad consensus which already exists throughout the region in support of the multi-purpose Auburn Dam. When compared with the handful of extreme environmental organizations that oppose the multi-purpose project, the list of supporters is overwhelming.

Summary

Inherent in the rationale for the expandable dry dam alternative which you and other Sacramento officials have expressed interest in is the notion that at some point down the road a multi-purpose project to provide additional water benefits to the area will be needed.

The flood control stage of the expandable dry dam won't be completed until 1998 at the earliest, according to the Corps of Engineers. By that time the need for more area water will be dire. A second stage to provide that water would be another 10 to 15 years off at best. What is the point of going through the added delay and prohibitive expense of staging a project when the demand for water, and the local interest in buying it, is known now?

While I don't represent any of the Sacramento flood-prone areas, I am keenly aware of your needs. However, I do represent the Auburn Dam site; and given the water, power, recreation and fisheries needs of my district and the greater American River region, I will not support any of the dry dam or expandable dry dam alternatives. As I have outlined in some detail, neither the





facts nor the local support bear any of those alternatives out as a prudent planning decision for the area. The multi-purpose dam, with proper legislative amendments to the authorization, is a winner for all of the American River counties which we jointly represent.

I would be pleased to discuss any aspect of this issue with you at any time. With best regards,

Sincerely,

NORMAN D. SHUMWAY
Member of Congress

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

March 30, 1990

Mr. Merritt Rice
Project Manager
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Subject: American River Watershed, Fish and Wildlife Service Funding FY 1990

Dear Mr. Rice:

This is in response to the meeting that you held on March 29 with my staff regarding additional funds needed for work on the American River Watershed Study. As per agreement in the meeting we have revised the estimates that we transmitted on March 20, 1990. We understand that this funding is for anticipated work during FY 1990 to see us through the draft Coordination Act Report phase. Funding for completion of the final CAR will be negotiated later this year for FY 1991. See enclosure for the revised estimates.

If you have any questions regarding this matter, please contact Gary Taylor of my staff for further information (916-978-4613).

Sincerely,

Wayne S. White
Field Supervisor



United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

April 16, 1990

Mr. Merritt Rice
Project Manager
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Subject: American River Watershed, Information Needs

Dear Mr. Rice:

This concerns the March 29, 1990 meeting with you and members of my staff on project funding and remaining work to be done this fiscal year. As a result of that meeting, we submitted a letter dated March 30, 1990 describing tasks and funding needs (copy enclosed). Also, we agreed to provide our additional informational needs for completion of the draft coordination act reports scheduled for early June. They are as follows by project area:

Fremont Weir/Yolo Bypass - For each alternative protection level (100, 150, 200) and each plan (NED vs. EQ), we need the distance that the weir will be widened and levees lengthened. What area will be affected by construction (temporary and permanent construction easements)? How long will construction be in progress? What and where are sources of levee materials, location of haul roads, staging areas, and waste sites? Will the old levee be removed? What is the plan, if any, for revegetation of disturbed areas and new levees?

Sacramento Weir and Bypass - We need similar detail as in #1. Will widening occur to the north or south? What will happen to the existing levee?

Natomas and South Sutter County - Generally, the same information as in #1 is needed: (1) specific locations of levee raising and/or new levee construction; (2) height, slope, manner of construction, and construction period; and (3) details on weir location and size of facility. How will

STATE OF CALIFORNIA
STATE LANDS COMMISSION

LEO T. McCARTHY, *Lieutenant Governor*
GRAY DAVIS, *Controller*
JESSE R. HUFF, *Director of Finance*

GEORGE DEUKMEJIAN, *Governor*

EXECUTIVE OFFICE
1807 - 13th Street
Sacramento, California 95814

CHARLES WARREN
Executive Officer
(916) 322-4105

April 16, 1990

Don Maughan
Chairman
State Water Resources
Control Board
901 P Street
Sacramento, CA 95814

SUBJECT: California's Public Trust Responsibilities in Water Allocation Decisions

Dear Don:

The State Lands Commission is charged with the responsibility for management and protection of California's navigable waters. These waterways, which include inland lakes and rivers such as the Lower American, the Sacramento, and the San Joaquin, are held in public trust for fishing, navigation, picnicking, and as the Supreme Court states, "as ecological units for scientific study, as open space, and as environments which provide food and habitats for birds and marine life, and which favorable affect the scenery and climate of the area." Marks v. Whitney, (1971) 6 Cal.3d 251, 250-260.

Many of these waters, like the Lower American River, have been identified by the Commission as environmentally sensitive lands, and have been given wild and scenic designations by the Legislature.

In past years, actions taken to protect the people's trust in their navigable waters have traditionally been in the form of the prevention of trespass, County of Marin v. Roberts, (1970) 4 Cal.App.3d 480, 487; the prohibition of dredging and filling, Staten v. Superior Court (Lyon), (1981) 29 Cal.3d 210, and the removal of physical obstructions to the public rights of access and use. People ex rel. Baker v. Mack, (1970) 19 Cal.App.3d 1040. In National Audubon Society v. Superior Court, (1983) 33





Cal.3d 419, 436-437 however, the California Supreme Court quite logically held that "If the public trust doctrine applies to constrain fills which destroy navigation and other public trust uses in navigable waters, it should equally apply to constrain the extraction of water that destroys navigation and other public interests. Both actions result in the same damage to the public interest."

The need for public trust protection for the beds of these waters and their shorezones equally goes without saying. Our Supreme Court in another case noted that the shorezone is a "fragile and complex resource" which in its natural condition provides an environment necessary for the survival of numerous fish, birds and many other species of wildlife and plants, provides a gene pool for the preservation of biological diversity, and is essential to the maintenance of good water quality and as a buffer against flood and erosion. State v. Superior Court (Fogerty), (1981) 29 Cal.3d 240, 245-246.

Until the 1983 National Audubon decision, the doctrines of appropriation and public trust had been on "collision course." While the prior appropriation system, in the words of one commentator, had "both permitted and encouraged enormous economic growth in western agriculture, industries and municipalities," it had ignored public interests in such instream values as environmental quality, fishing, recreation, wildlife enhancement and clean water. R. Johnson, The Emerging Recognition of a Public Interest in Water: Water Quality Control by the Public Trust Doctrine, published in Water and the American West (Getches ed. Univ. of Colorado 1988). Consistent with that doctrine as it was recognized for many years, the Water Board's predecessor agency took the position that it was powerless to prevent harm to aesthetic and recreational values in allocating water. National Audubon, supra at 427-428. As a result, few rivers in California have escaped damage to their fisheries, channelization of their beds, and denudation of their shores in the interests of consumptive water uses and to the detriment of public trust values.

In National Audubon, however, the court integrated the doctrines of appropriative use and public trust, clarifying the State's responsibilities as trustee and providing the framework for cooperative action by the State Water Resources Control Board, charged with allocation of water under the beneficial use and trust doctrines, and the State Lands Commission, as trustee of the State's navigable waters.

The Supreme Court has given us several rules to follow in applying the trust:

1. There is an "affirmative duty to take the public trust into account in the planning and allocation of water resources, and to protect public trust uses whenever feasible." "Unnecessary and unjustified harm to trust interests" should be avoided. National Audubon, supra at 446.

2. The State has the power and affirmative duty to exercise continuing supervision over the taking of appropriate water, even when allocation decisions were made after consideration of their effects in the public trust. Id at 447.

These principles are consistent with more recent legislative directives governing the policy of water allocation. The Board today has the power and the duty to consider instream values in making water allocations: both by statute and under the public trust doctrine. See, e.g., Water Code §§ 1243, 1243.5, 1257, Public Res. Code §21000 et seq., Fish and Game Code §5937; California Trout, Inc. v. State Water Resources Control Board, (1989) 207 Cal.App.3d 585, U.S. v. California (1986) 182 Cal.App.3d 82, Robie, Some Reflections on Environmental Quality Considerations in Water Rights Administration, (1971) 2 Ecology L.Q. 695. [1]These principles mandate that water allocations be subject to continuous review with respect to their effect on public trust values, that the public trust be given independent consideration, over and beyond any beneficial use balancing, and that wherever over and beyond any beneficial use balancing, and that wherever feasible alternatives which protect trust values exist, they be followed. These alternatives can consist of water conservation measures, alternative sources of supply, and alternate points of diversion.[1]

In applying these principles to the Lower American it is important that decisions as to the amount and point of diversion of water be biologically based. That is, preservation of significant public trust resources, such as the River's ability to support fisheries and riparian habitat, should be the fundamental goal of any studies or actions taken. Judge Hodge's order in Environmental Defense Fund v. East Bay Municipal Utility District, in which a "physical solution" to maintain adequate flows in the Lower American is adopted, is such a biologically

[1]Indeed, in Peabody v. Vallejo, (1935) 2 Cal.2d 351, the Supreme Court held that the beneficial use doctrine requires that when supplies are limited there be "the greatest number of beneficial uses which the supply can yield." Id at 368. In its Decision D-1400 the Board recognizee that it was not only good water policy but good management to foster multiple uses for water when both trust and consumptive demands could be accommodated.





based decision. We urge, therefore, that the flows and standards set forth in that order be used by the Board as a baseline for analysis and decision. In this way, the Board can assure that flows are maintained at least at the minimum already deemed necessary by the court.

Thank you for this opportunity to discuss these matters with you. We look forward to working with you throughout your study and analysis of the public trust needs of the American River.

Sincerely,

Charles Warren
Executive Officer

cc: Larry Hancock, Regional Director
U.S. Bureau of Reclamation

Col. Jack Le Cuyer, District Engineer
U.S. Corps of Engineers

Pete Bontadelli, Director
California Department of Fish and Game

David Kennedy, Director
California Department of Water Resources

Brian Richter, County Executive
Sacramento County

George Barber, County Board of Supervisors
San Joaguin County

Anne Rudin, Mayor
City of Sacramento

Jerry Gilbert, General Manager
East Bay Municipal Utility District

John Krautkraemer
Environmental Defense Fund

Jim Jones
Save the American River Association

John Williams, Special Master
Alameda County Superior Court

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO, CALIFORNIA 95814-4794

REPLY TO ATTENTION OF

April 23, 1990

Planning Division

Dr. Bea Cooley
Executive Director
American River Coalition
909 - 12th Street, Room 207
Sacramento, California 95814

Dear Dr. Cooley:

Attached is a draft Working Paper for the American River Watershed Investigation. Besides meeting one of the requirements of the Corps planning procedures, the paper is intended to establish the overall scope and structure to the Feasibility Report (FR) and Environmental Impact Statement (EIS). The paper, particularly the EIS section, currently lacks sufficient technical detail in various study elements, including features of the Tentatively Selected Plan.

We would appreciate any observations you may have on the paper either in the form of comments or supplemental information. We plan to start preparing the initial draft of the FR and EIS in the next several weeks based on the working paper. Accordingly, we need your input by May 4, 1990.

If you have any questions please contact Merritt Rieu of this office at 551-1244.

Sincerely,

Walter Yep
Chief, Planning Division

Enclosure

A-53

SACRAMENTO AREA FLOOD CONTROL AGENCY

AGENDA OF: April 30, 1990

TO: Sacramento Area Flood Control Agency
Board of Directors

FROM: William H. Edgar
Executive Director

SUBJECT: AMERICAN RIVER WATERSHED INVESTIGATION--
4d. FEASIBILITY STUDY COST INCREASE

## SUMMARY

During the last Board meeting, staff indicated that the U.S. Corps of Engineers' American River Watershed Investigation Feasibility Study costs were increasing and that the existing cost sharing agreement would most likely need to be modified. On April 19, 1990, the Corps indicated that the increase could be as much as $2,100,000. This increased cost would be shared by the federal government (50%), the State (25%) and the remaining 25% to be spread to the six local entities contributors to the study (i.e. the Counties of Sacramento, Sutter and Placer; the City of Sacramento; the American River Flood Control District and the Reclamation District No. 1000).

## BACKGROUND/FINANCIAL DATA

The American River Watershed Investigation local cost sharing agreement was first entered into by the State Reclamation Board, Sacramento County, Sacramento City, Sutter County, Placer County, American River Flood Control District (ARFCD) and Reclamation District No. 1000 (RD1000) in June 1988. The non-federal interest was to fund 50% of the $2.5 million cost of the study.

During the first part of 1989, the Corps refined the cost estimates and determined that the study costs would increase by $800,000 for a total of $3.3 million. All the non-federal interests agreed to spread the costs based on the same percentage as the original agreement. The amended agreement was signed in April 1989.

On April 19, 1990, the Corps indicated that the cost of the feasibility study is likely to increase an additional $1.2 to $2.1 million. This increase will result in the following cost allocation:

926 J Street, Suite 424 . Sacramento, CA 95814
(916) 440-7606

| ORGANIZATION | ORIGINAL | 1989 INC. | 1990 INC. | TOTAL |
|---|---|---|---|---|
| State | $ 670,000 | $ 155,000 | $ 510,000 | $1,335,000 |
| Sac. City | 214,000 | 90,500 | 218,500* | 523,000 |
| Sac. County | 214,000 | 90,500 | 188,500 | 493,000 |
| RD1000 | 55,000 | 23,000 | 48,000 | 126,000 |
| Sutter | 45,000 | 19,000 | 39,000 | 103,000 |
| Placer | 26,000 | 11,000 | 23,000 | 60,000 |
| ARFCD | 26,000 | 11,000 | 23,000 | 60,000 |
| Non-Fed. Total | $1,250,000 | $ 400,000 | $1,050,000 | $2,700,000 |
| Federal Share | $1,250,000 | $ 400,000 | $1,050,000 | $2,700,000 |
| Study Costs | $2,500,000 | $ 800,000 | $2,100,000 | $5,400,000 |

*The City's share is higher because it has agreed to cost share in recreation related costs.

The Corps indicated that the increase is due to (1) more detailed federal requirements concerning cost estimates, (2) increased coordination as result of the project consensus process, (3) increased environmental requirements regarding wetlands, secondary impacts, reservoir area, etc. and (4) addition features such as recreation and storage space shifting.

During the American River Watershed Investigation Executive Committee meeting on April 19, 1990, Colonel Jack LeCuyer elaborated on the increased costs and provided Attachment A which details the areas where the major costs increases are anticipated and the areas where contingencies have been taken into consideration. Colonel LeCuyer assured the Executive Committee that he will have an audit performed to ensure the accuracy of the costs and that he will keep them fully abreast of future changes in a timely manner.

POLICY IMPLICATIONS:

The actions recommended are consistent with the Board's past practices in reviewing the major regional flood control issues prior to forwarding recommendations to the individual parent entities.





RECOMMENDATION

It is recommended that the attached resolution be adopted approving the increased feasibility study costs and recommending to the parent entities to approved the revised cost sharing formula.

Respectfully Submitted

William H. Edgar

WILLIAM H. EDGAR
Executive Director

May 7, 1990

American River Basin Branch

Mr. David N. Kennedy, Director
Department of Water Resources
State of California
1416 Ninth Street
Sacramento, California 95814

Dear Mr. Kennedy:

On April 19, 1990, at the Executive Committee Meeting, I notified you that the cost of the feasibility phase studies for the American River Watershed Investigation will be greater than previously estimated. This letter is to explain the increase and requirement for a modification to the Feasibility Cost Sharing Agreement (FCSA) for the investigation.

As you may recall, the current approved study cost is $3.3 million. We now estimate the cost to complete the investigation, barring significant changes in the selected plan, at $4.75 million. This is an increase of $1.45 million. As I explained in the April 19 meeting, the primary reasons for this increase in cost are (1) preparation and coordination of the Information Paper on Alternatives and related consensus building efforts, (2) the recent Federal requirement for more detailed and reliable cost estimate of the selected plan, and (3) significant increase in the effort required to identify and coordinate potential environmental impacts and mitigation features. We also estimate, however, that should there be a major change in the scope of the selected plan, the total cost to complete the study could be as much as $5.42 million. This is an increase of $2.12 million from the currently approved study cost. The additional increase of $670,000 ($2.12 - $1.45 million) is primarily to establish a contingency to allow for a major revision to the feasibility report following release of the document. However, this contingency would not cover the costs associated with a change in scope so significant that a complete redraft of the report and redistribution of a new draft report and EIS/EIR for comment is required.

Enclosed is a draft of the revised FCSA, essentially based on the information presented at the April 19 meeting. Table 1 of



that document is a breakdown of the estimated study cost increases under both the optimistic and contingency conditions. Included is a description of the reason for each change from the currently approved cost. Table 2 of the revised FCSA is a summary of the total revised study cost for the contingency condition. It also shows the estimated increase of work in-kind to be provided by the non-Federal participants. We have reviewed the above information with your staff and are currently working with them to identify the schedule for required funds transfers.

Concurrence for the cost increase from you and Mr. Wallace McCormack (President - The Reclamation Board) is needed in order for us to obtain our share of the increase. Accordingly, a letter from you stating agreement with the increased cost and assurance that funds will be provided is requested by May 14, 1990. Following its receipt we will prepare an amendment to the FCSA for your signature.

A similar letter has been sent to Mr. McCormack.

Thank you for your support in this matter. If you should have any questions or require additional information, please contact me.

Sincerely,

Jack A. Le Cuyer
Colonel, Corps of Engineers
District Engineer

Enclosures

May 7, 1990

American River Basin Branch

Mr. William McCormack, President
The Reclamation Board
1416 Ninth Street, Room 455-6
Sacramento, California 95814

Dear Mr. McCormack:

On April 19, 1990, at the Executive Committee Meeting, I notified Mr. Raymond Barach of your Board that the cost of the feasibility phase studies for the American River Watershed Investigation will be greater than previously estimated. This letter is to explain the increase and requirement for a modification to the Feasibility Cost Sharing Agreement (FCSA) for the investigation.

As you may recall, the current approved study cost is $3.3 million. We now estimate the cost to complete the investigation, barring significant changes in the selected plan, at $4.75 million. This is an increase of $1.45 million. As I explained in the April 19 meeting, the primary reasons for this increase in cost are (1) preparation and coordination of the Information Paper on Alternatives and related consensus building efforts, (2) the recent Federal requirement for more detailed and reliable cost estimate of the selected plan, and (3) significant increase in the effort required to identify and coordinate potential environmental impacts and mitigation features. We also estimate, however, that should there be a major change in the scope of the selected plan, the total cost to complete the study could be as much as $5.42 million. This is an increase of $2.12 million from the currently approved study cost. The additional increase of $670,000 ($2.12 - $1.45 million) is primarily to establish a contingency to allow for a major revision to the feasibility report following release of the document. However, this contingency would not cover the costs associated with a change in scope so significant that a complete redraft of the report and redistribution of a new draft report and EIS/EIR for comment is required.

Enclosed is a draft of the revised FCSA, essentially based on the information presented at the April 19 meeting. Table 1 of



that document is a breakdown of the estimated study cost increases under both the optimistic and contingency conditions. Included is a description of the reason for each change from the currently approved cost. Table 2 of the revised FCSA is a summary of the total revised study cost for the contingency condition. It also shows the estimated increase of work in-kind to be provided by the non-Federal participants. We have reviewed the above information with your staff and are currently working with them to identify the schedule for required funds transfers.

Concurrence for the cost increase from you and Mr. David Kennedy, Director, California Department of Water Resources, is needed in order for us to obtain our share of the increase. Accordingly, a letter from you stating agreement with the increased cost and assurance that funds will be provided is requested by May 14, 1990. Following its receipt we will prepare an amendment to the FCSA for your signature.

A similar letter has been sent to Mr. Kennedy.

Thank you for your support in this matter. If you should have any questions or require additional information, please contact me.

Sincerely,

Jack A. Le Cuyer
Colonel, Corps of Engineers
District Engineer

# County of Yolo

625 Court Street, Room 204 Woodland, California 95695 (916) 666-8195

First District — Clark H. Cameron
Second District — Helen Thomson
Third District — George P. DeMars
Fourth District — Betsy A. Marchand
Fifth District — Cowles Mast

BOARD OF SUPERVISORS

May 10, 1990

Colonel Jack A. Le Cuyer
U.S. Army Corps of Engineers
650 Capitol Mall, Room 6309
Sacramento, CA 95814

SUBJECT: Yolo Bypass -- Prospects for Environmental Mitigation

Dear Colonel Le Cuyer:

As the environmental documentation for both the American River Watershed and Sacramento Metropolitan Investigation progress, it appears that environmental mitigation for growth and development related impacts may be substantial. This is particularly true for the North Natomas area.

Also, the public is becoming more aware and recognizes the value in restoring habitat throughout the Central Valley for migratory waterfowl and other wildlife.

As we observe the myriad of activities that are currently taking place, we believe there would be a great deal of merit if all these forces could come to bear on a common goal. To this end, the Yolo County Board of Supervisors would like to offer for consideration by the Corps and other federal and state resource agencies, the concept of utilizing the Yolo Bypass as a federal/state managed waterfowl refuge.

The Yolo Bypass is a valuable resource for Yolo County in terms of agricultural production, its associated economics, and the tax base it provides. These factors are by no means minor, and in offering the concept of a waterfowl refuge, any adverse economic impacts on Yolo County must be offset.

Yolo County is interested in working with the Corps and other federal and state resource agencies and organizations to advance the concept of a Yolo Bypass National Waterfowl Refuge. We will be interested in your reaction to this proposal.

Sincerely,

Helen M. Thomson

Helen M. Thomson, Chair
Yolo County Board of Supervisors

HT:cn

cc: Congressman Vic Fazio

A-57

DEPARTMENT OF PUBLIC WORKS

DIVISION OF FLOOD CONTROL AND SEWERS

CITY OF SACRAMENTO
CALIFORNIA

1391-35TH AVENUE
SACRAMENTO, CA
95822-2911

916-449-5271

May 11, 1990
90244:BM:CC:rt

MEMORANDUM

TO: Bert McCollam, Division Manager

FROM: Craig Crouch, Senior Engineer

SUBJECT: COMMENTS ON THE APRIL 1990 DRAFT WORKING PAPER, AMERICAN RIVER WATERSHED, CALIFORNIA

At your request, staff has reviewed the subject report with the objective of providing the Corps of Engineers with informal comments. The following comments are within the areas of responsibility of the Division of Flood Control and Sewers and of the City of Sacramento as local cost-sharing entity and project co-sponsor. Other reviewing agencies (including SAFCA) have primary responsibility for commenting upon many key issues, including:

- formulation of alternatives,
- allocation of costs to the various project purposes,
- scoping of environmental studies

Therefore, our comments will be limited to the issue of impact of the proposed regional project upon local flood control and drainage projects. In addition to these comments, I understand that you will discuss with the Corps inclusion of Folsom reoperation plans into the Feasibility Report.

Growth Inducement and the North Natomas Drainage Project

Apparently, growth-inducing impacts of providing 100-year (or greater) flood protection to the Natomas area must be studied and mitigated in the course of the American River Project's environmental permitting process. The City has defined, and is currently preparing a Supplemental Environmental Impact Report (SEIR) for, a project to provide for the internal drainage needs of the North Natomas area as it urbanizes. Growth-induced impacts within the area were earlier addressed by the North Natomas Community Plan EIR. We strongly recommend that the scope

of the regional project studies provide for one-time-only mitigation of any growth-induced impacts in the North Natomas area (in the City or in the County), whatever component of the ultimate urban infrastructure these impacts may be associated with. However, the land use plans of the County may not be available to support this comprehensive treatment of growth-induced impacts.

The objectives of this one-time mitigation approach are to avoid repeated investigation and discussion of the same impacts (in CEQA and NEPA studies for flood control, drainage, highway/interchange, and other improvement projects) and to avoid repeatedly mitigating the same impacts. Any improvement of regional federal/state flood control facilities required to support behind-levee or upstream urbanization should be identified and the regional flood control plan should factor in those improvements early. The Corps should determine if timelines for the regional project and for the development and actual use of internal Natomas infrastructure are related. Any potentially significant impacts of peak drainage discharges from the urbanizing area would not occur for some years. However, any costs of mitigating ultimate impacts should be identified early by the Corps studies (so that those costs can be considered in the context of increasing system-wide Sacramento River Flood Control Project flows), and they should be allocated fairly and appropriately.

South Sacramento Urban Levees and Tributaries Project

On page 141, under Interior Drainage Problems, flooding from local streams is discussed. The report states that "the risk and certainty of flooding is great; however, in most cases, the flooding will be shallow and highly localized. The City and County of Sacramento have maps of many interior flood problem areas." The report goes on to describe the specific (and, for now, uncertain) risk to the Pocket Area from Morrison Creek. We recommend that this discussion be expanded to describe the efforts underway by the City and County to address many of the problems only generally alluded to.

Specifically to address local (internal) flood protection needs, the County and City have begun development of a revised and standardized hydrologic and hydraulic methodology, to be finalized in mid-1991 in the County-wide Drainage Manual. Concurrently, local agencies are studying or implementing projects on the following local streams:

- Arcade Creek - By mid-1991, the Drainage Manual consultant will also prepare for the City and County of Sacramento a master plan for providing 100-year protection along this stream.

- Beach Lake and Morrison Creek West Levees - By early 1991, the City will have completed reconnaissance-level investigations of the structural stability and height/freeboard adequacy of the levees which protect South Sacramento (including the Pocket Area) from flooding from Morrison Creek and from the south (high Delta stages and the Cosumnes and Mokelumne Rivers).





- Dry Creek - The Counties of Placer and Sacramento are developing flood control plans for the upper watershed.

- Florin and Strawberry Creeks - Studies to provide ultimate 100 or 200-year protection are beginning in August 1990, and implementation of the identified project is likely within 3 years if funding is obtained.

- Magpie Creek - Within the City of Sacramento, projects for 100- to 200-year protection are under study or preliminary design under: a) the Corps' 205 Small Project authority (on lower reaches); b) the Corps Military authority and the Air Force (within McClellan AFB); and c) local assessment district, road improvement, and drainage funding authorities (on middle reaches).

- Unionhouse, Elder, and lower Morrison Creeks - The Corps 205 Reconnaissance Study for flood protection improvements along these streams should be completed by September 1990. The project has a high local priority, and environmental studies and design should begin by early 1991.

The Corps should consult the County to clarify and confirm our descriptions of their projects and for information on other pending local flood control initiatives.

If the above detail is not included in the report, we would prefer that the fourth sentence on page 142 be worded: "The City of Sacramento is in the process of **investigating rehabilitation (to the original design grade or a more stringent current design criteria)** of the north levee of Morrison Creek west of Highway 99."

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

MAY 14 1990

Colonel Jack A. Le Cuyer
District Engineer
Department of the Army
Sacramento District Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Le Cuyer:

This is in response to your letter of May 7, 1990 which provided additional details supporting the increase in study cost for the American River Watershed Investigation and also provided a draft copy of the proposed amendment to the Feasibility Cost Sharing Agreement. This reply has been coordinated with The Reclamation Board.

The Department of Water Resources and The Reclamation Board concur in the need for the additional funds to complete the study. The 1989-90 and 1990-91 Governor's Budgets should include sufficient funds to cover the State's share of the net change in study costs. The local participants have indicated a willingness to fund their share of the increased cost; however, availability of the funds is subject to their approval of an amendment to the local cost-sharing contract. In anticipation of your request, we have already prepared a draft amendment for the local participants and it is being processed.

If you need further information, please call me at (916) 445-6582 or have your staff call Hal Higgins of our Central District office at (916) 322-6230.

Sincerely,

for David N. Kennedy
Director

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT CORPS OF ENGINEERS
650 CAPITOL MALL
SACRAMENTO CALIFORNIA 95814-4794

REPLY TO ATTENTION OF

CESPK-PB (11-2-240f) 21 May 1990

MEMORANDUM FOR: Commander, South Pacific Division

SUBJECT: Revision of Study Cost Estimate: Northern California Streams, American River Watershed Investigation, CA

1. Reference CESPK-PB letter dated 18 April 1990, subject: Request for Additional FY 1990 General Investigations Funds: American River Watershed Investigation, Northern California Streams, CA.

2. Enclosed for review and approval is a revised Study Cost Estimate for the Feasibility Phase of the subject study.

3. The previous approved PB-6 estimate is $3,300,000 for the Feasibility Phase. The current estimate to complete Feasibility studies is an increase of $2,200,000 ($1,100,000 Federal and $1,100,000 non-Federal) which includes an appropriate contingency amount on each feature (subaccount) of the study. The State of California, study sponsor, is in full support of the increased estimate and has provided assurances of their willingness and ability to provide their share of costs. A draft amendment to the FCSA reflecting the increase has been approved by the local sponsors and is pending execution.

4. The high visibility and political sensitivity of this study have required additional levels of detail, increased public involvement and development of additional alternatives. The increased cost estimate is specifically due to preparation and coordination of the Information Paper on Alternatives, the recent Federal requirement for a more detailed and reliable M-CASES cost estimate of the selected plan and a significant increase in effort to identify and coordinate potential environmental impacts and mitigation measures.

5. All study funds are essentially exhausted except for $182,000 requested by the above referenced letter. Currently, expenditures are averaging $200,000 per month and will increase in accordance with effort required to meet the scheduled completion date.





6. Federal funds of $450,000 are required in FY 1990 for the increased estimate and potential sources of the funds are as illustrated below:

| Amount | Source |
|---|---|
| $244,000 | Sacramento-San Joaquin Delta - Of the $294,000 remaining funds withheld at HQUSACE, $244,000 are not required due to delay in executing a cost-sharing agreement. ($19,000 previously reprogrammed out) |
| $65,000 | Yolo Bypass - Of the $150,000 funds withheld at HQUSACE only $21,000 will be required this FY because of a delay in initiating reconnaissance. (Additional $64,000 reprogrammed to another project). |
| $114,000 | Yuba River - Unobligated funds of $64,000 are excess to study needs in this fiscal year. Funds of $50,000 withheld at HQ USACE are also surplus to current year study needs. |
| $27,000 | Calaveras - $50,000 withheld at HQUSACE to initiate feasibility are excess in FY 90 due to extended schedule for reconnaissance. (Remaining $23,000 will be reprogrammed to other projects.) |
| $450,000 | |

7. Request immediate approval of revised Study Cost Estimate and reprogramming of funds as requested so that the critical study schedule can be maintained. Congressional Reprogramming Fact Sheet and Reprogramming Request Information Sheets are enclosed.

JACK A. Le COYER
Colonel, EN
Commanding

PLACER COUNTY

DEPARTMENT OF PUBLIC WORKS

JACK WARREN Director
JAN WEITER Assistant Director
LARRY QUICK Deputy Director
AL ARROYO Deputy Director

May 29, 1990

Mr. Larry Dacus
U. S. Army Corps of Engineers
650 Capitol Mall CESPK-ED-P
Sacramento, CA 95811

Subject: AMERICAN RIVER WATERSHED MAIN REPORT

The Placer County Department of Public Works has reviewed the Draft Working Paper for the Feasibility Report/EIR/EIS on the American River Watershed. We realize that the paper is in a very preliminary phase; therefore, our comments will be of a very general nature.

Our major concern is with the relocation of Highway 49. This part of the project could result in the greatest impact on the community and could well be the most controversial aspect of the Dam. The route will traverse a rapidly growing area and could result in significant noise, land use, visual, and air quality impacts. It may be that these impacts cannot be mitigated to a less than significant level.

We believe that these impacts should be addressed in this document in a formal manner. A decision to build a dam is a decision to relocate Highway 49. Therefore, policy makers should understand the ramifications of their decision. Since there appears to be only two alignments under serious consideration, a preliminary planning analysis could be performed with this document. It is not intended to take the place of a Route Adoption Study by Caltrans; however, it would give a general picture of the types of impacts that would occur.

The document should also address the impacts from construction and material supply vehicles. Access roads to this area are limited. The I-80/Newcastle interchange has limited capacity and may experience problems with large vehicles or high truck volumes. Similar problems exist in the city of Auburn.

[illegible] Fax (916) 885-3159



We would also like to comment on the Table 21 cost estimate found on page 76. It shows the Middle Fork crossing one-th more expensive than the R.M. 17 crossing. We question th relationship and would like to review the basis for this estimate.

We look forward to working with your agency on this project request that we be included in meetings that concern the system.

COUNTY OF PLACER
DEPARTMENT OF PUBLIC WORKS

JACK WARREN, DIRECTOR

c: Bob Everett, Caltrans

JW:RD:cp

United States Department of the Interior
FISH AND WILDLIFE SERVICE
1002 NE HOLLADAY STREET
PORTLAND, OREGON 97232-4181

May 29, 1990

Colonel Jack A. LeCuyer
District Engineer
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814-4794

Dear Colonel LeCuyer:

Enclosed are acceptance copies of the DA-2544 increasing funding for the American River Watershed Project (1926-K4).

Sincerely,

Robert P. Smith
Assistant Regional Director
Fish and Wildlife Enhancement

Enclosures

A-61

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
65 C QUINTA CT.
SACRAMENTO, CA 95823
(916) 602-7044

June 21, 1990

Mark Sogge
Army Corps of Engineers
544 Downtown Plaza
Sacramento, CA 95814

Mark:
Subject: Farmland Conversion Impact Rating - American River Watershed Project

On March 20, 1990 you requested a Farmland Impact Conversion Rating for the American River Watershed Project. Several phone calls and one meeting with Jerry Fuentes later, we have concluded that in this case, completing the rating form is meaningless.

In preparing the Agriculture section of the Draft EIS (6/90) for the project you have done a thorough job of identifying both the direct and indirect impacts of the project on the loss of important farmlands. The process that SCS would have gone through to calculate to acreages of important farmlands involved would not have been as accurate as the method you used. Therefore, your figures are acceptable to the SCS and should be used.

Since this project will have an impact on agriculture that goes beyond the loss of important farmlands, I hope that you will address the concerns of the farmers and ranchers in the project area. They can easily be reached through organizations such as Resource Conservation Districts, and the Farm Bureau.

Sincerely,

David Simpson
District Conservationist

cc: Wayne Sheldon, SCS
Bill Beatty, SCS

...TE OF CALIFORNIA - RESOURCES AGEN... GEORGE DEUKMEJIAN, Governor
...E RECLAMATION BOARD
...16 Ninth Street, Room 455-8
...acramento, CA 95814
...(916) 445-9454

JUN 2 6 1990

Colonel Jack A. Le Cuyer
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Le Cuyer:

This letter is in reference to the American River Watershed Feasibility Study and the Local Sponsor's responsibility for the operations, maintenance, repair, replacement, and rehabilitation of the proposed Auburn flood control dam, the associated lands, and any advanced features the dam may have.

As the local sponsor of the American River Watershed Feasibility Study, The Reclamation Board has recently met with the Department of Water Resources, the Sacramento Area Flood Control Agency, the Corps of Engineers, and the U. S. Bureau of Reclamation concerning the operations and maintenance of the proposed Auburn flood control dam. SAFCA, a potential local partner in the project, has stated they are not technically capable of directly operating, maintaining, and conducting other activities associated with the flood control dam.

SAFCA, as the primary local beneficiary of the project, will likely carry lead responsibility for the reimbursement of all expenditures incurred by the organization or agency carrying out the prescribed maintenance activities. Through future assessment authority, SAFCA will be able to collect the necessary operations and maintenance funds from the project beneficiaries for reimbursement to the organization conducting the work.

The Bureau has indicated interest in assuming operations and maintenance responsibilities for the dam and its advanced features. The Bureau has an interest in the project because of its impact on the operation of Folsom Dam and Reservoir which lie downstream of the Auburn damsite. Because of its experience in operating and maintaining Folsom Dam, as well as the other dams and facilities of the Central Valley Project, the Bureau is well qualified to operate and maintain the Auburn Dam facilities.



DWR is also capable of performing the necessary operations and maintenance. If its personnel were to carry out the maintenance and other associated duties at the flood control dam, a maintenance district could be formed under existing provisions (Section 12878) of the California Water Code. The formation of a maintenance district would require that DWR be fully reimbursed for all maintenance activities.

In conclusion, the Board, as potential local sponsor, has two alternatives to provide the federally required operations, maintenance, repair, replacement, and rehabilitation responsibilities if Auburn Dam is part of a federally authorized project. We will continue to pursue these alternatives as the project studies move forward.

If you have any questions on our approach, please call me at (916) 445-9454 or have your staff contact Peter Rabbon at (916) 445-8984.

Sincerely,

RAYMOND E. BARSCH
General Manager

cc: (See attached list.)

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET SACRAMENTO (916) 445-9248
P.O. BOX 942836 94236-0001

GEORGE DEUKMEJIAN Governor

STATE OF CALIFORNIA RESOURCES AGENCY
THE HONORABLE [illegible]
1416 Ninth Street, Room 455 8
Sacramento, CA 95814
(916) 445-9454

JUN 2 7 1990

Mr. Robert J. Reeb, Manager
El Dorado County Water Agency
330 Fair Lane
Placerville, CA 95867

Dear Mr. Reeb:

Thank you for your letter of May 23, 1990 expressing your Agency's intent to contract for a water supply from a multipurpose Auburn Dam project.

The Department of Water Resources has been working with your Agency to evaluate El Dorado County water needs and water supplies. We also will assist the U. S. Bureau of Reclamation if it initiates studies of a multipurpose Auburn Dam.

If you have any questions on our activities associated with the American River, please call me at (916) 445-6582 or Hal Higgins of our Central District office at (916) 322-6230.

Sincerely,

David N. Kennedy
Director

Colonel Jack A. Le Cuyer
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Le Cuyer:

Attached is a draft financing plan for the American River Watershed Investigation Project. The draft plan describes the financing mechanism for the nonfederal costs of the project.

If you have any questions, please contact me at (916) 445-[illegible]; have your staff contact Peter Rabbon at (916) 445-8984.

Sincerely,

RAYMOND E. DARSCH
General Manager

Attachment

STATE OF CALIFORNIA RESOURCES AGENCY

THE RECLAMATION BOARD
1416 Ninth Street, Room 455-6
Sacramento, CA 95814
(916) 445-9454

GEORGE DEUKMEJIAN, Governor

JUN 6 1990

Colonel Jack A. Le Cuyer
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Le Cuyer:

During the June 6, 1990 Reclamation Board meeting, the Board approved the study cost increases for two of the ongoing feasibility studies: (1) the American River Watershed Investigation, and (2) the Sacramento Metropolitan Area Investigation. Copies of the signed documents are enclosed.

The Board is concerned that the cost estimates for these investigations are increasing at such large percentages. They put this concern on the record and asked me to relay the message to you. Once the Board is committed, there is no stopping halfway; however, when the nonfederal share doubles, it is hard to budget and to explain the increases. The Board is involved in many studies with the Corps and if they were all to increase, we would be overcommitted. I know this is also a concern to you and your staff. We may want you to address the Board in the near future to discuss this further.

If you have any questions, please call me at (916) 445-9454.

Sincerely,

RAYMOND E. BARSCH
General Manager

Enclosures



STATE OF CALIFORNIA RESOURCES AGENCY

THE RECLAMATION BOARD
1416 Ninth Street, Room 455-6
Sacramento, CA 95814
(916) 445-9454

JUL 11 1990

Colonel Jack A. Le Cuyer
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Le Cuyer:

Attached is a draft letter of intent from The Reclamation Board to the Corps of Engineers confirming that the Board intends to act as a local sponsor for the flood control project of the American River Watershed Investigation. We intend to send the letter final subsequent to completion of the public hearing process.

If you have any questions, please call me (916) 445-9454 or have your staff call Peter Rabbon at (916) 445-8904.

Sincerely,

RAYMOND E. BARSCH
General Manager

Attachment

Congress of the United States
House of Representatives
Washington, DC 20515

July 16, 1990

Mr. William H. Edgar
Executive Director
Sacramento Area Flood Control Agency
926 J Street, Suite 424
Sacramento, CA 95814

Dear Bill:

Thank you for the opportunity to review the position on the Bureau of Land Management's recent draft national recreation area report which you have proposed to the Sacramento Area Flood Control Agency Board. We are in complete accord with your recommendation.

We believe an American River National Recreation Area could be a good thing for Northern California, both economically and environmentally. It is one of those rare instances where both jobs and preservation of our natural and historical heritage can be promoted.

However, the NRA's importance does not begin to compare with the necessity for obtaining flood protection for Sacramento as soon as possible. We will have to forgo the potential benefits of an NRA if it becomes an impediment to flood control. It is unfortunate but entirely possible that we will be forced to forgo these potential benefits not because an NRA could not be made to work but because polarizing entities on both sides of the flood control debate are distorting it for their own purposes.

We wish to convey to you two points concerning the NRA. First, under no circumstances will we support or allow Congress to pass an NRA authorization bill that does not provide for inundation of the Auburn Canyon as an automatic consequence of a decision by Congress to expand a flood control dam for water and power purposes. To fail to make and adhere to that pledge would be to compromise our commitment to a flood control dam which is entirely neutral on the question of water and power development at Auburn. It would make a mockery of the expandability of the expandable dam. Since we see complete impartiality on the question of water and power as essential to reaching an agreement on flood control, we are committed and will oppose any NRA which compromises that neutrality.

No one can be for flood control who doesn't accept that the flood control dam must be sufficiently expandable so as to be neutral on the issue of expansion.

Second, we will not act or support Congressional action on an NRA unless it is in the context of Sacramento's entire flood control program. The NRA will not go first.

Thank you again for informing us of your recommendations and for this opportunity for articulate again our views on this extremely controversial subject.

Very truly yours,

VIC FAZIO
Member of Congress

ROBERT T. MATSUI
Member of Congress

# United States Department of the Interior

## FISH AND WILDLIFE SERVICE

Central Valley Habitat Joint Venture Coordinator
2233 Watt Avenue, Suite 375
Sacramento, California 95825-0509

July 24, 1990

Mr. Fred Kindel, Chief
Environmental Resources Branch
U.S. Army Corps of Engineers, Sacramento District
650 Capitol Mall
Sacramento, California 95814

Dear Fred,

As we have discussed, the Central Valley of California is the most important wintering area for waterfowl in the Pacific Flyway, supporting sixty percent of the total population. Historically, the Central Valley contained more than four million acres of wetlands; now only 291,555 acres remain. In June, 1989, the U.S. Fish and Wildlife Service published Wetlands of the California Central Valley: Status and Trends (1939 to mid-1980's). I have enclosed a copy of this report for your information.

We have reviewed the draft American River Watershed Investigation of the Natomas Area completed by our Fish and Wildlife Service Enhancement Office, and are pleased to see that some wetlands are being considered as mitigation within the Natomas area.

The Natomas Area falls within the American Basin objectives for the North American Waterfowl Management Plan, and the Central Valley Habitat Joint Venture (CVHJV) Implementation Plan. This 55,000 acre area is extremely important to the wintering populations of waterfowl as a feeding and resting area. Radio telemetry studies recently conducted by our USFWS Research Station in Dixon have documented heavy waterfowl use in the fields and wetlands of North Natomas with some birds coming from the Yolo Bypass and as far away as Sutter National Wildlife Refuge to the north.

For the American Basin, the CVHJV objectives are: 1) protect 2,000 acres of existing wetlands through fee acquisition or perpetual conservation easement; 2) restore and protect 10,000 acres of wetlands; 3) enhance 3,150 acres of existing wetlands; and 4) enhance 20,948 acres of private agricultural lands for wintering and nesting waterfowl.

We also note that no wildlife restoration or enhancement projects are proposed for the area south of Sacramento in the Stone Lakes area. This flood zone is being planned as a National Wildlife Refuge which calls for substantial restoration and enhancement of wetlands which have been drained and farmed as a result of previous flood protection measures. We hope that you will also consider this former wetland area in your environmental engineering for the American River Project. We stand ready to provide you with conceptual restoration and enhancement plans.

This office is prepared to work with you and the Corps in carrying out the new mission of mitigation, restoration and enhancement, in an effort to include your environmental engineering for the American River Project in objectives of the North American Waterfowl Management Plan.

Now is the time to acquire these lands in fee title or easement and restore and manage them in accordance with the North American Waterfowl Management Plan.

Sincerely,

David G. Paullin

David G. Paullin
Joint Venture Coordinator

cc: SFO, Sacramento, CA

July 24, 1990

Dr. Bea Cooley, Director
American River Coalition
909 12th Street, Room 207A
Sacramento, CA 95814

Dear Bea:

In response to your letter dated July 20, 1990 in which you discussed several issues and asked a question, the following is my reply.

First, I believe that it is true that the more responsible environmental organizations and representatives have attempted to assist us in providing the Sacramento community with the necessary flood control improvements that are critically needed now. This assistance has been demonstrated not only in the public statements from time to time, but also in a willingness to refrain from technical and legal challenges which could have prevented the levee rehabilitation project from proceeding on time. Also, I believe that our difficult negotiations over the interim moratorium in Natomas was indicative of everyone coming together in order to reach a satisfactory compromise. In my view, it is imperative that these efforts continue if a reasonable and prudent level of flood protection for Sacramento is ever to be achieved.

Second, with respect to the issue of Congress considering the creation of a National Recreation Area (NRA) in the Auburn Canyon area prior to deciding on the issue of flood control, I would simply point out that Ed Hastey's letter (attached) clearly states that, "these comments will be used in preparing a final study for submission to Congress before September 30, 1990."

As you might suspect, this statement caused considerable concern among not only the multipurpose dam supporters, but also those of us who have attempted to remain neutral on the multipurpose dam issue. You are obviously well aware that the Auburn Canyon National Recreation Area designation has been a priority for environmental organizations since 1984 (before the flood events). And, given the fact that several advocates testified at the Bureau of Land Management (BLM) hearings that the best way to stop the multipurpose dam was to designate the area as an NRA, many (including myself) became somewhat suspicious of the process.

Bea, given Ed Hastey's statement that the study will be submitted to Congress, "...prior to September 30, 1990," the well known fact that environmental groups have been supporting an NRA designation for the Auburn Canyon since 1984, and given the strident testimony on behalf of the advocates at the BLM hearings, I believe the concern of a premature Congressional hearing on this matter was well founded and justified. In any event, I am relieved that both Vic and Bob have restated their positions that the issue of an NRA designation for Auburn will not be taken up by the Congress separately from flood control.

926 J Street, Suite 424 . Sacramento, CA 95814
(916) 440-7606





Third and finally, your point on the definition of neutrality is well taken. We do disagree. As you recall, in 1988 Congress directed the Corps to examine potential flood improvements for the Sacramento area. Pursuant to those studies the draft feasibility report will recommend the authorization of a project designated to provide high levels of flood protection to metropolitan Sacramento. Along the mainstem of the American River, the project will include the construction of a flood control dam at the existing Auburn Dam site. This facility will contain certain "advance features" which are not strictly necessary for flood control, but which will permit the conversion of the flood control dam into a multipurpose facility without imposing significant retrofit costs on water and power interests or, alternatively, compelling those interests to replace the flood control dam with an entirely new multipurpose structure.

Neutrality has always turned on the design and construction of the expandable features of the flood control dam. The issue has been whether or not the dam could be designed and constructed in such a way as to neither advance nor impede the development of water and power facilities at the Auburn site. The debate has never been conducted on the issue of whether or not the construction of a flood control dam in and of itself would skew the existing circumstances in the canyon regardless of the design of the dam. Rather, the debate has been about the type and nature of the advance features to be included in the flood control dam. We have always been supportive of including those features that do not enhance expansion but at the same time do not preclude options for the future.

The "advanced features" being proposed at this point consist of provisions for the addition of penstocks for power generation, the foundation for a future wet well and a continuous downstream slope of the dam section. The purpose of including these features in the design of the flood control dam is not to facilitate the development of water and power facilities at the Auburn site. Rather, they are being included in order to offset the discouraging effect that a non-expandable dam would otherwise have on water and power. A flood control dam which occupies that site and which is not efficiently convertible to multiple purposes could impede the subsequent development of water and power facilities by compelling water and power interests to either fund the retrofitting of the flood control dam or replace this dam with an entirely new multipurpose structure. Flood control would not help fund the retrofit or contribute to a new multipurpose dam because flood control would be a pre-project condition and there would be no new flood control benefits to justify more flood control costs. As a result, water and power interests would pay more to retrofit or replace a flood control dam than they would contribute as their shares to the construction of a new conventional dam serving water, power, flood control, and other purposes.

Thus, the rationale for including the "advance features" in the flood control only facility is to preserve the pre-project status quo by offsetting potential economic impediments to the development of water and power facilities at Auburn, and by insuring that the prospects for such development are no better or worse after the construction of the

expandable dam than they would have been had no action been taken. This in my view is what has always been meant by neutrality. From this perspective, it may be argued that construction of the proposed flood control dam with "advanced features" would not significantly enhance or facilitate, nor would it significantly discourage or hinder, development of water and power at the Auburn site compared with the present situation.

I hope this is an area in which we can come to agreement. I look forward to working with you in an effort to do so as we both strive to provide Sacramento with adequate flood protection.

Sincerely,

WILLIAM H. EDGAR
Executive Director

PLACER COUNTY

DEPARTMENT OF PUBLIC WORKS

JACK WARREN, Director
JAN WITTER, Assistant Director
LARRY ODDO, Deputy Director
ALAN ROY, Deputy Director

July 26, 1990

Robert O. Watkins, Director
Caltrans District 03
P.O. Box 911
Marysville, CA 95901

Subject: HIGHWAY 49/AUBURN_DAM

Dear Bob,

For the past two years or more, the Corps of Engineers has been working on a Feasibility Study for a Flood Control Dam at Auburn that, until the last few days, included the relocation of Highway 49 where it crosses the American River to a site outside the project area.

You may recall that Placer County submitted a recommendation for a future study project to Caltrans that recommended the relocation of Highway 49, so that it would connect to the existing high level bridge over the North Fork of the American River and to the Community of Cool. The Corps of Engineers, in their earlier analysis, disregarded the local preference and recommended a route to the south of the proposed dam, connecting with Highway 80 in Newcastle. The Corps of Engineers (more recently) suggested that the relocation of Highway 49 be left to Caltrans totally, and they would not participate any further in location studies.

On July 25, 1990 at a meeting in Sacramento, which was attended by Bob Merrill from your office, yet another position was put on the table suggesting that the dam project include (at local expense) the construction of a new bridge in the same location as the old bridge, but at an elevation to accommodate the chosen flood control facility.

As you can see, we have a moving target - which has not yet stopped moving. This current proposal generates the following questions directed to you:

1. Will Caltrans agree with replacement of the highway structure at the existing location, knowing that the access roads to the structure will not meet Caltrans requirement for minimum grade and other design features?

11444 B Avenue / Dewitt Center / Auburn, California 95603 / (916) 889-7500 / Fax (916) 885-3199



HIGHWAY_49/AUBURN_DAM

2. Will Caltrans agree to a reconstruction at the existing location, knowing that a full size Multi-Purpose Auburn Dam would innundate the new structure?

3. What would be the impact of this proposal on County Minimums for Placer and El Dorado Counties?

4. If the Corps of Engineers reverts to one of their earlier positions to relocate Highway 49 out of the project area, would County Minimums be affected?

5. Would it, in your opinion, be appropriate for Placer County and for Caltrans to discuss the relocation of Highway 49 and the Auburn Dam project at the upcoming meeting with the California Transportation Commission, scheduled for August 10, 1990 in Sacramento?

I look forward to your early response to these very serious questions and, perhaps, a more indepth discussion at a mutually convenient time.

Very truly yours,

COUNTY OF PLACER
DEPARTMENT OF PUBLIC WORKS

JACK WARREN, DIRECTOR
JW/jm
cc: Board of Supervisors
Don Lunsford
Scott Chadd
Herritt Rice
Walter Yep
Jan Witter
Alan Roy
Larry Oddo

July 27, 1990

American River Basin Branch

Mr. David M. Harris, Team Leader
Bureau of Land Management
Folsom Resources Area Office
63 Natoma Street
Folsom, California 95630

Dear Mr. Harris:

I have reviewed your draft report on the American River National Recreation Area (NRA) Feasibility Study. The report was helpful in explaining the criteria for designating NRA's and the consequences of such a designation for the American River Watershed.

Since your team was briefed on the status of the Corps of Engineers' American River Watershed Investigation, we have modified the final range of alternatives that are being addressed. Specifically, alternative plans for providing high levels of flood protection to the Sacramento metropolitan area no longer include the local benefits minimum pool dam alternative that is discussed in your report. Additionally, the alternative plans are not limited to the 200-year level of protection that is discussed. The selected plan will be optimized at a level that provides the greatest net benefits, or some other locally preferred level of protection can be selected. I have provided several comments addressing these and other technical aspects of the Corps flood control studies that you refer to in your report.

I hope these comments are helpful in completing your report. If you have any questions regarding these comments, please contact Mr. Herritt Rice at (916) 551-3244.

Sincerely,

Jack A. LeCuyer
Colonel, Corps of Engineers
District Engineer

AMERICAN RIVER COALITION
CALIFORNIA NATURAL RESOURCES FEDERATION
ENVIRONMENTAL DEFENSE FUND
FRIENDS OF THE RIVER
NATIONAL WILDLIFE FEDERATION
NATURAL RESOURCES DEFENSE COUNCIL

August 13, 1990

The Honorable Robert W. Page
Assistant Secretary of the Army (Civil Works)
Room 2-E-570
The Pentagon
Washington, DC 20310-0103

Dear Secretary Page:

As you know, the Sacramento District of the Corps of Engineers is presently developing a feasibility report and environmental impact statement on flood damage reduction alternatives for the American River near Sacramento, California. The District has made it clear that it favors a flood control dam at the site of the long-debated Auburn Dam, a currently authorized, but long-stalled multi-purpose Bureau of Reclamation project. We believe there is reason to question much of the methodology, and the resulting conclusions, used by the Sacramento District to justify its Auburn project.

It is our understanding that various issues relating to Auburn Dam were discussed but not resolved at a recent Feasibility Review Conference on the Sacramento District's proposed report. Because the District has not responded to prior criticisms of its analysis of the flood risk to Sacramento, and of the alternatives for alleviating that risk which it is willing to consider in depth, we are writing to bring our concerns to your attention prior to the release of the draft feasibility report. The issues raised in this letter and its attachments need to be addressed in order to ensure that the legitimate concerns of the Sacramento area with respect to flood damage reduction are addressed in a timely, economical, and environmentally sensitive manner.

By way of background, the Corps completed construction of Folsom Dam on the American River above Sacramento in 1955. Prior to Folsom



Dam's construction, the Corps promoted that project as one that would forever protect the Lower American River watershed, below the dam, from flooding. This was stated in both the popular and technical Corps documents of that era.

Soon after a significant flood in 1955, albeit one well within the capabilities of Folsom Dam to handle, the Corps and the Bureau began to change their view. More flood protection was thought to be needed and promotion began for a second major dam on the river at the Auburn site, upstream of Folsom. In 1965, a multi-purpose Auburn Dam was authorized for construction as a Bureau of Reclamation project, based in part upon the new flood protection rationale. In the 1970's, after the construction of a coffer dam had been completed, this project was stalled due to seismic, environmental, economic, and legal concerns.

In 1987, following another significant storm in February 1986, but again one which Folsom Dam should easily have handled had it been operated properly, the Sacramento District reanalyzed the risk to the Sacramento area from flooding of the American River. The conclusions of this recent analysis have been the impetus for renewed efforts to construct a flood control dam at the Auburn site. Based upon an independent review of the District's analysis, undertaken for the Environmental Defense Fund by Philip Williams and Associates, we believe that the analysis exaggerates the probability of large floods and is biased toward the construction of an upstream dam. Furthermore, the District's analysis ignores the opportunity for least-cost alternatives, such as avoiding in the future misoperation of Folsom Dam similar to that which occurred in 1986, which could provide immediate increased flood protection for the Sacramento area. As a result, critical choices now being presented for the prevention of flood damage to the Sacramento area may not be grounded on credible information.

We also question whether it is appropriate for the federal government to provide funds for a given community to achieve a level of flood protection in excess of what FEMA considers sufficient to meet federal flood insurance requirements, when this may decrease the availability of funds for other projects. Given the relatively small amount of funds that, under current law, non-federal interests are required to contribute for costs allocated to flood contro – compared with costs allocated to other project components, such as water supply and power -- such a policy provides a strong incentive for local communities to "gold

PART B

FLOOD-CONTROL OPERATION

FOLSOM DAM AND RESERVOIR
AMERICAN RIVER, CALIFORNIA

1. Operational requirements.- Folsom Reservoir will be operated for flood control in accordance with the regulations contained herein to achieve the following objectives:

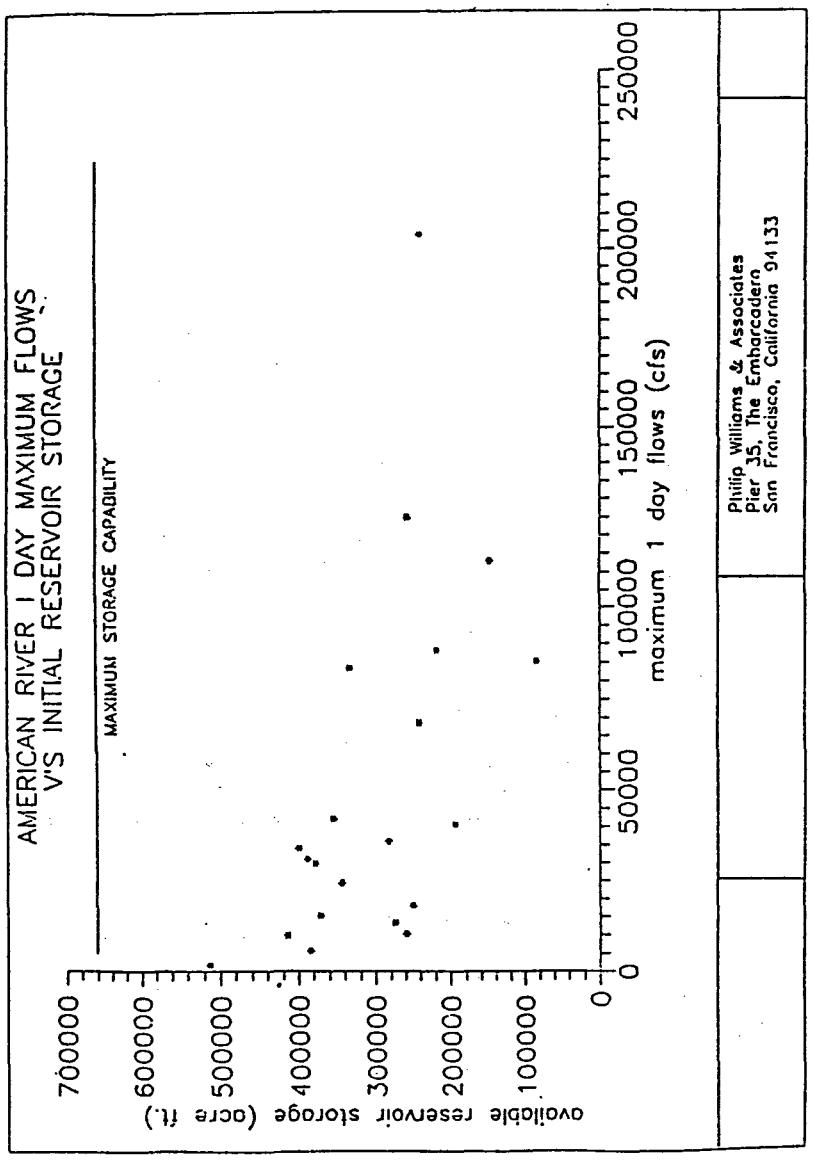
a. To eliminate flood damages along American River between Folsom Dam and the confluence of the American and Sacramento River, by utilizing a maximum of 400,000 acre-feet of flood control space.

b. To permit use of the maximum practical amount of storage space for conservation and power purposes without impairment of the flood control functions.

2. Flood control space will be required only for control of large rain floods, inasmuch as downstream channel capacities are adequate to carry ordinary rain floods and the maximum unregulated snowmelt discharge. The occurrence of large rain floods is restricted to the months of October through May, and there is no need to reserve space for flood control in the remaining months. Since the rain-flood potential during the winter months is dependent to a large extent upon the wetness of the ground, provisions have been incorporated in the regulations to provide more space when this potential is high and less space when it is low.

3. Flood control releases from Folsom Reservoir will be very large in comparison with the space reserved for flood control, and the adequacy of this reservoir for flood control is dependent upon the full and prompt use of the release capacity. For example, a 12-hour delay in the initiation of flood control releases would have the same effect on flood control as would diminishing the flood control space by 100,000 acre-feet. Consequently, it is essential that the need for releases be determined at the earliest possible time and that action to initiate releases be taken as soon as possible.

4. Operation plans in previous reports. - The only operation plan previously published is that contained in the Definite Project Report, Folsom Dam and Reservoir, Part 1-Hydrology, revised 12 October 1949. That plan is identical to the plan contained herein except as follows:



4. Hydrograph. The same form of the hydrograph developed by the Corps for the 200-year flood was used and adjusted for upstream storage by subtracting the daily volume stored for the preceding day.

5. Operation of Folsom. It is assumed that Folsom is operated according to the 1959 operating manual, and specifically Part B, Clause 3 is obeyed (see attachment). This is in contrast to the Corps's assumption that the reservoir will be managed so as to lose 80,000 ac-ft of flood storage prior to the main flood flow.

6. Downstream Levee Capacity. Downstream levees protecting Sacramento were originally constructed to convey mean daily flows of 180,000 cfs and peak flows of 240,000 cfs (American River Flood Control District, December 1929). In 1958, after the construction of Folsom, the channel capacity above Cal Expo was downgraded by the construction of the Corps American River Project levee, with a capacity of 152,000 cfs with 3 ft. of freeboard, or 115,000 cfs with 5 ft. of freeboard. Since the construction of Folsom, the river channel has lowered over time, increasing effective channel capacity; however, it is unclear whether levees have been adequately maintained. Except for the Natomas area (see below), the Corps assumes the maximum flow without levee failure to be 140,000 cfs (see Table 5, Corps 1987 study). (134,000 cfs was released in 1986.)

   It is possible to upgrade the existing levees to at least their original design capacity of 152,000 cfs with 3 ft. of freeboard by reinforcing the levee core and, if necessary, by raising the levee crown - probably less than 1 ft. Neither of these actions need be environmentally destructive. FEMA flood insurance regulations require 3 ft., not 5 ft. of freeboard as assumed by the Corps.

7. Backwater from Sacramento River. It was assumed that with correct operation of Folsom, coincident peaks on the Sacramento and American would be unlikely to occur and the design backwater elevation affecting the Natomas Drain would be at least 1 ft. lower than used in the Corps analysis. This would mean that non-damaging American River flows could be significantly higher than the 135,000 cfs assumed by the Corps.



8. Benefits of using telemetered flood warning data. Prior analysis ("Operation of Folsom Dam for the American River Standard Project Flood," 1973) indicates at least 20,000 ac-ft equivalent flood storage benefit by making anticipatory releases based on telemetered flow and precipitation data in the watershed.

9. Use of surcharge storage. Temporary use of up to 100,000 ac-ft of surcharge storage space during very large floods. In 1986, 13,000 ac-ft of surcharge storage was used for what was approximately a 30-year flood event.

To refine this analysis requires the following studies:

1. Specific detailed evaluation of upstream reservoir operation, identifying alternative operating schedules to maximize flood control benefits and minimize power generation loss. This would also require multireservoir flood routing simulation.

2. Updating flood frequency analysis using most recent data and correcting 1986 data error to develop Folsom inflow hydrographs for different upstream reservoir operational scenarios.

3. Analyze Folsom reservoir operation and analysis for alternative inflow hydrographs, reservoir release schedules, and surcharge storage use.

4. Analysis of flood hydraulics on the American River for different Folsom discharges and Sacramento River stages using updated channel cross-sections and roughness.

5. Analysis of joint probability of river stages at the Sacramento confluence, as affected by upstream reservoir operation and the Sacramento weir.

I hope these comments are useful.

Yours very truly,

Philip B. Williams, Ph.D., P.E.
Principal

/cw



Philip Williams & Associates, Ltd.

COMPARISON OF AMERICAN RIVER 200-YEAR FLOOD ESTIMATES

| | Instantaneous Peak Discharge (cfs) | 1-Day[1] Mean Discharge (cfs) | 3-Day Mean Discharge (cfs) |
|---|---|---|---|
| Folsom Reservoir Design Flood | 340,000 | 256,000 | 146,000 |
| COE 1987 Projection - No Upstream Storage | - | 362,000 | 245,000 |
| COE 1987 Projection - With Upstream Storage | - | 362,000 | 245,000 |
| FWA Projection Using FEMA Guidelines - No Upstream Storage | - | 316,000 | 233,000 |
| FWA Projection Using FEMA Guidelines - With Upstream Storage Reservoirs Operated as in February 1986[4] | - | 288,000 | 205,000 |
| 1986 Flood | 206,000 | 172,000 | 166,000 |

Notes

1. Not corrected for effect of Auburn Cofferdam failure on 1986 1-day discharge.
2. All frequencies based on period 1965-1986.
3. All frequencies based on 1-day and 3-day peaks rather 24- and 72-hour peaks.
4. Adjusted for 5 largest upstream reservoirs constituting 81% of total upstream storage.

plate" their flood damage prevention projects. The result will be that limited federal dollars are allocated not on the basis of cost-effectiveness and need but rather on the ability of a local community to enlarge its claim on federal funds through the political process.

The foregoing issues are not meant to be exhaustive, but are intended to highlight key concerns. We would be pleased to meet with you to discuss these concerns in greater detail and we would, of course, be happy to attempt to answer any questions you may have.

Sincerely,

E. R. Osann

Edward R. Osann, Director
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on behalf of

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Attachments



# ENVIRONMENTAL DEFENSE FUND

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ENVIRONMENTAL DEFENSE FUND

CRITIQUE OF

U.S. ARMY CORPS OF ENGINEERS

SACRAMENTO DISTRICT OFFICE

ANALYSES OF FLOOD CONTROL FOR THE AMERICAN RIVER

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August 1990

This document critiques the U.S. Army Corps of Engineers, Sacramento District, analysis of flood control on the American River. Attached to this critique are two letters from Dr. Philip Williams, an independent consulting hydrologist, to EDF. (Enclosures 1 and 2). Dr. Williams has had considerable experience in flood risk analysis, and has worked on flood problems on the American River since 1973. The enclosed letters summarize Dr. Williams' critique of the District's calculation of the flood risk on the American River, as set out in two recent District reports, and his own analysis of that risk. Dr. Williams analysis is also explained in greater detail in two reports he prepared: "Analysis of the February 1986 Flood on the Lower American River" and "Analysis of the 100-year Flood into Folsom Reservoir." These reports are not included with this critique, but will be made available upon request.

Dr. Williams concludes that:

> The two Corps reports do not provide an adequate technical basis for defining cost-effective solutions for reducing flood risks to the Sacramento area. Underlying the recommendations of these reports is a series of engineering computations and assumptions concerning reservoir operation, flood hydrology, and river hydraulics. I find many of these technical computations to be questionable and some of the most important assumptions to be either incorrect or biased towards justifying the construction of new flood control storage above Folsom.

In particular, the District's analysis is flawed in two fundamentally important respects. First, if proper operation of the existing Folsom Dam, in accordance with present Corps flood control operation regulations, is assumed, and if flood risk is calculated in accordance with Federal Emergency Management Agency (FEMA) guidelines, rather than according to the Corps' methodology, Folsom Dam alone already provides protection against a 1 in 100



year flood event on the American River. The level of protection increases to about a 1 in 150 year event if proper consideration is given to the effect of existing upstream hydroelectric dams on reducing flood flows into Folsom Reservoir. This is in direct conflict with the District's analysis which concludes that Folsom Dam provides less than 1 in 100 year protection, leading raised elevation requirements for new construction in order to obtain federally subsidized flood insurance.

Second, the District has failed to consider adequately a mix of quickly-implementable measures that could provide additional protection without construction of a new upstream dam. Apparently driven by a decision that any options incompatible with an upstream dam will not be considered, Corps planning to date has not taken a serious look at these "non-dam" options. Because of the economic and environmental costs involved, it is essential that the District give thorough consideration to all alternatives, and not be biased toward construction of an expensive and environmentally damaging upstream dam.

Some of what EDF believes are the most serious shortcomings of the District's analysis are summarized below. Because of their fundamental importance to the District's purported justification for a new dam, it is imperative that these issues be addressed by the Corps prior to release of the feasibility study, and that the Corps publicly respond to these concerns.

Operation of Folsom Dam

The recent concern over flood risk in the Sacramento area was prompted by a February 1986 storm which resulted in high flows in the American River, and near flooding of portions of Sacramento. However, contrary to the District's representations, this near-disaster was not the result of the storm itself,

which was considerably less severe than the flood for which Folsom Dam was designed, but rather of the failure of the Folsom Dam operators to comply with Corps flood control regulations. The Bureau of Reclamation's own data show that the dam operators permitted encroachment into the flood control reservation in Folsom Reservoir for several days before making required releases to the Lower American River. Because the reservoir was not drawn down early enough, as required by flood operation requirements, releases in excess of the design capacity of the Lower American River levees were necessary. The problem was further exacerbated by the dam operators' failure to anticipate adequately the collapse of the coffer dam at the Auburn site. However, even with the increased flow resulting from the coffer dam failure (an event that, of course, will never again recur) excessive releases would not have been required had Folsom been operated properly.

Ensuring proper operation of Folsom Dam is particularly important since it is the single most important step that can be taken to provide immediate increased flood protection for the Sacramento area. However, the District has failed to acknowledge the misoperation of Folsom, and has sponsored no independent inquiry of the events leading to the 1986 near-disaster.

Related to this problem is the District's apparent assumption that actual operation of Folsom Dam can achieve only 80 percent efficiency compared to the "hypothetical" operation. Imagine a nuclear power plant operator assuming it would achieve only 80% compliance with its safety requirements. Even the California Department of Water Resources has questioned the validity of this assumption, and stated that it believes higher efficiencies in actual operation are possible. (Department of Water Resources, A Preliminary Study of Flood Control Alternatives on the Lower American River, September 1982, at p.





1). At the very least, improving operation efficiencies needs to be an option for increased flood protection that should be given high priority by the Corps. It also appears that this assumption is not consistent with the Corps' original representations concerning the size of flood that Folsom Dam was designed to handle.

Corps v. FEMA Methodologies

The Federal Emergency Management Agency (FEMA) has prescribed a specific methodology for estimating flood risks. The Corps, on the other hand, uses a different methodology. The net effect of using the Corps methodology is to increase the 100-year flood flow estimates by about 12% over those estimated using the FEMA methodology. As stated above, if FEMA methodologies were used, and Folsom Dam were operated as it was originally designed, protection against a 100 year flood on the Lower American River would be assured without taking any additional steps.

Given that estimates of flood hydrographs are subject to a wide range of "error", and are highly sensitive to the methodology used, one would assume that federal agencies would use one consistent methodology for calculating flood risk. Yet the Corps, to EDF's knowledge, has never explained its rationale for deviating from FEMA's methodology, despite the fact that the Corps methodology is "not in accordance with Water Resources Council Guidelines." (Hydrologic Engineering Center, 1986. Computer program catalog, U.S. Army Corps of Engineers, Water Resources Center, Davis, California, November, p.21). EDF particularly questions the Corps' use of "expected probabilities" in calculating flood peaks, which results in increased estimated flood risk, even though that methodology has been specifically superseded by FEMA.

Upstream Storage

Another critical factor affecting the flood peak into Folsom Reservoir is the storage effect of the hydroelectric dams upstream from Folsom. A logical approach to calculating this effect would be to analyze the actual historical operation of the upstream reservoirs during winter flood periods. This was the approach used in Dr. Williams' analysis. The District, on the other hand, used a seemingly arbitrary and unrealistic methodology that calculated total available storage in these upstream reservoirs by adding together the minimum storage available in each reservoir at any time in any winter. The result was virtually to negate any effect that the upstream reservoirs would have on flows into Folsom Reservoir.

The probability that every upstream reservoir would have minimum available storage at the same time is exceedingly small. The likelihood that such a "worst case" upstream storage scenario would occur coincident with a 100-year (or 200-year) flood must be nearly zero. The approach used by the District is yet another example of how the methodology it employed is biased toward justifying a new upstream dam.

Additional flood protection could also be obtained by entering into formal agreements with hydroelectric dam operators to provide flood storage. The District has rejected this alternative because it would purportedly require modification of outlet works and provide little benefit. However, based upon actual operation of these upstream reservoirs (which would have no impact on power revenues), there is generally at least 200,000 acre-feet of storage available upstream under existing operations with existing outlet works. The facts thus contradict the District's position and demonstrate that this is a viable and probably least-cost alternative.





Failure of the Auburn Coffer Dam

The District failed to account for the increased flows resulting from the collapse of the Auburn coffer dam in calculating flood frequencies following the 1986 flood. This biased the District's calculations upward.

Non-Coincidental Peaks on Sacramento and American Rivers

The District's flood peak calculation is based upon the unsupported assumption that the peak Sacramento River stage (causing backwater into the American River) will occur at the same time as peak flow on the American River. In reality, the Sacramento River usually peaks 1 to 3 days after the American unless there is a serious misoperation of Folsom Reservoir as occurred in 1986. The result of the District's assumption is again to overstate the flood risk.

Deepening of Lower American River Channel

There is evidence that since the construction of the Folsom Dam, which has blocked the addition of new sediment from the upstream watershed, the Lower American River channel has deepened by at least three feet in some places. However, it is not clear that the Corps has taken this fact into account in calculating the river's channel capacity.

Alternatives

The District has effectively prejudged many alternatives by concluding that protection against a 200 year flood is required, and that the only way to achieve that protection is by constructing a dam upstream of Folsom. It then rejects any flood damage prevention option that it views as inconsistent with the dam alternative. The result is to avoid any systematic analysis of measures that in combination could provide protection against a 1 in 200 year flood. These measures, and the necessary approach to evaluating their

potential, are discussed in Dr. Williams' letter of March 5, 1990. Some of the measures, such as use of upstream hydroelectric dam storage, have been discussed above. Other specific alternatives are briefly discussed below.

One quickly-implementable measure that would improve flood protection for Sacramento would be to maintain and upgrade levees along the American River to allow higher release rates from Folsom Dam. These levees could be upgraded in an environmentally acceptable way to ensure at least their original design capacity of 152,000 cfs with three feet of freeboard. This would be consistent with FEMA flood insurance regulations, which require three feet of freeboard.

Another potential alternative that needs to be considered in combination with other measures is the use of telemetered flood warning data and anticipatory releases from Folsom Reservoir to increase flood protection. Such measures could provide the equivalent of 20,000 acre-feet of flood storage benefit. Yet the District apparently has not assessed this option.

Finally, during the February 1986 storm, floodwaters were temporarily stored in the surcharge space available above the normal full pool in Folsom. An additional alternative that needs to be evaluated is the potential for using this surcharge storage on a temporary basis in large flood events.





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January 25, 1990 #645

John Krautkraemer
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Dear John:

As you requested, I have reviewed the Corps of Engineers's "Informational Paper on Alternatives of December 1989" and "Special Study of the Lower American River of March 1987," as well as other recent reports concerning flood problems along the Lower American River.

It is my conclusion that the two Corps reports do not provide an adequate technical basis for defining cost-effective solutions for reducing flood risks to the Sacramento area. Underlying the recommendations of these report is a series of engineering computations and assumptions concerning reservoir operation, flood hydrology, and river hydraulics. I find many of these technical computations to be questionable and some of the most important assumptions to be either incorrect or biased towards justifying the construction of new flood control storage above Folsom.

I believe a rigorous independent evaluation of the real causes of flood risk to Sacramento that follows FEMA guidelines would lead to quick and effective steps to ensure that downtown Sacramento is removed from the 100-year floodplain designation. The same steps may also reduce designated flood hazards from the Natomas area.

The same rigorous independent analysis, carried out by an agency that has as its primary objective flood risk reduction for Sacramento, would also identify a series of cost-effective flood management alternatives to provide greater than 100-year flood protection for Sacramento.

Because of the limited time for this review, I have not attempted a comprehensive critique, but instead have addressed some of the major issues.

Reservoir Operations

As you know, I have been involved in various analyses of flood problems on the Lower American River since 1973. In reviewing these most recent documents, I concur with the Corps's conclusion

that there has been a significant increase in the risk of flood damage to Sacramento from floods on the Lower American River.

However, the reasons for this increased risk are not theoretical computations of increased flood frequency, but the demonstrated inability of the Bureau of Reclamation to operate Folsom Dam in the way it was intended. The near-disaster that occurred in February 1986 was not caused by the size of the flood, which was smaller than the flood for which Folsom was designed, but by a series of major operational errors that allowed the reservoir to fill prior to the flood peak. (I have detailed these operational errors in my report "Analysis of the February 1986 Flood on the Lower American River," prepared just after the flood.)

The Corps of Engineers, which has responsibility for overseeing reservoir flood control operation, has so far provided no acknowledgment or explanation for what is probably the most serious reservoir operational incident in its history. By failing to take vigorous measures to ensure that Folsom will be operated correctly, the Corps leaves open the probability that future floods will continue to be managed as ineptly - thereby exposing Sacramento to higher flood risks. In fact, in comparing flood control alternatives, the Corps now even appears to be willing to institutionalize some of these operational errors that downgrade Folsom's flood control ability by using reduced storage availability in its flood routing computations (p. 10, Special Study).

The recent Corps planning documents provide no explanation of the crucial importance of internal Corps decisions on Folsom Dam's operating criteria, in determining 100- or 200-year flood flows on the Lower American. An example of how what appears to be an objective engineering assumption can have major impact on flood damages is the Corps decision to modify Folsom's emergency spillway release diagram in November 1986, allowing releases up to 160,000 cfs. The Lower American River levees are designed to carry 115,000 cfs with 5 ft. of freeboard, or 152,000 cfs. with 3 ft. of freeboard. FEMA flood insurance regulations assume levees to have failed if the flood level rises into the 3-ft. freeboard. Therefore, establishing a 160,000 cfs release limit instead of a 152,000 cfs release limit can ensure that downtown Sacramento becomes a designated flood zone for several of the alternatives the Corps examined.





Hydrology

Instead of recognizing the true causes of the high flows in the Lower American in February 1986, the Corps instead attempts to shift the blame to nature, by exaggerating the size of the 1986 flood in the American River basin, by referring to it as a "record" flood, and by representing it as a flood larger than the design flood for Folsom Dam.

In fact, the 1986 flood was large, but for the purposes of analyzing flood control not exceptional. The most significant parameter for evaluating flood hazards on the American River is the one-day average natural unregulated discharge. The Corps erroneously reports this natural flow as 204,000 cfs on February 17th, when in fact a large portion of this flow was the huge surge of water from the collapsing Auburn coffer dam. Subtracting this effect shows the flow to be 173,000 cfs, exceeded by floods in 1955 and 1964, and to be about a 30-year event. The Corps refers to the record 6-day average flow as greater than the volume of the reservoir design flood (p. 8, Special Study). This is true but completely meaningless - for example, a steady flow of 115,000 cfs for 6 days into Folsom Reservoir would have an even larger flow volume, but would be controlled to the American River levees with virtually no effect on Folsom Reservoir capacity.

The analysis of the historic flood frequency is the second crucial area that has a major effect on determining the flood hazard to Sacramento. After the 1986 flood, the Corps revised upwards its estimate of the 100- and 200-year flood hydrographs, and these are used as the basis of its planning studies.

I performed the same analysis as the Corps using the same historic data set, and I concur that the estimate of the unimpaired or natural flood flow hydrograph requires revision upwards (see "Analysis of the 100-Year Flood into Folsom Reservoir," March 1987).

Estimating 100- or 200-year flood hydrographs requires extrapolating data from shorter historic records. Inevitably, error bands are large (for example, the 95% confidence limits of the peak one-day flow are 189,000 to 360,000 cfs), and estimates are very sensitive to the methodology used. Because of the variety of techniques available, FEMA has prescribed a specific methodology to be used in estimating flood peaks for its flood studies. For its planning studies, the Corps has chosen to use methodologies "not in accordance with the Water Resources Council

Guidelines," the net effect of which is to make the natural 100-year flood flow estimates about 12% higher than they should be for the one-day flood discharge. The Corps's disregard for the FEMA methodology of course has a substantial effect in exaggerating flood damage estimates downstream.

Regardless of the estimate of the natural unimpaired hydrograph, what is important for Sacramento is the flow that enters Folsom reservoir - the impaired flow. As the Corps points out, there are 820,000 acre-feet of hydropower reservoirs upstream of Folsom. These reservoirs have a significant role in reducing flood peaks into Folsom because they are operated to maximize power generation, which means that they are drawn down during the winter flood season. The Corps has treated the role of these reservoirs in an arbitrary and unrealistic fashion. It has apparently taken the minimum storage available in each of the reservoirs at any time in any winter, added this together to be 47,000 acre-feet, and treated this as if it were a single reservoir immediately upstream of Folsom. Obviously, with these assumptions, this storage is filled at the beginning of the flood and has no effect on the flood peak.

In contrast, I examined the actual operation of the five biggest upstream reservoirs in each winter flood period. It is apparent that in periods of high rainfall, the reservoirs are drawn down lower. It is also clear that during major floods such as 1964, 1980, 1982, and 1986, appreciable volumes are stored not just at the beginning of the flood, but on the second and third days as well. For example, during the 1986 flood more than 150,000 acre-feet of runoff was stored in the 5 largest hydro reservoirs, 57,000 acre-feet of which occurred on the day of peak flow. A systematic analysis shows that upstream reservoirs operated as they are at present, reduce the actual 100-year flood peak by approximately 14%.

The net effect on inflows to Folsom is that although there has been an increase in flood estimates of about 10% since earlier computations made in 1961, the increases are more than counterbalanced by the effect of upstream storage. Furthermore, the 100-year flood hydrograph is still significantly smaller than the design flood for Folsom.

Flood Hydraulics and Levee Failure

The most significant hydraulic factor affecting the risk of levee failure is the maximum river stage during the flood (although





flow velocity period of high water, and rate of change of stage are also important). The maximum river stage is the criterion used for calculating flood damages and flood zones.

For a particular flow release from Folsom, the American River stage is affected by the channel geometry, channel roughness, and backwater from the Sacramento River. While I have not had time to examine the Corps's hydraulic assumptions in detail, I can identify two key areas in which assumptions appear to have been made that exaggerate flood damages.

The first relates to the question of what exactly is the current capacity of the Lower American River channel. The original design assumption for the levees prior to completion of Folsom was that the river channel could convey 115,000 cfs with 5 ft. of freeboard or 152,000 cfs with 3 ft. of freeboard. Because of the construction of Folsom, large reaches of the river bed downstream have lowered about 3 ft. This could lower flood stages significantly below the original design criteria, or alternatively allow for an upgrading of the river channel capacity, again based on the original design river stages. I realize, of course, that it is quite possible that the Corps project levees have been allowed to deteriorate since the construction of Folsom. Nevertheless, it appears that the Corps planning studies assume levee failure on the main river channel at 140,000 cfs, but the criteria for assuming failure are unclear and seem to be based on encroachment on a 5-ft. levee freeboard rather than the 3-ft. requirement of FEMA (p. 13, Special Study).

The second important hydraulic criterion is the Corps's assumption of the Sacramento River stage causing backwater at the time of peak flow in the American River. Usually, the Sacramento River stage peaks 1 to 3 days after the American (see USGS OFR 88-82). The record stage of 30.58 ft. that occurred in February 1986 could be explained by the Bureau allowing a 36-hour delay in making releases from Folsom. Usually, at the time of the peak American flow, stages are substantially less. Nevertheless, the Corps appears to be assuming Sacramento River stages of about 31 to 32 ft. at the confluence for its hydraulic calculations. This assumption can have a substantial effect on the determination of flood damages in the Natomas area. A specific analysis of this joint probability of high flows in the Sacramento and American would probably allow a significantly lower value to be assumed.

It should be noted that the Corps flood profiles show that the flood stages on the Natomas East Main Drainage Canal are

influenced as much by Sacramento River stages and local runoff as by American River flows.

Assessment of Alternatives

Because of the Corps's exaggeration of flood hydrographs and evasion in dealing with poor operation of Folsom, it is unable to formulate and compare alternatives realistically. The Corps studies have missed the significance of the following easily accomplished improvements:

- Utilizing existing upstream reservoir capacity.
- Improving Folsom's operational ability to control flood flows.
- Upgrading Folsom's operational ability using telemetered precipitation and forecasting data.
- Improving coordination of flow releases from Sacramento Valley reservoirs to avoid coincident flood peaks at Sacramento.
- Providing environmentally sensitive, low-cost means of upgrading the most sensitive levees along the American River - as, for example, the Corps is doing along the San Lorenzo River.
- Identifying a series of small-scale improvements of river channel hydraulics, such as removing sewer lines in the river bed.

Conclusions

I believe that if the following short-term steps were taken, it would be possible to ensure that the downtown area of Sacramento would be quickly removed from 100-year floodplain designation. In addition, this would probably reduce designated floodplain areas in the Natomas region:

1. Adopt a 100-year unimpaired flood hydrograph developed in accordance with FEMA requirements.
2. Modify the unimpaired flood hydrograph by the actual effect of upstream reservoir operation. This could be formalized in an operating agreement with upstream reservoir owners.
3. Ensure that the Bureau of Reclamation operates Folsom according to its Congressionally authorized operations manual.
4. Ensure that the American River levees are maintained to their original design criteria.
5. Analyze American and Sacramento River floodflows using a flood routing model to determine appropriate Sacramento River backwater control elevations.
6. Utilize FEMA guidelines in determining criteria for levee failure.

For additional flood protection above the 100-year flood level, the following relatively inexpensive steps could be taken:

1. Optimize joint operation of upstream dams and Folsom's compensating for lost power revenues.
2. Improvement of Folsom's operating criteria to provide for releases in advance of flood flows based on real-time precipitation measurements, use of surcharge storage, or increase in release rates to the actual river channel capacity.
3. Provide for upgrading of sections of levees by the installation of low flood walls or internal reinforcement.

I hope these comments are useful.

Yours very truly,

Philip B. Williams, Ph.D., P.E.
Principal

/cw



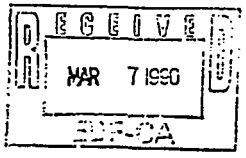
Philip Williams & Associates, Ltd.

Philip Williams & Associates, Ltd.
Consultants in Hydrology

Pier 35, The Embarcadero
San Francisco, CA 94133
Phone: (415) 981-8363
Fax: (415) 981-5021

March 5, 1990

#645




John Krautkraemer
EDF
Rockridge Market Hall
5655 College Avenue
Oakland, CA 94618

RE: Alternatives for Providing 200-Year Flood Protection for the Lower American River

Dear John:

Our prior analysis has shown that the 100-year American River flood flows into Folsom Reservoir are smaller than the flood for which Folsom was designed (see "Analysis of 100-Year Flood into Folsom Reservoir," 3/27/87). Therefore, provided Folsom is operated correctly, areas along the Lower American River will be protected against the 100-year flood. In PWA's analysis, unlike the Corps of Engineers's analysis, we used standard FEMA methodologies for calculating the 100-year flood hydrograph and the actual effect of upstream storage reservoirs on flood peaks.

We have now reviewed the 200-year flood hydrographs for the American River, again using standard FEMA methodologies and considering the effect of upstream storage reservoirs. While we have not carried out a detailed flood routing analysis, it is very clear that the 200-year flood flows are considerably smaller than those estimated by the Corps. For example, it appears that the peak one-day flood flow is about 12% larger than Folsom's design flood, not 40% as claimed by the Corps (see attached table).

Although the 200-year flood is larger than the reservoir design flood, it can be controlled to a non-damaging release rate from Folsom if the following quickly-implementable measures are taken:

1. Ensure that Folsom is operated according to the principles clearly described in its operating manual.

2. Upgrading the flood control operation in Folsom by making releases prior to large floods, using inflow forecasts based on measured precipitation data in the watershed.

3. Upgrading the flood control capability of Folsom by temporarily storing floodwaters during large floods in the surcharge storage space available above the normal full pool level - as was done during the February 1986 flood.





4. Securing operating agreements with upstream reservoir owners to provide for additional temporary storage immediately prior to and during large floods.

5. Ensuring that downstream levees are maintained to design specifications, thereby allowing release rates from Folsom up to their original design capacity.

If no action is taken except to simply ensure that Folsom is operated according to its originally authorized operating manual ("Reservoir Regulation Manual for Flood Control," March 1959), Sacramento would be provided protection against flooding up to about the 150-year flood. If this action is not taken, Sacramento could be threatened with flooding from the misoperation of Folsom by floods as small as the 30-year event.

These conclusions are based on a review of the recent work carried out by the Corps together with analysis PWA completed in 1987 using the following assumptions:

1. Flood frequency data. The one-day and three-day discharges used are the Corps's estimates for the period 1905 to 1986. The erroneous data point for 1986, which exaggerates flood risk by a few percentage points, has not been corrected.

2. Flood frequency analysis. The data was analyzed using the Corps program flood flow frequency analysis HECWRC, not the 1972 Regional Frequency Computation REGFQ. In addition, computed probabilities were used, not expected probabilities.

3. Adjustment for upstream reservoirs. For our analysis of the 100-year hydrograph, we used an empirical relationship for floodwater stored in upstream reservoirs based on observed data. Generally, there are at least 200,000 ac-ft of storage available at the start of the flood (see attached graph), and significant volumes of floodwaters are stored during the initial four days of the flood hydrograph. However, using the same empirical relationship for floods of the size of the 200-year flood is too conjectural. In the absence of a detailed flood routing analysis of the upstream reservoirs, and to err on the conservative side, the actual storage that occurred in the February 1986 flood was used to adjust the 200-year hydrograph.

4. Hydrograph. The same form of the hydrograph developed by the Corps for the 200-year flood was used and adjusted for upstream storage by subtracting the daily volume stored for the preceding day.

5. Operation of Folsom. It is assumed that Folsom is operated according to the 1959 operating manual, and specifically Part B, Clause 3 is delayed (see attachment). This is in contrast to the Corps's assumption that the reservoir will be managed so as to lose 60,000 ac-ft of flood storage prior to the main flood flow.

6. Downstream Levee Capacity. Downstream levees protecting Sacramento were originally constructed to convey mean daily flows of 180,000 cfs and peak flows of 240,000 cfs (American River Flood Control District, December 1929). In 1958, after the construction of Folsom, the channel capacity above Cal Expo was downgraded by the construction of the Corps American River Project levee, with a capacity of 152,000 cfs with 3 ft. of freeboard, or 115,000 cfs with 5 ft. of freeboard. Since the construction of Folsom, the river channel has lowered over time, increasing effective channel capacity; however, it is unclear whether levees have been adequately maintained. Except for the Natomas area (see below), the Corps assumes the maximum flow without levee failure to be 140,000 cfs (see Table 5, Corps 1987 study). (134,000 cfs was released in 1986.)

   It is possible to upgrade the existing levees to at least their original design capacity of 152,000 cfs with 3 ft. of freeboard by reinforcing the levee core and, if necessary, by raising the levee crown - probably less than 1 ft. Neither of these actions need be environmentally destructive. FEMA flood insurance regulations require 3 ft., not 5 ft. of freeboard as assumed by the Corps.

7. Backwater from Sacramento River. It was assumed that with correct operation of Folsom, coincident peaks on the Sacramento and American would be unlikely to occur and the design backwater elevation affecting the Natomas Drain would be at least 1 ft. lower than used in the Corps analysis. This would mean that non-



damaging American River flows could be significantly higher than the 115,000 cfs assumed by the Corps.

8. Benefits of using telemetered flood warning data. Prior analysis ("Operation of Folsom Dam for the American River Standard Project Flood," 1973) indicated at least 20,000 ac-ft equivalent flood storage benefits by making anticipatory releases based on telemetered flow and precipitation data in the watershed.

9. Use of surcharge storage. Temporary use of up to 130,000 ac-ft of surcharge storage space during very large floods. In 1986, 15,000 ac-ft of surcharge storage was used for what was approximately a 30-year flood event.

To refine this analysis requires the following studies:

1. Specific detailed evaluation of upstream reservoir operation, identifying alternative operating schedules to maximize flood control benefits and minimize power generation loss. This would also require multireservoir flood routing simulation.

2. Updating flood frequency analysis using most recent data and correcting 1986 data error to develop Folsom inflow hydrographs for different upstream reservoir operational scenarios.

3. Analyze Folsom reservoir operation and analysis for alternative inflow hydrographs, reservoir release schedules, and surcharge storage use.

4. Analysis of flood hydraulics on the American River for different Folsom discharges and Sacramento river stages using updated channel cross-sections and roughness.

5. Analysis of joint probability of river stages at the Sacramento confluence, as affected by upstream reservoir operation and the Sacramento weir.

I hope these comments are useful.

Yours very truly,

Philip B. Williams, Ph.D., P.E.
Principal

/ccw





COMPARISON OF AMERICAN RIVER 200-YEAR FLOOD ESTIMATES

| | Instantaneous Peak Discharge (cfs) | 1-Day,[1] Basin Discharge (cfs) | 3-Day, Basin Discharge (cfs) |
|---|---|---|---|
| Folsom Reservoir Design Flood | 340,000 | 250,000 | 140,000 |
| COE 1957 Projection - No Upstream Storage | - | 361,000 | 215,000 |
| COE 1957 Projection - With Upstream Storage | - | 302,000 | 211,000 |
| FWA Projection Using FEMA Guidelines - No Upstream Storage | - | 310,000 | 211,000 |
| FWA Projection Using FEMA Guidelines - With Upstream Storage Reservoirs Operated as in February 1986[4] | - | 233,000 | 209,000 |
| 1986 Flood | 206,000 | 172,000 | 166,000 |

Notes

1. Not corrected for effect of Auburn Cofferdam failure on the 1-day discharge.

2. All frequencies based on period 1965-1986.

3. All frequencies based on 1-day and 3-day peaks rather than 24- and 72-hour peaks.

4. Adjusted for 5 largest upstream reservoirs constituting 81% of total upstream storage.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

August 14, 1990

Mr. Mike Welsh
Environmental Resources Branch
Sacramento District, Corps of Engineers
650 Capitol Mall
Sacramento, California 95814-4794

Subject: American River Watershed Study

Dear Mr. Welsh:

As per your recent telephone request, we have enclosed an itemized list of anticipated tasks and funding needs for additional work on the American River Watershed Study. Incomplete work and remaining funds from the previous July 20, 1990 reimbursable work order were considered in developing these estimates.

If you have any questions, please contact Gary Taylor or Fred Nakaji at (916) 978-4613.

Sincerely,

Wayne S. White
Field Supervisor

Enclosure

A-86

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 445-9248

AUG 17 1990

Mr. Lewis A. Whitney, Chief
Engineering Division
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814

Dear Mr. Whitney,

Auburn Dam
Placer County

On August 7, 1990, Jim McDaniel and I met with members of your staff regarding the final configuration of the diversion tunnel at the Auburn Dam. The main topic of discussion was installation of gates near the entrance of the Diversion Tunnel with construction of the flood control dam.

After careful consideration, we can not determine a benefit from installing these gates with regard to dam safety. If gating were to be accomplished, it would seem simplier to do so on the new sluiceways.

During the meeting I requested additional information regarding the design and construction of your proposed roller compacted concrete alternative in order that DSOD might answer some additional questions that surfaced during the meeting. To date I have not received the portions of the COE report requested.

Please call me at 445-7606 if you have questions regarding our position on the tunnel gates.

Sincerely,

Vernon H. Persson, Chief
Division of Safety of Dams

A-87

STATE OF CALIFORNIA-BUSINESS, TRANSPORTATION AND HOUSING AGENCY
DEPARTMENT OF TRANSPORTATION
DISTRICT 3
P.O. BOX 911, MARYSVILLE, CA 95901
TDD Telephone (916) 741-4509
Telephone (916) 741-4233

'90 AUG 27

August 17, 1990

Mr. Jack Warren, Director
County of Placer
Department of Public Works
11444 B Avenue
DeWitt Center
Auburn, CA 95603

Dear Mr. Warren:

Thanks for our productive meeting on Wednesday and your July 26 letter concerning the proposed Auburn Dam and relocation of Highway 49. I feel that our mutual positions on the issue of relocating Highway 49 through the American River canyon are close and that the interests of both Placer and El Dorado counties cannot be overlooked in this project.

The attachment details my staff's analysis on the proposed relocation of the State highway and covers the questions addressed in your letter. We need to continue to work closely on this project; my staff will keep you informed of any developments at Caltrans. Please call me or John Webb at (916) 741-4004 anytime to discuss this project.

Sincerely,

ROBERT O. WATKINS
District Director

Attachment

# United States Department of the Interior

**FISH AND WILDLIFE SERVICE**

Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

August 20, 1990

Colonel Jack A. Le Cuyer
District Engineer
650 Capitol Mall
Sacramento District Corps of Engineers
Sacramento, CA 95814-4794

Subject: American River Watershed Investigation

Dear Colonel Le Cuyer:

This is in response to the August 1, 1990 Technical Conference held by your agency in Sacramento, California. As a result of discussions at the conference, we were reminded of several issues that require resolution before we can consider the project clearly defined for purposes of consultation under the Fish and Wildlife Coordination Act (16 U.S.C. 661-667 (e)). These issues are discussed below along with our suggestions for resolving them.

We understand that information presented at the technical conference, along with information in the Sacramento District's draft feasibility report, will be used to reach consensus on the project alternatives, including the National Economic Development Plan. Since the Service was not invited to participate in any of the pre-conference meetings or the conference on Tuesday July 21, 1990, we wish to provide our input via this letter.

During the reconnaissance phase of this investigation the Corps determined that it would be necessary to construct a facility upstream of Folsom Reservoir to accomplish greater than 150-year level flood protection for Sacramento. The Reconnaissance Report stated that 200-year level protection could be obtained with a single-purpose (flood control only) or a multipurpose reservoir at or near the existing Auburn Dam site.

During the feasibility phase, the Corps investigated several different alternative designs for a single purpose flood control facility at the Auburn site. Designs ranged from a narrow base flood control only dam to a much broader arch design dam with added features such as a wet well and penstocks for potential expansion. Descriptive terminology for these alternatives evolved from an "Expandable Dam" to an "Enhanced Features Dam". Obviously, those designs which include added physical base structure and features to facilitate eventual construction of a multipurpose dam, in essence, encourage future development of such a multipurpose facility. At this time, it is unclear to the Service which design is being considered as the preferred alternative.



Construction of any added features which are not needed to accomplish the purpose of flood control but are for other purposes such as power generation or reservoir storage, constitutes phased development of a multipurpose facility. In order to assure that such a multipurpose facility not be constructed and operated without full and proper environmental review, we recommended to the District that any project authorization language require deauthorization of the multipurpose Auburn Dam. Subsequently re-authorization of the flood control only facility would be required for it to be expanded into a multipurpose facility. Should the Corps decide to include an Expandable or Enhanced Feature Dam alternative as part of its current investigation, we will need to provide a preliminary analysis of the potential impacts of the expanded project with the assumption that it would be expanded and operated in the future. We would expect to conduct a complete detailed analysis of fish and wildlife impacts at the time of re-authorization.

Another issue which remains unclear is the justification for 200-year or greater flood protection. This is a key issue because extensive irreversible environmental impacts will occur with the upstream features required for that level of protection. Many of those impacts occurring in the North and Middle Fork American River canyons are unmitigable on project lands. In contrast, 150-year level protection or less will have relatively fewer impacts, primarily in the downstream area, which are more readily mitigable. Our June 1990 draft Coordination Act Report demonstrates the significant increase in environmental impact that occurs between the 150-year and 200-year protection level (USFWS, 1990). It is also unclear to us why the Corps appears to be promoting 200-year or greater protection when the Federal Emergency Management Agency finds that 100-year level protection is adequate for floodplain insurance purposes.

Corps guidance for implementing Executive Order 11988 (ER 1165-2-26) on Flood Management clearly directs the Corps to "provide leadership" and take action to:

a. Avoid development in the base floodplain unless it is the only practicable alternative;

b. Reduce the hazard and risk associated with floods;

c. Minimize the impact of floods on human safety, health and welfare; and

d. Restore and preserve the natural and beneficial values of the base floodplain.

The test of practicability will apply to both the proposed Corps action and to any secondary development likely to be induced or facilitated by the action. Identification and evaluation of practicable alternatives shall include consideration of alternative sites (carrying out the proposed action outside the floodplain); alternative actions (other means which accomplish the same purpose as the proposed action); and no action. When a determination is made that no practicable alternative to undertaking an action in the floodplain

Best Available Copy



exists, it will be appropriately documented and the features or qualities of the floodplain that make it advantageous over alternative non-floodplain sites shall be described and adequately supported.

In view of that guidance, we do not understand the Corps' decision to select the full Natomas Area 200-year level protection plan as their preferred alternative. This alternative supports flood protection for about 60,000 acres of lands of which 50,000 acres are agricultural lands situated in the more northerly portion of the Natomas area. Practically all of the existing developed area lies south of Del Paso Road (Figure 1). One hundred year or greater flood protection for all of the Natomas Area will result in the eventual loss due to development of over 20,000 acres of rice fields which serve as important seasonal wetland habitat for thousands of wintering migratory waterfowl including swans, ducks and geese. About 500 acres of open waterways, 150 acres of freshwater marsh, and 125 acres of riparian scrub-shrub would ultimately be lost or altered in such a manner that it would be of little value to most wildlife species.

Wetland habitat in the Central Valley has declined from the 4 million acres once present to approximately only 290,000 acres present today. About 30 percent of the remaining wetlands are within National Wildlife Refuges and State Wildlife Areas; the remaining 70 percent are privately owned and managed primarily as duck hunting clubs. About 40 percent of the private wetlands are protected through State legislation, Federal perpetual easements, or by conservation organizations. The remaining 119,000 acres of wetlands are unprotected and are a priority objective. There is a great need to work with the agricultural industry, primarily rice growers, in cooperative management efforts to meet the total food needs of waterfowl and enhance nesting habitat opportunities (USFWS, 1990).

A significant portion of the Central Valley wetland loss is attributable to urbanization of farmlands in the rapidly developing counties. Sacramento is experiencing the highest conversion with over 3600 acres per year being lost (Alf, 1989). Providing 200 year or greater levels of protection to the Natomas area would greatly exacerbate these losses.

Loss of the remaining habitat in Natomas will impact the valley elderberry, host plant of the federally listed threatened Valley Elderberry Longhorn Beetle. Losses of host plants are expected to increase as lands are converted from agricultural to urban use. Loss of large expanses of open fields, pasture and croplands which support large rodent populations will adversely impact raptor populations, including the State listed threatened Swainsons hawk. The riparian forest along the Sacramento River upstream and downstream of Sacramento, including the Garden Highway segment of Natomas, supports the highest known concentration of nesting pairs of Swainson's hawks in California. Loss of nesting and/or foraging habitat in Natomas could pose a



serious threat for survival of this species. The Natomas area may also support the most important remaining habitat for the State listed threatened giant garter snake. The highest number of sightings of this seldom seen species have been in the Natomas area. It is likely that loss of Natomas habitat could greatly reduce garter snake populations thus bringing the species closer to extirpation and possibly federal listing.

Limiting flood protection to the one-third plan, using a cross levee at Del Paso Road, seems a more reasonable and practicable alternative. This would accomplish the needed flood protection for the existing developed urban area and greatly reduce environmental impacts and mitigation needs. In addition, it would continue to allow periodic flooding of the remaining two thirds of Natomas, thus retaining what now serves as a natural overflow/retention basin during extreme flood events. This periodic flooding provides fresh, nutrient rich, soil deposits, improving both agricultural lands and seasonal habitat for wintering waterfowl. As stated in a July 24, 1990 letter to Fred Kindel of your Environmental Branch, preserving agricultural and open lands in Natomas would facilitate the objectives in the American Basin of the North American Waterfowl Management Plan and the Central Valley Joint Venture Implementation Plan (enclosure 1). Retention of agricultural lands would allow for possible conservation easements, enhancement of existing wetlands, and restoration of historic wetlands.

Another important unresolved issue centers on project impact assessment and mitigation responsibilities. We provided the Corps with an impact analysis based on the Corps' with and without-project future land use projections. Using our Habitat Evaluation Procedures, we calculated the wildlife habitat units that would be lost due to the project during its 100-year life. Based on these projected losses, we recommended measures to avoid, minimize and/or compensate for these losses. As of this date, the Corps and local sponsors agree to mitigate for construction impacts but are unwilling to accept responsibility for land use change impacts that will occur once the project is constructed and operated. Both initial construction impacts and ongoing operational impacts are an integral part of the defined project.

We understand that a cost/benefit analysis is being performed for the 100-year life of the project. Economic benefits are being claimed for structural improvements with land use conversions. Clearly, land use changes that alter wildlife habitat and result in habitat losses should also be included in the accounting, along with cost for implementing mitigative measures. This should be part of any complete project analysis. To accomplish this there should be a specific mitigation plan and responsible parties to implement it.

We understand that the Corps is placing responsibility for the land use change impacts on the local sponsors. The local sponsors are unwilling to mitigate for these changes as defined in our report. Instead, they propose that we accept a memorandum of understanding which defines measures that local government will take to address Fish and Wildlife Service and other Federal agency environmental concerns.

We have carefully reviewed the proposed MOU and find it unacceptable as mitigation. We cannot accept interim promises as appropriate mitigation for such significant impacts. We cannot accept assurances that are subject to local politics and future local planning decisions. As evidenced in past local development, there are great pressures for high density, rapid urbanization in all areas around Sacramento. Another look at South Natomas (Figure 1) shows the extent of urban growth in 1985. The remainder of South Natomas is expected to be fully urbanized by the year 2010 or sooner. There is little reason for us to believe that similar development will not occur throughout the remainder of the Natomas area.

The following summarizes the key issues that remain unresolved in the American River Watershed Investigation and offers measures to resolve them.

Issue 1. Expandable and Enhanced Feature Dam alternative. These alternatives are a piecemeal approach to full-sized, multipurpose project design. Assuredly, these alternatives will result in greater pressure to ultimately expand the partially completed project to the full-sized, multipurpose project. Therefore a much greater level of detail about the larger project, including potential hydroelectric service area, water supply service area, future planned storage, and other potential impact issues will need to be evaluated.

We recommend this alternative not be considered. We further recommend that the multipurpose Auburn Dam project be deauthorized when the single purpose American River Watershed Flood Control Project is authorized.

Issue 2. Two hundred year level or greater flood protection for Sacramento. A clear and complete evaluation should be presented for public review that provides justification for selecting this level of protection. As we previously stated, protection at or below the 150-year level can be accomplished with relatively small fish and wildlife habitat losses whereas 200-year or greater causes very high and likely unmitigable fish and wildlife habitat losses in the North and Middle Fork American River Canyons.

We recommend that 100-year level protection plan as defined in our report be selected or some other alternative that is far less damaging than those proposed for 200-year level and greater protection.

Issue 3. Flood Protection For Natomas

In view of the many important fish and wildlife resources in the Natomas Area, including thousands of acres of seasonal migratory waterfowl habitat (rice lands), hundreds of acres of agricultural water conveyance channels, riparian habitat and uplands that support a variety of game and non game species, including the State listed Swainson's hawk and giant garter snake, recognition of and compliance with executive orders 11988 and 11990 should be



effected. This project embodies the very same resource elements and conditions that led to issuance of the Presidential Orders in 1977. It also presents a unique opportunity for the Corps to demonstrate their new role as an environmental conservation *planning organization*. *An alternate flood control plan* that confines protection to existing urbanized areas is a reasonable alternative whereas one that protects and induces growth in primarily agricultural area is not reasonable nor easily defensible.

We recommend that the 1/1 Natomas Plan be selected and that the Floodplain Management Executive Order 11988 be rigorously adhered to.

Issue 4. The project and impacts associated with the project during its 100-year life are inseparable. Responsibility for mitigation rests with the project sponsors including the Corps. It is not our role to sort out mitigation responsibilities but to assure they are fully met prior to project operation. We view the project as incomplete and would be obliged to recommend against its construction unless and until a specific plan with mitigation measures is developed, approved by us, accepted by the Corps, and ready to be implemented.

We recommend that the Corps and local sponsors work cooperatively with the Service to develop a mitigation plan for the project that is acceptable to all parties and ready to be implemented prior to project operation.

We trust you will accept these comments as a constructive effort on our part to resolve issues of utmost concern to us. Your careful attention and full consideration will be greatly appreciated. We await your response.

Sincerely,

Wayne S. White
Field Supervisor

Enclosure

AFT, 1989. American Farm Land Trust. Risk, Challenges and Opportunities Agriculture, Resources and Growth in a Changing Central Valley. San Francisco, CA. 95pp.

USFWS, 1990. Central Valley Habitat Joint Venture Implementation Plan. A component of the North American Waterfowl Management Plan. Sacramento, California 102pp.

August 27, 1990

American River Basin Branch

Mr. Wallace McCormack
State Reclamation Board
1416 Ninth Street, Room 455-6
Sacramento, California 95814

Dear Mr. McCormack:

The Corps of Engineers is revising the draft Feasibility Report (Main Report and Environmental Impact Statement/Report (EIS/EIR)) for the American River Watershed Investigation. The revisions are based on guidance received at the recent American River Feasibility Review Conference (FRC). This letter identifies information we need from the State in order to accommodate the revision and complete the draft document. It is also to alert you to several project related needs.

A summary of information required from the State to complete the draft Feasibility Report is listed below. A more detailed description of these needs is provided in Enclosure 1. Our schedule calls for initiating public review of the draft document in mid-November 1990. Accordingly, indicated below are the dates when the requested information is required to accomplish this schedule.

1. Feasibility Report Comments - Comments on the review draft Feasibility Report for the American River Watershed Investigation (Comments needed as soon as possible).

2. Land-Use Projections - Land use projection confirmation (September 7, 1990).

3. Growth-Induced Impact Mitigation - Memorandum of Understanding describing mitigation for growth induced impacts (September 14, 1990).

4. Reservoir Area Inundation/Species Mortality - Supporting analysis regarding potential impacts on vegetation in the reservoir area (September 1, 1990).

5. CEQA Compliance Information - Analysis and supporting information on CEQA compliance requirements not specific to the EIS (includes State listed rare and endangered species information) (September 13, 1990).





Items 1, 2, and 4 are included in the FCSA of June 17, 1988 (as amended) and, as such, are being cost shared. The Corps does not have the authority to cost share in studies needed to satisfy non-federal requirements. Accordingly, since items 3 and 5 are required to satisfy CEQA, they are outside the negotiated FCSA. It is currently anticipated that the sections of the report specific to the EIR will be provided by the State and incorporated by the Corps into the draft report. The cost to assess, coordinate, and incorporate the CEQA specific information into the draft report is estimated at $8,000.

On the basis of recent discussions with representatives of your Board, the California Department of Water Resources, and SAFCA the feasibility report will recommend the NED plan as the Tentative Selected Plan. This is also in accordance with Federal Water Resources Principles and Guidelines and recommendations from the FRC. Studies to date indicate the NED plan would provide about a 385-year level of protection. It is requested that you notify this office of any modifications to the Tentative Selected Plan as soon as possible. A delayed reconfirmation of the plan will result in adverse impacts in the project schedule and study costs.

After a series of discussions at the FRC and with CALTRANS representatives, it has been agreed that the Corps will select the least costly realignment of Highway 40 as required to accommodate the proposed flood control project. At this time, it is assumed that the proposed realignment would be as close to the existing alignment as possible, designed to meet current standards and without consideration of future traffic projections. The realignment will be analyzed as a component of the proposed project in the Feasibility Report and EIS/EIR. We recognize that the proposed alignment may not be the route preferred by CALTRANS or the local government. We also recognize the requirement by CALTRANS for a detailed route analysis. We therefore recommend that any transportation or route analysis associated with an alternative be performed in conjunction with CALTRANS and the non-federal sponsors and initiated as soon as possible.

We recognize the time available to complete these items is extremely limited and we appreciate your assistance. As you know it is critical that we adhere to this schedule in order to essentially complete the feasibility phase of the study next year. This will allow for inclusion of the project in the next Water Resources Development Bill.

Should you have any further questions or suggestions for completing these documents, please contact me at 551-2005.

Sincerely,

Jack A. La Cuyer
Colonel, Corps of Engineers
District Engineer



Placer County Water Agency
185 Ferguson Rd. • P. O. Box 6570 • Auburn, California 95604
(916) 823-4850

A Public Agency
BOARD OF DIRECTORS
R. G. Rocca • Walter Fickewirth
Otis Wallace • J. K. Norman
E. W. Horton
Ed Schnabel, General Manager

September 26, 1990
File No. 400-36

Colonel Jack A. LeCuyer
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

SUBJECT: Auburn Dam

Dear Colonel LeCuyer:

During the Issues Resolution Conference on the Auburn Dam held on July 31 and August 1, 1990 in Sacramento, there was no discussion of, nor was there concern indicated for, Placer County or El Dorado County in regard to developing systems to provide for domestic water. Upon reviewing this issue with the full Board of Directors on September 20, 1990 it was felt necessary and appropriate to submit to you for your consideration a re-evaluation of the position of Placer County Water Agency regarding the Auburn Dam, as contained in Resolutions Nos. 90-03, 90-04, and 90-37, enclosed.

I sincerely hope that, in the not-too-distant future, some sincere efforts will be made to address the concerns of the Counties in which this project is proposed to be constructed.

Yours truly,

PLACER COUNTY WATER AGENCY

Walter Fickewirth
Chairman, Board of Directors

WF:bms
encl.
cc: Placer County Water Agency Board of Directors
Placer County Board of Supervisors

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON, DC 20310-0103

16 NOV 1990

Honorable Constance Harriman
Assistant Secretary for Fish
and Wildlife and Parks
Department of the Interior
Washington, D. C. 20240

Dear Ms. Harriman:

Based on the interagency meeting of October 11, 1990, regarding the proposed flood control project for the American River, California, we have developed the enclosed issue paper. I would appreciate your review and comment as soon as possible.

Because of the need to stay on schedule, we have directed the Corps to proceed on the basis of the Project Guidance Memorandum also enclosed, which reflects the content of the issue paper.

Please be assured, however, that should further coordination among agencies at the Washington level so require, we will amend the guidance as appropriate.

Sincerely,

G. Edward Dickey
Acting Assistant Secretary of the Army
(Civil Works)

Enclosures

A-93

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO ATTENTION OF:

CECW-PW (335-2-5a) 28 NOV 1990

MEMORANDUM FOR Commander, South Pacific Division, ATTN: CESPD-PD

SUBJECT: American River Watershed Investigation, Feasibility Review Conference, Project Guidance Memorandum (PGM)

1. Reference is made to CESPD-PM-C memorandum dated 11 September 1990, subject, Feasibility Review Conference (FRC), American River Watershed Investigation, California.

2. The subject FRC was attended by representatives from OASA(CW), HQUSACE, CERRH, CEWRC-WLR, CESPD, CESPK, local sponsors, USBR, EPA, USFWS, CALTRANS, and state resources agencies. The FRC was held to provide agency review of the American River Watershed Investigation draft feasibility report prior to circulating the report for public review, and to discuss the remaining feasibility study activities needed to be accomplished in order for the proposed project to likely receive agency support. As a result of a Washington level agreement, the requirement for a project management plan was waived for the purpose of the FRC. The FRC process does not preclude possible project modifications resulting from public and agency review during Washington level review of the final report.

3. The subject FRC Memorandum For Record has been reviewed in HQUSACE, CEWRC-WLR, and OASA(CW). The following constitutes a coordinated assessment of the issues and guidance which must be followed in order to produce a feasibility report that can be supported by the Army. It should be noted that the issues raised by the EPA and the USFWS are still under discussion at the Washington level and thus, the guidance on those points is subject to change. However, you should proceed with the report on the basis of the PGM in order to maintain project schedule commitments.

a. Hydrology and Hydraulics.

(1). The report will include a list of operational assumptions consistent with the proposed operation of the Auburn Dam and Folsom Dam under with project conditions.

(2). The report will include a discussion of the methodology and rationale used in selecting the proposed modifications to the Fremont Weir.

(3). Correct any inconsistencies in the freeboard analysis and document in the report impacts relative to with and without project conditions.

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(4). The report will clarify and expand discussions documenting concurrent flood events.

(5). Analysis of localized impacts of the project related to proposed improvements must be addressed in more detail in the report. The DWOPER model results must be combined with a more thorough presentation of volume balances and overtopping assumptions to show actual impacts.

(6). The report will address consistency of hydrologic studies in the various water resources development studies underway for the Sacramento area.

(7). The report will provide the methodology used in developing the design flood and include further discussion on the extrapolation of the 1986 flood event and concurrency assumptions above the 100-year flood event.

(8). For system safety considerations and to insure structural integrity of the single purpose Auburn flood control dam, control gates will be included in the project.

b. Benefits.

(1). Freeboard Benefits and Levee Failure Assumptions.

(a). The benefit analysis will be reviewed to insure freeboard benefits are claimed. Freeboard benefits should be estimated in accordance with existing guidance in, ER 1105-2-100, 15 September 1990, and in a manner consistent under with and without project analysis.

(b). The report discussions will be clarified to explain the linkage between levee failure assumptions and corresponding geotechnical determinations. Link specific failure points by reach or levee segment to specific geotechnical investigations, judgments and determinations.

(c). A sensitivity analysis showing effects on feasibility of assumed levee failure points for the NED plan and recommended plan, if different, will be made. The results of the sensitivity analysis will be documented in the final report.

(2). Location Benefits.

(a). Due to increasing levels of uncertainty, the time horizon for projecting land use changes should not extend

beyond the year 2010 or the period covered by currently approved local land use plans.

(b). The general areas likely to develop under without project conditions should be identified.

(c). The undiscounted location benefit per acre should reflect the difference in cost for complying with state and local controls on development between Natomas and areas likely to develop under without project conditions.

c. Relationship to the Authorized Auburn Dam. The report will include a brief discussion of the history of the authorized multipurpose Auburn Dam, will note that no analysis has been done by the Corps of anything besides flood control and no recommendations will be made regarding the continued authorization of the multipurpose dam.

d. Sunk Cost of USBR Work At the Auburn Damsite.

(1). Work/construction completed by the USBR applicable to the Corps project (presently estimated at $70 million) will be credited to the Corps recommended project and included as a project financial cost for Federal/non-Federal cost sharing purposes. Such sunk construction costs will be credited to the Federal government's share of the project cost but not included as an economic cost in the economic analysis.

(2). The report will include a more detailed explanation of the basis for the $70 million in estimated project creditable costs which was previously furnished by the USBR. These costs will again be reviewed with USBR to insure the report reflects a field level agreement between the USBR and Corps on cost of existing construction which should be included in the flood control project cost estimates.

(3). The Section 404(b)(1) evaluation of practicable alternatives will be consistent in the treatment of sunk costs. As in 3.d.(1) sunk construction costs will not be included as an economic cost in the economic analysis of practicable alternatives.

e. Highway 49 Relocation. The credit for LERRD resulting from the non-Federal sponsor relocating Highway 49 will be in-kind (i.e., a two lane bridge and appropriate approach lanes as close to the existing alignment as possible, designed to current design standards and without consideration of future traffic projections) as required to accommodate the Corps flood control project. Cost





of any betterment that the local sponsor might desire will not be included in project cost and are not eligible for credit as part of LERRD. The EIS will address environmental impacts of this road/bridge relocation. The analysis of environmental impacts and the provisions of mitigative measures associated with any betterments will be the responsibility of the non-Federal sponsors.

f. Level of Protection of the Recommended Plan. The draft report will recommend the NED plan in accordance with the Principles and Guidelines. The draft report will also be edited to more clearly explain and highlight reasons why an increase in upstream flood control storage is the only technically sound, economically efficient means to achieve the non-Federal sponsors minimum target of 200 year level of protection for the Sacramento urban area flood plain. The report will also present the non-Federal sponsors rationale for selection of a 200 year minimum level of protection.

g. Advanced Measures Requirements. The report will reflect that the proposed Corps action is providing flood control only. The report will note the history of interest in water supply and hydroelectric power and state clearly why advanced measures were not included at the Corps proposed flood control project. The report should also note that the proposed Corps action is not expected to significantly influence nor enhance future determinations as to the need for, justification of, likelihood of, or timing of water or hydroelectric power facilities in the American River watershed. The EIS will address in broad terms the relationship between the flood control project and a multiple purpose Auburn Dam, but will concentrate primarily on the flood control structures recommended for construction.

h. NED Analysis. For the NED analysis the Natomas levee improvements will be treated as a separable element and evaluated for inclusion in the system on the basis of a last added increment. Natomas will not be tested as a first added increment. Accordingly, the NED plan will be based on optimizing the flood control dam only and then optimizing the Natomas levees as a last added increment.

i. Special Cost Sharing in the Natomas Area. No special cost sharing, due to locational advantage, is to be considered since actual use of the land for development is uncertain, subject to local and state controls and unknown development and/or mitigation costs.

j. M-CACES Cost Estimate. The draft report released for

field level coordination will present the best available cost estimate for the NED plan. The estimates will utilize the M-CACES cost data developed for the 200 year level of protection plan. There is a strong possibility that field level coordination will result in modification to the NED plan and detailed design should be delayed until after the public comment period. The PMP and final report will contain an approved M-CACES estimate for the recommended project. The M-CACES estimate will be prepared according to EC 1110-2-263, including the required narratives and an explanation as to the work procedure for major work elements.

x. Acquisition of Land. Any project required lands now owned by private interests will be obtained by the non-Federal sponsor. Lands currently held in Federal ownership would stay in Federal ownership; for reservoir lands, easements would be provided to the sponsor by the respective owner Federal agencies at fair market value to accommodate the flood control requirements. For lands under the structural footprint of the reservoir, fee title would be transferred to the Corps. Any special rules applying to land transfers of the various Federal agencies involved will be honored. The non-Federal sponsor will be credited with the fair market value of all lands and easements acquired as part of the Corps' project real estate requirements.

1. Environmental.

(1). Combined EIS/EIR. To satisfy State of California EIR requirements, the EIS for the final draft report will be a combined EIS/EIR document. If for any reason this procedure should become an issue, the preparation of separate documents should again be considered.

(2). Mitigation Due to Land Use Change (Indirect Impacts). The recommended plan will include only requirements to mitigate for direct project impacts; any requirements to mitigate for impacts of induced future development will be a state and local responsibility relying on existing state statutes which control development of individual areas as it occurs. The induced development impacts will be addressed in the EIS document and recognition given to state and local controls as the appropriate type and amount of mitigation. This procedure will be clearly explained in the feasibility report. The assessment of impacts due to induced land use changes will be consistent with the evaluation of location benefits.

(3). Programmatic EIS. It does not appear that a programmatic EIS will be required since requirements for advanced





measures features are no longer included in the flood control dam.

(4). Wetlands. In assessing impacts to wetlands, all wetlands classified as wetlands must comply with criteria defined in (a)"Interagency Federal Manual for Identifying and Delineating Jurisdictional Wetlands, dated 10 January 1989" or any revision thereto, and (b)"Clarification of the Phrase "Normal Circumstances" as it pertains to Cropped Wetlands", issued by the Corps on 26 September 1990.

(5). Executive Order 11988. Provision of flood protection for developed areas, mitigation for direct environmental impacts, and local and state controls over future indirect impacts will meet the requirement of Executive Order 11988. This should be appropriately addressed in the reporting document.

m. Incidental Power and Water Benefits to Folsom. No additional analyses are required to evaluate incidental power and water benefits to Folsom Dam since, if such benefits were derived, they would be of too little magnitude to be reasonably evaluated or considered.

n. Other Studies. The report will expand the discussion of concurrent studies addressing water resources development in the Sacramento Metropolitan area. This will include the study area, problems addressed, potential solutions/alternatives and their relationship to the study area of the American River Watershed Investigation.

o. Justification of Measures Included to Mitigate for Induced Increases in Flood Stages.

(1). Natomas Features. The report will identify the areas where there is an increase in flood stages, flood frequency, flood depth and flood duration caused by measures to provide an increased level of protection for the Natomas basin with the Auburn Reservoir in place. To the extent practicable, the increase in resulting flood damages will be quantified or described in sufficient qualitative detail so that a comparison with the cost of mitigative measures can be provided for decision makers.

(2). Natomas Full Versus Partial Area Protection: The above will also be included in the comparative analysis of full versus partial protection alternatives for the Natomas area. Mitigation measures now included in the partial protection alternatives include acquisition of flowage easements for these areas in the Natomas area not provided increased level of

protection. The report must clearly demonstrate the increase in flood damages, depth, frequency and duration to support the implicit assumption of a real estate taking from induced flooding.

p. Project Management Plan (PMP). Prior to issuance of the division engineers notice, a PMP should be prepared, reviewed by the sponsor and the Corps (including Washington level review), and approved by the sponsor and the Division. The PMP for this project should recognize the potential for other pertinent projects to be integrated into the project during PED. The PMP should also address the linkages between the studies, and drawbacks and other risks and impacts associated with potential project integration.

q. Review Comments. HQUSACE technical and documental review comments raised and provided at the technical review conference will be considered in completion of the feasibility study and preparation of the final report.

5. The division is to prepare a Process Memorandum (PM). This document is to include the district's comments on the content, format, timing, usefulness, and any other appropriate observation about the IRC process which may be used to assist in improving the process for future IRC's. The PM should be forwarded to reach HQUSACE, ATTN: CECW-PW, within 30 calendar days after the district has received this memorandum.

6. We will recommend allocation of PED funds upon issuance of the Division Engineers's Notice and upon compliance with guidance in this memorandum.

for [illegible] BATES
Chief, Policy and Planning Division
Directorate of Civil Works

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 21 1990

OFFICE OF ENFORCEMENT

Mr. Morgan Rees
Office of the Assistant Secretary of the Army
(Civil Works)
Department of the Army
Washington, DC 20310-0103

Dear Mr. Rees

Thank you for providing EPA with an opportunity to comment on the draft American River Watershed Investigation Project Guidance Memorandum (PGM) and Issue Paper provided by Mr. Dickey, the Acting Assistant Secretary, to Mr. James Strock, Assistant Administrator for Enforcement on November 15, 1990. This letter is a follow up to our December 6, 1990, conversation. EPA looks forward to the review of draft PGMs as it affords yet another opportunity to resolve key planning issues that may impact the environment. EPA will continue to work with your office and the District to resolve our concerns with the American River Watershed Investigation. Region IX will be contacting the District regarding more specific concerns than we have articulated in this letter.

EPA supports the draft PGM regarding direction on the need for consistent analysis with other Sacramento area studies currently underway and guidance requiring further extrapolation of the 1986 flood event. The PGM's direction that the Environmental Impact Statement (EIS) clearly articulate the single purpose of this dam -- flood control -- while acknowledging the history of and continued interest in a multi-purpose dam is important to clarify the Federal action.

We have one substantive objection to the issue paper's and PGM's characterization of the requirements of and relationship between the Clean Water Act Section 404(b)(1) Guidelines and the Principles and Guidelines (P&G). EPA's understanding of the P&G is that the Corps must first complete its 404(b)(1) Guidelines analysis to determine if there are any less environmentally damaging practicable alternatives that meet the basic project purpose (i.e., flood control), and then, pursuant to the P&G, select *from among* those alternatives the alternative that maximizes the national economic development. The PGM inverts this order and therefore places an inappropriate limit on the scope of practicable alternatives analysis. Our detailed comments (enclosed) further articulate this point as well as other concerns with the draft PGM.

The PGM does not address all of EPA's concerns with the American River Watershed Investigation. The National Environmental Policy Act and the Guidelines require a broad scope of alternatives including differing levels of flood protection, non-structural options, and both full and partial protection options for the Natomas area that will meet the basic project purpose of flood control. If the District continues to maintain that the environmental impacts of the 400 year flood protection dam are less than those of the 100 year and 150 year alternatives requiring permanent re-operation of Folsom Dam, then the Corps must provide firm evidence of this finding. The PGM should provide guidance on the inclusion of these critical analyses.

Again, thank you for the opportunity to review and comment upon the American River PGM. I believe that if the PGM satisfactorily addresses EPA's concerns that future project planning would continue more smoothly. If you have questions about EPA's comments please contact me ((202) 382-5053).

Sincerely,

Richard E. Sanderson
Director
Office of Federal Activities

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DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PW (335-2-5a)

10 JAN 1991

MEMORANDUM FOR Commander, South Pacific Division, ATTN: CESPD-PD

SUBJECT: American River Watershed Investigation - Project Guidance Memorandum (PGM) dated 28 November 1990

1. Reference is made to the 10 January 1991 telecon between Messrs. Frank Dunn and Jay Soper of CESPD and Messrs. Earl Eiker and John Lucyshyn of HQUSACE concerning HQUSACE interpretation of guidance contained in paragraph 3a(8) of the subject PGM.

2. As required by paragraph 3a(8) of the subject PGM, all low level outlet provisions for Auburn Dam are to be provided with regulating gates and emergency closure and bulkhead provisions in order to regulate flows during periods of seismic, flood or other emergencies or threat to the structural integrity of Auburn Dam itself. In accordance with guidance contained in EM 1110-2-1602, emergency closure provisions can be provided with one transferable gate capable of closure under flow. If provisions are upstream of bellmouth entrances, this gate will also serve for bulkhead requirements. The diversion tunnel is to be permanently closed.

Hugh E. Wright

JIMMY F. BATES
Chief, Policy and Planning Division
Directorate of Civil Works

BRUCE MCCLURE, Chairman
STANLEY W. HART, Vice Chairman
JOSEPH A. DUFFY
ELAINE L. FITZMAN
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DAN E. MORGAN
WILLIAM S. MCLEOD
MAC LEVY
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ROBERT K. REMEN, Executive Director

STATE OF CALIFORNIA

PETE WILSON
GOVERNOR

# CALIFORNIA TRANSPORTATION COMMISSION

1120 N STREET, P.O. BOX 942873
SACRAMENTO 94273-0001
FAX (916) 445-1233
(916) 445-1600

January 22, 1991

George Qualley
Chief of Flood Management Division
Department of Water Resources
1416 9th Street, Room 1601
Sacramento, CA 95814

Dear George:

The California Transportation Commission has become aware that plans and environmental clearance for Auburn Dam are proceeding again, toward an expandable flood control dam. A project of this scope would put the existing Route 49 bridge across the American River upstream of the dam in a position to be inundated whenever the dam held water for flood control purposes. As part of the dam project, the Route 49 bridge will have to be relocated.

Relocation of Route 49 will require one, and perhaps more, Commission decisions. The Commission must approve a route adoption for any new alignment. The Commission also approves any state or federal highway funding that may have to be used for the bridge project, and makes findings toward any property condemnations that may be needed to get right-of-way. The Commission wants you to know what its responsibilities and process requires for these actions.

A route adoption will clearly be necessary, since even if a high level bridge were to be built directly above the existing bridge, the bridge approaches would have to be realigned considerably. A route adoption requires environmental clearance, and the Commission must offer a chance for public input. Environmental clearance typically requires and EIR under CEQA (and a joint document EIS if any federal funding is to be used, under NEPA). If substantial right-of-way must be taken from more than one owner or if controversy exists. Significant controversy is known to exist for the Route 49 American River bridge location, among Caltrans, Placer and El Dorado Counties and other local agencies, and community groups and local residents.

The Commission understands that Auburn Dam will need environmental clearance with an EIS, and the new Route 49 bridge must be a mitigation measure for construction of the dam. The Commission also understands the bridge is to be funded from the state matching share of the dam project itself. Thus, the new location of Route 49 either must be cleared as part of the EIS for the dam, or cleared with a separate EIR for the bridge mitigation project. After environmental clearance, the Commission would be in a position to approve a new route adoption.



A number of project scope issues will be raised along the way, including the best location for the new bridge and its approaches, the engineering parameters to use for the new bridge, the traffic horizon for which the new bridge is to be designed, and the height of the new bridge in relation to expansibility of the dam. Multiple federal, state, and local agencies will be involved in decisions about cost implications, cost shares, and preferred project alternative, through the environmental clearance process for the bridge.

Funding for the bridge project may be a second issue for the Commission. The Commission understands that the dam project will include payment to replace the bridge with an equivalent facility, built to currently-acceptable standard, which would have a cost to be determined. The bridge that is actually built may not be this same equivalent facility, depending on the choice of project through the environmental process that clears the relocation of Route 49. The new bridge and its approaches may require funding beyond the cost of the equivalent replacement facility. This funding may be provided from additional state funding for the dam project beyond the required federal match share, or from state or federal highway funds, or from local funds, or from some combination.

If state or federal highway funds are involved, the Commission must program these funds in its biennial, seven-year State Transportation Improvement Program (STIP), and later must allocate the funds from a state budget in the year when construction is to be done. Programming of funds for the Route 49 bridge would have to follow the requirements of federal bridge programs, the state south/north split and county minimum requirements for the STIP, and state and regional priorities at the time of programming. At present, due to highway conditions and growth elsewhere in Placer County, the Route 49 bridge project would not likely be a high enough priority to receive federal or state highway funding in the STIP in the near future. Approval and continuation of construction of Auburn Dam might cause these priorities to be reconsidered, but highway projects typically are programmed seven years into the future, so lengthy lead time would be needed before highway funding could be assigned to a project.

It is not clear whether Department of Water Resources or Caltrans, or both, would be lead agency for the Route 49 bridge replacement project. In any case, California Transportation Commission would be a responsible agency under CEQA since it must make a decision to approve the project. The Commission looks forward to working with you as the Auburn Dam project moves ahead, since relocation of Route 49 would yield a desirable improvement from present transportation conditions. The Commission's Chief Deputy Director Pete Mathaway should continue to be your main contact for this project.

Sincerely,

ROBERT K. REMEN
Executive Director

24:OK12

A-100

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

28 MAR 1991

Colonel Laurence R. Sadoff
District Engineer
U.S. Army Corps of Engineers
Sacramento District
650 Capitol Mall
Sacramento, California 95814

Dear Colonel Sadoff:

As a follow-up to the Environmental Protection Agency's (EPA) review of the Draft American River Watershed Investigation Project Guidance Memorandum (PGM) and Issue Paper (HQ EPA letter enclosed) and our January 28, 1991 meeting with Walter Yep of your staff and Frank Dunn of the South Pacific Division of the Corps of Engineers (Corps), I would like to provide you with a summary of issues of concern to EPA Region 9.

All of these issues have been raised in letters or at meetings between EPA and the Corps over the past 24 months and we are pleased that some progress has been made. However, if any of the following issues are substantially at variance with the Draft Environmental Impact Statement (DEIS) you propose to publish this spring, I suggest we continue to work toward resolution prior to publication of the DEIS.

The Corps has determined that flood control measures are needed to provide protection to areas within the lower American River drainage and is in the process of evaluating alternatives that would protect properties within the 100-year to 400-year flood plains. EPA supports the protection of existing property and structures from flood damage. We believe that such protection can be accomplished by means that are sensitive to the environment.

I have enclosed a copy of a December 21, 1990 letter from EPA headquarters to Army headquarters providing comments about this project. Additional comments about several of the same issues including facilitation of a multipurpose dam, Folsom Reservoir reoperation, compliance with Section 404(b)(1) Guidelines, and mitigation for indirect impacts are enclosed.

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We appreciate the opportunity to comment on the draft PGM. We look forward to continuing to work with you and your staff regarding this DEIS and the proposed project. If you wish to discuss these issues further, please feel free to call me at (415) 744-1566 or Dr. Jacqueline Wyland, Chief of our Office of Federal Activities at (415) 744-1584 or invite your staff to contact Ms. Laura Fujii at (415) 744-1579.

Sincerely,

Deanna M. Wieman

Deanna M. Wieman, Director
Office of External Affairs

Enclosures: Detailed Comments
HQ EPA PGM Comment Letter

cc: EPA Office of Federal Activities, Washington, D.C.
EPA Office of Wetlands Protection, Washington, D.C.
USACE, OASA Civil Works, Morgan Rees, Washington D.C.
COE, Sacramento District, Walter Yep, Sacramento

**National Environmental Policy Act Issues**

1. The greatest environmental impacts would occur from conversion of the flood control only dry dam to a multipurpose dam. Therefore, we are very concerned that the Corps' project not facilitate construction of a multipurpose dam with its attendant severe environmental impacts without an explicit environmental review of that project. Consequently, we are very pleased with the Corps' decision to eliminate the "advance features" from the dam design. Had the design retained such features as a penstock opening and wetwell for future hydroelectric power generation and water supply, we believe the National Environmental Policy Act (NEPA) and Section 404 of the Clean Water Act would have compelled an evaluation in the EIS of alternatives for these project purposes and the impacts of hydropower and water supply as "reasonably foreseeable future actions."

We will review the DEIS for a clear demonstration that the dam's general structural design and construction do not exceed the requirements for a dry dam. If the ability to expand the dam for other purposes is facilitated by the project design, its features, or construction, the project purpose is no longer merely flood control. In that case, the DEIS should be expanded to include other project purposes, their alternatives and impacts.

It is our understanding that HQ COE has directed the dam design to include outlet gates at the base of the dam for releasing water as a safety feature. The District and Division COE stated at the Feasibility Resolution Conference that they do not believe these gates are a necessary safety feature. These outlet gates raise the issue of advance features for a multipurpose dam being included in the flood control-only project. We urge the Corps to fully explain the purpose of the outlet gates as well as why they would not facilitate water supply operation.

2. For the same reason, the Corps' preferred alternative for the reconstruction and realignment of Highway 49 should not incorporate features necessary to accommodate a future storage reservoir. Selection of a specific Highway 49 realignment route should be based upon full evaluation of environmental, traffic, and socioeconomic impacts of various realignment alternatives and on public input. This evaluation should precede the selection of an alternative, so that the results may be incorporated into the decision (40 CFR Sections 1505.1 and 1506.1). The Corps should not rely on future, post-decision CALTRANS environmental and traffic analysis studies of realignment alternatives to ensure environmental requirements and impacts will be appropriately addressed.





The Corps should clearly describe the current design standards used to design the new realignment. Although the Corps may require the non-Federal sponsor to pay for, analyze, and mitigate for any betterment of the road/bridge realignment; the Corps cannot void its obligation to include in its own DEIS an evaluation of and mitigation measures for impacts from any betterment of the road/bridge realignment.

3. If there is a change in the operation of the flood control only dry dam for water supply and/or hydropower, we believe this would be a major operational change which would seriously affect the purpose for which the project was authorized, surveyed, planned and constructed. Such a change, we believe, would require approval of Congress and an environmental impact statement. We request that the Corps commit in the DEIS to initiating these steps prior to using the dam for water supply or hydropower.

4. It is our understanding that temporary (10 year) Folsom Reservoir reoperation would be necessary to achieve 100-yr flood protection during construction of the selected alternative. Permanent reoperation is also a feasible alternative for flood protection by increasing upstream floodwater storage capacity. We believe that the impacts of both temporary and permanent reoperation should be evaluated and fully disclosed in the present DEIS.

5. It is our understanding that State and local sponsors have requested a minimum 200-year level of flood protection because of urbanization already within and beyond the 100-year flood plain and expected growth in the Sacramento area. We hope that the Corps has worked with project sponsors to evaluate mechanisms beyond levee and dam construction available to State and local sponsors to provide higher levels of flood protection. These actions should be described in the DEIS in accordance with the provision of NEPA regulations to consider alternatives beyond those for which the Federal sponsor has direct authority (40 CFR Section 1502.14(c)) and to ensure compliance with the 404(b)(1) Guidelines. We believe this approach is further supported by the Executive Order 11988 on Flood Plain Management which exhorts Federal agencies to provide leadership and take action to restore and preserve the natural and beneficial values served by flood plains and to consider alternatives to avoid adverse effects and incompatible development in flood plains (E.O. No. 11988, May 24, 1977, 42 F.R. 26951 Section 1, Section 2(a)(2)).

6. We presume that the DEIS will provide a thorough environmental analysis of all reasonable structural and non-structural alternatives to provide flood protection in the lower American

River. These alternatives should include but not be limited to permanent reoperation of Folsom Reservoir and regulation of additional upstream reservoirs.

7. The Corps should clearly describe the land acquisition and crediting process and identify the Federal, State, and local entities involved with the easements and land transfers. The EIS should describe the relationship between the Bureau of Reclamation's Auburn Dam and land acquisition for the Corps flood control project. We recommend that the Corps examine the implications and consequences of deauthorization of the Bureau's Auburn Dam.

8. The DEIS should clearly define and explain the assumptions, criteria, and the analysis process used for the economic analysis, benefit analysis, and financial analysis. For instance, M-CACES cost estimates should be clearly defined and their purpose described. We also suggest the Corps state the reasons for incorporation of Bureau of Reclamation sunk costs as part of the project financial cost but not as an economic cost in the economic analysis.

**Clean Water Act Issues: Wetlands**

1. Inasmuch as the Corps intends to request exemption from Section 404 requirements under Section 404(r), EPA expects the DEIS to fully address compliance with the 404(b)(1) Guidelines. You may wish to consult regulatory staff of the South Pacific Division as to whether full compliance has been achieved.

2. We wish to emphasize that State and local sponsors' desire for 200-year or greater flood protection does not necessarily eliminate lower levels of flood protection as practicable alternatives under the 404(b)(1) Guidelines.

3. We recommend the DEIS discuss how the Corps would comply with Executive Order 11988 on Flood Plain Management if it selects an alternative which would provide flood protection for the full Natomas area.

**Mitigation Issues**

1. We are pleased that the Corps is committed to full mitigation for direct impacts of the selected alternative. However, we are very concerned with statements that the Corps will not mitigate for indirect impacts. Although we understand that it is a long-standing Corps policy, we request the Corps address the derivation of this policy and whether it is consistent with the





understanding reached between HQ EPA and the Corps during the CEQ referral of Corps 404 Regulations. We believe that the Corps' policy may be inconsistent with the EPA/Corps Mitigation MOA (dated February 6, 1990) which does not make a distinction between direct and indirect impacts.

EPA believes that State and local responsibility for indirect impact mitigation does not obviate the necessity for the Corps' DEIS to fully disclose mitigation measures for direct, indirect and cumulative impacts and evaluating the feasibility of their implementation, even if they are outside the jurisdiction of the lead agency (40 CFR Sections 1502.14(f), 1502.16(h), 1508.8, and 1508.20; March 16, 1981 CEQ Memorandum - Questions and Answers About the NEPA Regulations, Question 19 Mitigation Measures). We believe up-front mitigation for cumulative impacts or contributions to a mitigation bank, would provide effective and flexible means to compensate specific resources likely to be degraded or destroyed by the project.

**Clean Air Act Issues**

1. Sacramento County is a nonattainment area for ozone, carbon monoxide and fine particulate matter. EPA is very concerned with the potential cumulative impacts to air quality and possible lack of mitigation for these impacts. Under Section 176(c) of the Clean Air Act, no federal agency may approve or support any activity that does not conform to an air quality implementation plan. The 1990 Clean Air Act Amendments further define conformity to mean that the activity will not "(i) cause or contribute to any new violation of any standard in any area; (ii) increase the frequency or severity of any existing violation of any standard in any area; or (iii) delay timely attainment of any standards or any required interim emission reductions or other milestones in any area." Consequently the DEIS must clearly demonstrate that the proposed action would not have a negative impact on timely attainment of standards or cause or contribute to increasing violations of national standards.

The Corps, State and local sponsors should work together to evaluate potential mitigation of air impacts associated with anticipated development resulting from this project. We recommend working closely with the Sacramento Air Quality Management District and Sacramento Area Council of Governments to develop mitigation addressing potential increases in emissions. In doing so, the air quality plans for Sacramento that are being developed under the California and Federal Clear Air Acts should be used.

Detailed Comments on Army's
American River Draft Planning Guidance Memorandum (PGM)

NED Selection and 404(b)(1) Guidelines Compliance:

The P&G states that the Federal objective of water resources project planning is:

> "to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements".

The 404(b)(1) Guidelines recognize that only "practicable" alternatives should be considered in the evaluation of potential project alternatives. For an alternative to be practicable, it must satisfy the basic purpose of the proposed activity, and it must be available and capable of being accomplished after taking into consideration cost, existing technology and logistics. Maximizing the national economic development is not an appropriate component of the basic project purpose, but rather a factor the Corps must use to select a project alternative from a range of practicable alternatives that meet the basic project purpose, i.e., flood protection for the Sacramento area. In short, the desire to maximize the net economic development benefits is not an appropriate limit for a test of practicability to determine compliance with Section 404 as the PGM implies. Alternatives that have a positive benefit to cost ratio would be considered practicable under the Guidelines.

EPA's understanding of the P&G is that the Corps must first complete its 404(b)(1) Guidelines analysis to determine if there are any less environmentally damaging practicable alternatives that meet the basic project purpose (i.e., flood control), and then, pursuant to the P&G, select from among those alternatives that alternative that maximizes the national economic development. To address this concern, EPA suggests that the following could be inserted into Issue Paper paragraph 6.c in lieu of the second to last sentence and paragraph 6.d: "The identification of less environmentally damaging practicable alternatives through the Section 404(b)(1) Guidelines alternatives analysis should precede the selection of the national economic development alternative. Alternatives with positive cost to benefit ratios should be considered as meeting the 404(b)(1) Guidelines' practicability cost standard".

Level of Flood Protection:

Because the basic project purpose is provision of flood control for the urban Sacramento area flood plain, all alternatives that can achieve this purpose must be discussed in detail. Because the Corps is not an advocate for its projects, flood protection less than the local sponsor's goal does not indicate that an alternative is impracticable. Rather it means that there is no local support for that alternative and therefore no Federal action would take place.

Multi-purpose Dam Issues:

The PGM should include a requirement for discussion regarding National Environmental Policy Act (NEPA) and other environmental statute requirements if the dam's purpose were to be changed in the future. Direction requiring a commitment that additional NEPA documentation would be prepared for either the change in the dam's purpose or the re-operation of the dam (i.e., changes to the water control manual) should be included.

The PGM directs inclusion of the history of interest in a multi-purpose dam and states that the report should note that "the proposed Corps action is not expected to significantly influence nor enhance future determinations as to the need for, justification of, likelihood of, or timing of water or hydroelectric power facilities in the American River watershed". The latter direction does not address one crucial EPA issue -- the existence of the dam at this location may influence the selection of this location for a hydropower and water supply source. The EIS should acknowledge and address this influence.

The PGM should further direct that all project features that could be construed as facilitating a multi-purpose dam (e.g., Highway 49 re-alignment) be evaluated in light of the desire to clearly represent the dam as a single purpose flood control structure.

Temporal Scope of Analysis:

The PGM (paragraph 3.b.2) limits the temporal scope for projecting land use changes for assessing the locational benefits to the year 2010. This direction limits the assessment of impacts and mitigation to the same time frame. The project life for flood control projects -- and, therefore, the temporal scope of impact and mitigation analyses -- is typically 100 years. EPA concurs that it is difficult to ascertain future land use changes 100 years into the future -- unless such land is already protected or, conversely, slated for development. The 20 year horizon would seem to pass a reasonableness test for detailed projections and analyses. However, the Corps must still consider the reasonably foreseeable future events anticipated to occur between years 20 and 100. EPA believes that it is reasonable to assume that some growth will continue beyond 2010 or the period covered by current local land use plans.

Development of the Natomas Area and NEPA's Mitigation Analysis Requirements:

The PGM and Issue papers seem to inconsistently deal with the Natomas area's likelihood of development. At points the Army argues that the development or amount of development is uncertain (PGM paragraphs 3.b.2.a and 3.i) and later indicates that

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DEC 21, 1990

OFFICE OF ENFORCEMENT

Mr. Morgan Rees
Office of the Assistant Secretary of the Army
(Civil Works)
Department of the Army
Washington, DC 20310-0103

Dear Mr. Rees:

Thank you for providing EPA with an opportunity to comment on the draft American River Watershed Investigation Project Guidance Memorandum (PGM) and Issue Paper provided by Mr. Dickey, the Acting Assistant Secretary, to Mr. James Strock, Assistant Adminstrator for Enforcement on November 15, 1990. This letter is a follow up to our December 6, 1990, conversation. EPA looks forward to the review of draft PGMs as it affords yet another opportunity tc resolve key planning issues that may impact the environment. EPA will continue to work with your office and the District to resolve our concerns with the American River Watershed Investigation. Region IX will be contacting the District regarding more specific concerns than we have articulated in this letter.

EPA supports the draft PGM regarding direction on the need for consistent analysis with other Sacramento area studies currently underway and guidance requiring further extrapolation of the 1986 flood event. The PGM's direction that the Environmental Impact Statement (EIS) clearly articulate the single purpose of this dam -- flood control -- while acknowledging the history of and continued interest in a multi-purpose dam is important to clarify the Federal action.

We have one substantive objection to the issue paper's and PGM's characterization of the requirements of and relationship between the Clean Water Act Section 404(b)(1) Guidelines and the Principles and Guidelines (P&G). EPA's understanding of the P&G is that the Corps must first complete its 404(b)(1) Guidelines analysis to determine if there are any less environmentally damaging practicable alternatives that meet the basic project purpose (i.e., flood control), and then, pursuant to the P&G, select from among those alternatives the alternative that maximizes the national economic development. The PGM inverts this order and therefore places an inappropriate limit on the scope of practicable alternatives analysis. Our detailed comments (enclosed) further articulate this point as well as other concerns with the draft PGM..

The PGM does not address all of EPA's concerns with the American River Watershed Investigation. The National Environmental Policy Act and the Guidelines require a broad scope of alternatives including differing levels of flood protection, non-structural options, and both full and partial protection options for the Natomas area that will meet the basic project purpose of flood control. If the District continues to maintain that the environmental impacts of the 400 year flood protection dam are less than those of the 100 year and 150 year alternatives requiring permanent re-operation of Folsom Dam, then the Corps must provide firm evidence of this finding. The PGM should provide guidance on the inclusion of these critical analyses.

Again, thank you for the opportunity to review and comment upon the American River PGM. I believe that if the PGM satisfactorily addresses EPA's concerns that future project planning would continue more smoothly. If you have questions about EPA's comments please contact me ((202) 382-5053).

Sincerely,

Richard E. Sanderson
Director
Office of Federal Activities

Enclosure

cc: Daniel McGovern, Region Administrator, Region IX
David Davis, Director, Office of Wetlands Protection

A-105

development is certain with all Federal action alternatives (Issue Paper paragraphs 3.a and 4.c.5).

Regardless of these inconsistencies, the direction regarding mitigation should be clarified to ensure that it is consistent with the Clean Water Act and NEPA. NEPA requires that mitigation for direct, indirect and cumulative impacts be identified and evaluated for its feasibility of implementation (regardless of the Federal handle on its implementation).

Impacts of Folsom Dam Reoperation:

It is our understanding that Folsom Dam reoperation will be necessary to achieve some flood protection during dry dam construction. Reoperation is also a plausible alternative to increase upstream floodwater storage capacity. EPA believes that the impacts of both temporary and permanent reoperation should be discussed in detail in the EIS either as an appendix or incorporated by reference. To do otherwise invites criticism for failure to comply with NEPA and the 404(b)(1) Guidelines.

Air Quality Impacts:

The PGM did not address air quality issues. The Clean Air Act, as amended, clearly requires the Corps to determine that their action will not cause or contribute to, nor cause a delay in compliance with the National Ambient Air Quality Standards or meeting emission reduction deadlines and milestones. The PGM should reflect EPA's Federal Implementation Plan activities in the Sacramento area and advise the District to conduct sufficient analyses to support preparation of their determination of conformity pursuant to Section 176 of the Clean Air Act.

Cumulative Impact Analysis:

The PGM addresses the need for consistency of hydrologic studies in the various water resources development studies underway for the Sacramento area. The PGM should also address the need for a cumulative impact analysis which includes all related and reasonably foreseeable future actions. This analysis should include the Corps Sacramento/American River Systems Evaluation, Sacramento Metropolitan, Sacramento Urban, Folsom Reoperation, and American River Diversions projects. In addition, the likelihood of the Bureau of Reclamation's Auburn Dam should be discussed; if the Corps determines that a multi-purpose dam is reasonably foreseeable, its impacts should also be taken into account in the cumulative impacts analysis.



United States Environmental Protection Agency
Regional Administrator 75 Hawthorne Street San Francisco CA 94105
Region 9 Arizona, California, Hawaii Nevada, Pacific Islands

**ENVIRONMENTAL PROTECTION AGENCY**

March 28, 1991

General Roger Yankoupe
Division Engineer
U.S. Army Corps of Engineers
South Pacific Division
630 Sansome Street
San Francisco, CA. 94105

Dear General Yankoupe:

Enclosed is a copy of a letter to Colonel Laurence Sadoff from Deanna M. Wieman, Director of our Office of External Affairs, which provides a summary of issues of concern to EPA Region 9 on the American River Watershed Investigation project. These issues have been discussed, as indicated by the attached chronology of EPA actions, by EPA and Corps staff over the past two years.

I hope that insofar as our concerns are not addressed by the Draft Environmental Impact Statement (DEIS) the Corps proposes to publish this spring, that EPA and the Corps will continue to work toward resolution prior to publication.

We look forward to continuing to work with you and your staff regarding this DEIS and the proposed project. If you wish to discuss these issues further, please feel free to call me at (415) 744-1001 or Ms. Deanna M. Wieman, Director of our Office of External Affairs at (415) 744-1566.

Sincerely,

Daniel W. McGovern
Regional Administrator

Enclosures: 2

cc: COE, Sacramento District, Colonel Laurence Sadoff
HQ EPA, Office of Federal Activities, Dick Sanderson

## CHRONOLOGY OF EPA ACTIONS

-- **EPA Scoping Letter** sent to COE February 17, 1989.

-- EPA staff met with American River Coalition/Sierra Club December 21, 1989.

-- **Informational Briefing for RA/DRA** August 25, 1989.

-- **COE Briefing for RA and Region** September 11, 1989.

-- EPA staff attended Management Team Meeting January 24, 1990.

-- EPA staff met with State Reclamation Board and California Department of Water Resources staff April 2, 1990.

-- EPA attended **Executive Committee Meetings** April 19 & December 5, 1990; March 6, 1991.

-- **RA met with Colonel Jack Le Cuyer, Sacramento District Engineer** May 7, 1990.

-- EPA staff met with Walter Yep, Director of Planning Division, Sacramento District COE, May 17, 1990.

-- OFA attended **Feasibility Resolution Conference**, August 1, 1990.

-- EPA staff met with Walter Yep, Director of Planning Division, Sacramento District COE, October 4, 1990.

-- **RA meeting with General Roger Yankoupe**, Southwest Pacific Division Engineer, October 9, 1990.

-- **HQ OFA meeting with HQ level COE, FWS, BOR**, October 11, 1990.

-- **HQ OFA/Region 9 comments on the COE Program Guidance Memorandum (PGM)** to Morgan Rees, Office of the Assistant Secretary of the Army (Civil Works), December 21, 1990.

-- EPA staff met with Walter Yep, Director of Planning, Sacramento District COE and Frank Dunn, Director of Planning, Southwest Pacific Division COE, January 28, 1991.

-- **HQ OFA letter to Morgan Rees requesting response to our PGM comments**, March 1, 1991.

-- **HQ OFA meeting with Morgan Rees**, March 7, 1991.

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
WASHINGTON DC 20310-0103

Mr. Edward R. Osann
Director
Water Resources Program
National Wildlife Federation
1400 Sixteenth Street, NW.
Washington, D. C. 20036

4 APR 1991

Dear Mr. Osann:

This is in further response to the letter signed jointly by you and five other organizations providing a critique developed by the Environmental Defense Fund of the Army Corps of Engineers evaluation of potential flood control measures for the American River in the Sacramento, California area.

We sincerely appreciate receiving the critique and are pleased to have an opportunity to provide the enclosed Corps' evaluation of the critique. This office has reviewed and participated in the evaluation and believe it to represent a reasonable analysis.

As background, you should be aware that the Assistant Secretary of the Army (Civil Works) and the Corps do not favor any particular outcome of a project feasibility analysis. The recommendation developed by the Corps for any project is the outcome of a complex but well established and accepted Federal water resources project planning process for determining appropriate engineering, environmental, and economic aspects of water resources problems. The Army civil works program and the Corps of Engineers neither advocate nor oppose any particular project other than in the context of how, in our opinion, a proposal measures up to those well established Federal project criteria. Thus, we particularly welcome critiques such as yours which focus on the issues relating to the Federal project planning criteria.

We regret you believe that the Corps has not responded to prior criticisms of its project planning. Please be assured that the views you previously provided and those in the current critique have been fully considered during the planning analysis even if perhaps you may not have seen them explicitly addressed in any particular document to date. The Sacramento District plans to issue its draft feasibility report within a few days. I believe you will find many of your comments reflected in that document.





The enclosed point by point evaluation of the critique is given in the spirit of constructive cooperation with a view towards developing the plan which best meets the Federal water project planning criteria. Any further comments on the evaluation, the draft feasibility report or on the project in general would be most welcome.

Sincerely,

/S/

G. Edward Dickey
Acting Principal Deputy
Assistant Secretary (Civil Works)

Enclosures

3 April 1991

EVALUATION OF THE
ENVIRONMENTAL DEFENSE FUND CRITIQUE OF THE
FLOOD CONTROL ANALYSIS FOR THE AMERICAN RIVER, CALIFORNIA

1. Comment: Proper Operation of Folsom Dam. The critique indicated that Folsom Dam was operated inappropriately and that proper operation would have reduced the downstream discharges. This in turn would yield a smaller estimate of potential flooding in future storms.

Evaluation: Operating procedures are based on forecasts of rainfall events, estimates of amounts of runoff, and other factors not precisely known ahead of time. In developing an operating procedure, these uncertainties are considered along with the potential impacts of making releases to determine an appropriate timing and amount of releases. Following normal Army Corps of Engineers practice, a review of the flood control operation of Folsom Dam during the 1986 flood was made and a report was prepared by the Bureau of Reclamation. That report is entitled "PREVENTING A CRISIS: The Operation of Folsom Dam During the 1986 Flood", copy attached. The Corps has examined the data surrounding the February 1986 flood, the timing of when the data were known and the resultant releases and finds that the operation followed during that storm event was appropriate. The operating scenario presented in the critique that would have allowed smaller peak releases appears to be based on hindsight. Unfortunately, this is a luxury not available during the actual event, when, as in this case, the actual inflows to the reservoir were greater than forecasted throughout the first three days of the storm. The following is a more detailed discussion of the operation at Folsom Dam.

A hydrometeorological network of gages installed at twelve locations in the basin above Folsom Dam transmit data on rain, snow and temperature to a computer model located at the National Weather Service River Forecast Center in Sacramento. Inflows into the lake, based on hydrologic occurrences, can then be projected for a number of days. An accurate prediction of inflow requires advanced knowledge of the intensity and amount of rain expected, as well as the elevation above which snow will fall. However, despite technological advances such as computer maps, satellite photographs, radar and observed data, forecasts are generally not precise enough to operate a reservoir for longer than twenty-four hours following the prediction. Standard procedure by the Bureau of Reclamation, which was followed in the February 1986 event, is to coordinate proposed large releases with agencies including the Corps of Engineers, California Department of Water Resources, National Weather Service and State Reclamation Board.

In determining the appropriate timing and amounts of releases, the following downstream factors are considered.

a. Campus Commons Golf Course and Discovery Park are inundated when flows exceed 20,000 cfs;

b. erosion to the Nimbus Fish Hatchery screen foundation begins to occur when flows exceed 20,000 cfs;

c. the Sacramento County bike bridge crossing the American River downstream of Sunrise Boulevard is inundated and seriously damaged when flows exceed 45,000 cfs; and

d. the American River bike trails are damaged when the flows exceed 65,000 cfs.

Another concern raised to support the position that Folsom Dam was operated inappropriately was the fact that the 1986 event peak flows were considerably less severe than the flood for which Folsom Dam was designed. While the February 1986 flood peak was less than the Reservoir Design Flood (RDF) peak flow, the 1986 event six-day runoff volume was 17 percent greater than the six-day RDF volume. Large reservoirs, such as Folsom, are more sensitive to volume than to peak flows. While a large reservoir could easily accommodate the volume of a high but brief peak flood flow, in the same reservoir a lower peaked flood flow with a larger volume often results in more storage space being occupied. This is especially true if, as at Folsom in 1986, actual inflows exceeded forecasted inflows.

The provision of a maximum of 400,000 acre-feet of flood control space in Folsom Lake is based on the control of the RDF with a maximum release of 115,000 cfs. The RDF was computed as the flood which would result from the occurrence, directly over the drainage basin, of the largest rainstorm that had occurred at that time within the region (December 1937 storm) for a period when ground and snow cover conditions are moderately conducive to high runoff. This flood, with a basin mean precipitation of 14.86 inches, has a peak flow of 340,000 cfs and a 6-day volume of 978,000 acre-feet, or 9.6 inches depth over the drainage basin. The February 1986 flood is the flood of record in the American River Basin for durations of one through thirty days. The 1986 flood, with a basin mean precipitation of 23.19 inches, had a maximum 6-day inflow volume of 1,140,000 acre-feet. Fortunately this flood occurred on a very dry basin or runoff would have been even higher.

2. Comment: 100-Year Flood Flows are Less Than Folsom Design Flood. Analysis by Philip Williams & Associates indicates that the 100-year flood flows into Folsom Reservoir are smaller than the flood for which Folsom was designed.

Evaluation. The implication of the comment is that Folsom Dam is adequate, given a proper operating plan, to control a 100-year flood. This statement appears to be based on the similarity between the reservoir design peak inflow and the 100-year peak flow; 340,000 cfs and 352,000 cfs respectively. However, there are three reasons why operation of Folsom dam would not evacuate the flood storage space rapidly enough to accommodate the peak inflow over an extended period of time. First, in the early stages of a storm, if the flood control storage utilization in the reservoir is relatively low, there is insufficient hydraulic pressure to achieve the release of 115,000 cfs which is the maximum long term capacity of the downstream channel. Second, because of the unpredictability of rainfall, reservoir operations are based on minimizing downstream damages until it is relatively certain that incurring such damages is unavoidable. In the American River, these damages begin to occur at releases of 20,000 cfs. Thus, in the early stages of a storm, releases are not maximized. To do otherwise would induce extensive damages unnecessarily and create many false alarms over the long term. Third, the total volume of available storage compared to the total volume of inflow becomes a significant controlling factor in an extended storm. While peak flows of the reservoir design and the 100-year storms may be similar, the six-day reservoir design volume of 978,000 acre-feet is substantially less than the six-day 100-year storm volume of 1,520,000 acre-feet. There is simply insufficient flood control storage in the reservoir to accommodate an extended storm while maintaining releases at or below 115,000 cfs.

3. Comment: Dam Operation Failed to Anticipate Adequately the Collapse of the Coffer Dam at the Auburn Site.

Evaluation: The coffer dam was closely monitored throughout the runoff event. During the flood operation of Folsom, the recorded inflows to Folsom were adjusted for the effect of coffer dam storage changes. Adjusted flows and coffer dam storage changes were used to assess conditions during the scheduling of flood releases from Folsom. The coffer dam was continuously monitored and breaching was predicted more than twenty hours before it occurred. This is further discussed in the attached report. Flood frequency computations for Folsom subsequent to 1986 exclude the artificially peaked flow from the coffer dam breach.

4. Comment: An 80 Percent Operational Efficiency at Folsom Dam is too Conservative and Thus, Overstates the Degree of Flooding.

Evaluation: The reference to use of an assumed 80 percent operating efficiency is not correct. The confusion may be related to the fact that when the flood control storage requirement for Folsom Dam was established during project formulation, it was based on the conservative assumption that the



downstream channel capacity would be only 80 percent of theoretical capacity. This was to account for numerous unknown conditions such as prior storms, possible structural problems at downstream bridges, potential channel instability and possible delays in initiation of releases due to inaccurate forecasts and was in accordance with Corps guidelines in existence at that time. The current water control plan is based on 30-plus years of operating experience and does not reflect a reduction in overall operating efficiency of the project. Based on historical streamflow data, project operational history and a geotechnical analysis of downstream levee stability, a channel capacity for sustained flows of 115,000 cfs was established. Starting storage and outflow requirements were arrived at by tabulating storages when flood control releases equal to or greater than 20,000 cfs were made. On the average, during these flood events, Folsom storage was encroached 80,000 acre-feet into the flood control space due to antecedent events. Release decisions must consider that, although it is desirable to empty the flood control space as fast as possible, it is not desirable to cause downstream flood damage by exceeding threshold values until factors such as increased inflow and weather conditions require higher releases. Below Folsom Dam, damage thresholds are incurred at 20,000 cfs, 45,000 cfs and 65,000 cfs as previously discussed.

Releases based on inflow forecasts, a consideration of the downstream impacts of those flood releases, and the reservoir inflow volume contributed to the decision to temporarily use surcharge storage during the 1986 flood. The utilization of surcharge storage is operationally allowed only when existing hydrologic conditions permit (such as minimal forecasted runoff for the next 24 hours). It can not be used to permanently reduce the required flood control space, since hydrologic conditions for all flood events cannot be accurately predicted.

5. Comment: Modification of Spillway Release Operation. The Corps modified the emergency spillway release diagram for Folsom Dam in November 1986 to allow releases up to 160,000 cfs. This rate of release would cause flooding and ensure that downtown Sacramento becomes a designated flood zone for several of the alternatives examined by the Corps. If the maximum rate of release remained at 152,000 cfs, this flooding would not occur and additional flood protection would not be required.

Evaluation. This is an incorrect interpretation of the spillway release operation. The safe long term carrying capacity of the channel downstream of Folsom Dam is 115,000 cfs as discussed elsewhere in this document. The maximum allowable short term release for Folsom Dam remains at 152,000 cfs. The only time releases of 160,000 cfs would be allowed would be in the event of an oncoming uncontrollable flood. If an uncontrollable flood occurs, control gates would have to be fully opened in order to protect the integrity of the dam itself.

Failure to fully open the gates would cause water to spill over the top of the dam rather than over the spillway and jeopardize the structure. The spillway release diagram would allow 160,000 cfs to be released only for a period of six hours prior to fully opening the gates. This would delay onset of uncontrollable releases by six hours thereby allowing time for evacuation of the threatened areas downstream of the dam. There is no expectation that releases of 160,000 cfs are anything more than a dire emergency measure in the event of an uncontrollable flood and it cannot be considered as part of a normal operating plan for a design flood.

6. Comment: Corps vs. FEMA Methodology. The critique questions using the expected probability method in computing flow frequency for project planning purposes rather than the computed probability method used by FEMA in its Flood Insurance Program. The FEMA method generally yields lower discharges.

Evaluation: The objectives of the two programs are different. The objective of the Corps program, consistent with the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies", dated March 10, 1983 is to formulate individual projects in a way that maximizes the net economic development benefits specific to the project and consistent with national environmental criteria. A specific level of protection in a Corps project is not an objective; rather, it is the inherent result of a series of calculations designed to determine the optimum project size. On the other hand, the objective of the National Flood Insurance Program (NFIP) is to encourage voluntary participation of communities nationwide in a program to adopt local ordinances to manage and regulate land use to reduce future flood risks. In exchange, the NFIP makes flood insurance available within participating communities as a financial protection against flood losses which do occur.

Both the Corps and FEMA use accepted procedures as outlined in the Water Resources Council Bulletin 17B, "Guidelines for Determining Flood Flow Frequency", dated March 1982. These procedures were adopted by the Council for use in all Federal planning involving water and related land resources. Bulletin 17B described the use of the concept of expected probability but made no recommendation about whether the concept should be used. The decision was left to individual Federal agencies.

For long periods of record, there is essentially no difference between the two methods. The difference between the two methods is measurable for shorter periods of record when estimating the discharge for a given frequency flood. However, the differences are always within statistical confidence limits. For short periods of record, a large uncertainty exists in the estimate of the discharge frequency relationship. The expected probability



method takes this uncertainty into account; the computed probability method does not. As a result, the number of events which exceed a specific frequency flood discharge determined using computed probability is greater than the number of events which would exceed the same frequency flood discharge computed by the expected probability method. A consequence of this use of expected probability is a reduction in the risk and losses incurred with an exceedance event. Analysis and statistical tests using recorded data indicate that the expected probability method provides a better estimate of the actual probabilities.

The following discussion was provided by FEMA, "The question arises as to which is the "better" method to be used. To answer this question FEMA initiated a review by the National Academy of Sciences (NAS) in 1978 of the two probability methods. The NAS responded by indicating that precise answer is dependent upon what use is to be made of the application of the results of the two probability methods. The NAS recommended that FEMA not use the expected probability adjustment for estimating peak flows in the flood insurance studies of communities located in riverine areas. For floodplain management purposes, which include the establishment of regulatory base flood elevations and floodways which participating communities must adopt and enforce, the computed probability curve is better suited for NFIP use. Since the computed probability method is always close to the long-term probability at any individual site, it is the least biased estimate for regulatory purposes. The discharge which is established from the computed probability method has an equal chance of being too high or too low and thus is the most likely to win acceptance in a voluntary program when political and administrative implications are considered. However, while FEMA uses the computed probability method in determining estimates of the 100-year flood in its flood insurance studies, it realizes that the expected probability curve is better suited for use for other economic analysis purposes. As a result of concerns about the economic consequences of utilizing computed probability instead of expected probability and the net loss of revenue that could result from the National Flood Insurance Fund, FEMA has made a generalized adjustment to the standardized elevation-frequency curves, upon which flood insurance rates are based, to compensate for this potential negative impact.

"While FEMA utilizes the computed probability method in determining flood flows in flood insurance studies for NFIP purposes, it readily concedes that the expected probability method, as used by the Corps, is the more prudent choice for formulating individual projects in a way that maximizes the net economic development benefits specific to the project."

7. Comment: Flood Frequency Analysis. The Williams letter of March 5, 1990 to EDF states as an assumption of the Williams evaluation that the data were analyzed using the Corps program

for flood frequency analysis HECWRC, not the 1972 Regional Frequency Computation REGFQ. (Emphasis in original).

Evaluation. One might infer from the emphasis in the comment that the Corps used the 1972 REGFQ analysis. This is not correct. The Corps used the HECWRC analysis as did the Williams report. We are unable to account for why the Williams letter to EDF implies the Corps used the incorrect analytical program.

8. Comment: Upstream Storage. The critique states that the Corps used a seemingly arbitrary and unrealistic methodology to calculate the total available storage in existing upstream reservoirs by adding together the minimum storage available in each reservoir at any time in any winter. Further, it is believed that significantly greater amounts of storage should be creditable to flood control with a potential to reduce peak flow estimates along the American River. The critique suggests that additional flood protection could be obtained by entering into formal agreements with hydroelectric dam operators to provide flood storage.

Evaluation. Because of the important influence of upstream storage on runoff, examination of the hydrologic impacts and economic justification of using the existing upstream hydropower and water supply storage were considered in plan formulation. The following is a summary of that analysis. A more detailed description is included in the feasibility report.

Upstream storage was analyzed using 21 historical flood events to gain an understanding of how much storage actually existed before each storm. The analysis also considered that: (1) these reservoirs were constructed and are operated for hydropower generation and water supply (i.e. they do not include dedicated space nor physical features for flood control); (2) they control only 14 percent of the drainage area; (3) the reservoirs are disproportionately concentrated in the upstream area of Middle Fork American River; and (4) their impact occurs only during the early part of the runoff period, because once filled they are ineffective in reducing flood volume and peak flow.

For the 21 flood events, a statistical analysis of the potential reliable available space in these reservoirs creditable to effective flood control yielded approximately 50,000 acre-feet, which was used in plan formulation studies. It should be noted that FEMA criteria normally prohibit use of any upstream storage to reduce regulatory flood discharges unless that storage is specifically allocated to flood control. In this instance the Corps approach would appear to be more reasonable.

Studies have shown that it is not feasible to utilize flood control space in the five major existing reservoirs upstream from Folsom Dam for both physical and economic reasons. From the



physical standpoint, these reservoirs control only a small portion of the basin because of their remote location. From an economic standpoint, studies have shown that the cost to acquire the space, plus the cost to modify the outlet works for flood control would be in excess of the benefits gained.

9. Comment: Non-coincidental Peaks on Sacramento and American Rivers. The critique states that the Corps flood peak calculation is based on the unsupported assumption that the peak Sacramento River stage will occur at the same time as peak flow on the American River.

Evaluation. A review of the USGS stream gage data was made to determine when the Sacramento and American Rivers peaked at the confluence of these two rivers during major flood events. The major flood events in 1955, 1964, and 1983 were reviewed and it was found that historically these rivers peak at Sacramento on the same day or within one day of each other. In addition, the flood peaks are broad, and the difference between peak flow and flows one day previous or following is generally less than 5-percent. Thus, even assuming that the true peaks occur several days apart, there would be no significant change in the hydraulic calculations.

10. Comment: Deepening of Lower American River Channel. The critique indicated that there is evidence to show that since the construction of Folsom Dam, the lower American River channel has deepened and that it is not clear if this factor has been taken into account in calculating the river's channel capacity.

Evaluation. The current status of the American river channel is used in the analysis. A hydraulic backwater model was assembled for the lower American River in 1988. This model was developed for establishing new flood plain information for the Federal Emergency Management Agency for flood insurance studies. Flood plain cross sections surveyed in 1987 were used in developing this model and it was calibrated using surveyed high water marks for the 1986 flood. This flood was in excess of 130,000 cfs which very nearly filled the lower American River floodway. The use of these recent surveys and high water information for calibration has provided a backwater model with a high confidence in results provided. This backwater model was used in the determination of channel capacity and in the evaluation of the lower American River alternatives. Comparison of water surface profiles using the 1987 surveys with available stage-discharge relationships along the American River done in 1956 showed no significant differences.

11. Comment: Alternatives. The critique states that the Corps has effectively prejudged many alternatives by concluding that protection against a 200-year flood is required, and that the only way to achieve that protection is by constructing a dam

upstream of Folsom.

Evaluation. The non-Federal sponsor has expressed interest in alternatives which provide a high degree of flood protection. The following alternative flood control measures have been considered and evaluated:

Mainstem American River
- o Increase flood control storage space in Folsom Reservoir.
- o Increase downstream channel capacity with levee and channel modification.
- o Increase downstream channel capacity with setback levees.
- o Perform structural modification to Folsom Dam.
- o Raise Folsom Dam.
- o Use upstream reservoir storage space for flood control.
- o Construct new upstream flood control storage.
- o Modify Folsom Reservoir flood space management.
- o Construct small upstream dams.
- o Construct offstream storage.
- o Construct out of basin diversions.
- o Use capacity in Sacramento River Deep Water Ship Channel.

Natomas Area
- o Construct levee and channel improvements in and around Natomas area.
- o Construct compartment levee in Natomas.
- o Construct gated structures and pumping stations.
- o Construct detention dams upstream from Natomas.
- o Modify Fremont Weir and Yolo Bypass
- o Construct Sacramento River constriction.
- o Construct New Cross Natomas Canal

Nonstructural
- o Flood proofing.
- o Flood plan evacuation.
- o Development restrictions.
- o Flood warning.

12. Comment: Alternatives Analysis: It is further stated that the alternatives analysis has resulted in no systematic analysis of relatively simple individual measures that in combination could provide protection against a 200-year flood. In particular, the critique surfaces the potential for a quickly implementable measure consisting of upgrading the levees along American River to accommodate 150,000 cfs, telemetered flood warning systems, and use of surcharge storage in Folsom Reservoir.



Evaluation: All flood control measures listed previously were compared, and the most physically effective were assembled into alternative plans which would provide various levels of flood protection to the Sacramento Area ranging from about 80-years to 500-years. Each alternative will be presented in the draft feasibility report for the American River Watershed investigation. Alternative plans for the 100(FEMA)-, 150 -, 200- and 400-year levels of protection were identified combining the various measures. For comparative levels of protection alternatives were evaluated to determine the most suitable alternative for the level of protection.

The report will indicate that modifying the American River levees to accommodate 152,000 cfs objective release with 3 feet of freeboard is not a quickly-implementable or a practical solution. As discussed previously the identified safe channel carrying capacities of American River upstream levees are based on the 115,000 cfs objective release from Folsom Dam. A 1988 geotechnical analysis of the lower American River levees determined that the levees are stable for extended flows only up to 115,000 cfs. Extended flows above 115,000 cfs would lead to landslide levee sloughing and/or piping through the levees which could lead to levee failure unless remedial stability measures were constructed. In addition, hydraulic analysis indicates that flows above 115,000 cfs would cause damaging bank erosion along the lower American River. This was substantiated during the flood of 1986 which peaked above 130,000 cfs. For both of these reasons, extended flows above 115,000 cfs cannot be safely accommodated by the lower American River levees unless significant levee modifications are constructed. These modifications would include construction of stability measures such as toe drains, landslide berms, or cutoff walls, and extensive revetment of levees and channel banks, plus the associated land acquisition and mitigation of environmental impacts.

While higher objective releases may remove portions of the American River flood plains from FEMA regulatory requirements, the higher flows would adversely impact flows and water surface elevations in other parts of the Sacramento River flood control system, thereby increasing the flood risks at those locations. Levee improvements in the areas of impact would be required. Also, it should be noted that the portion of the lower American River from Nimbus Dam to the mouth has been designated a Wild and Scenic River in the recreation category. This designation affects both the type and extent of compatible work that can be accomplished on the river.

Regarding the use of telemetered flood warning data and anticipatory releases from Folsom Reservoir for protection, the BuRec presently has a real time runoff forecast computer model of the American River Basin as discussed previously. During major

flood events, the releases from Folsom are communicated to concerned agencies (Corps, State Department for Water Resources, National Weather Service, State Reclamation Board, etc.).

Surcharge storage is required to provide a safe means of transitioning from controlled to uncontrolled spillway flows during occurrence of the spillway design flood. Therefore, it is not available for permanent reduction of required flood control space. It is an operation goal at Folsom that floods up to and including the reservoir design flood, which was used in establishing the 400,000 acre-foot flood space requirement, should be controlled without using storage space above gross pool. The Corps does not believe that acceptance of the risks associated with permanently reducing the surcharge storage is warranted.

13. Comment: Identify a Series of Small Scale Improvements of River Channel Hydraulics.

Evaluation. Small scale improvements could help improve channel capacity locally. However, we are unaware of any cumulative combination of small scale improvements which would provide a stand alone project of FEMA 100 year level of protection. As a result, any small scale improvements would have to be part of a larger plan. Once they become part of a larger plan, they would be considered as part of each larger alternative and would therefore in effect cancel out in comparison of the larger plans against one another. The net effect is that consideration of small scale improvements would not affect the plan formulation decision process. Coupling this negligible effect on the decision process with the high cost of doing the hydraulic calculations involved, we judged it inappropriate to quantify effects of small scale hydraulic improvements.

14. Comment: Project Level of Protection. The EDF questioned whether it is appropriate for the Federal government to provide funds for a given community to achieve a level of flood protection in excess of what FEMA considers sufficient to meet Federal flood insurance requirements when this may decrease the availability of funds for other projects.

Evaluation. The "Principles and Guidelines" (P&G) which govern all Federal water resources planning require selection of the National Economic Development (NED) plan. The NED plan is defined in the P&G as the plan that reasonably maximizes net economic development benefits, consistent with protecting the Nation's environment. Thus, in order to be identified as the NED plan, an alternative must meet both economic and environmental tests. Implicit in this selection, of course, is proper engineering design and safety. The P&G also requires that alternative plans, including the NED plan, be formulated in consideration of four specific criteria: completeness,



effectiveness, efficiency, and acceptability.

The comment made in the critique relates to national policy developed outside the scope of this or any other individual project analysis. In the case of flood control for the American River, a complete array of alternative plans was evaluated. Based on existing benefits and costs, the plan which yields the maximum net NED benefits is the plan which provides about the 400-year level of protection along the American River. The current draft feasibility report demonstrates that the NED plan is consistent with protecting the Nation's environment and was formulated in consideration of the four criteria of completeness, effectiveness, efficiency and acceptability.

April 5, 1991

American River Basin Branch

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

TO: Librarians

A copy of the Draft Feasibility Report and Environmental Impact Statement/ Environmental Impact Report for the American River Watershed Investigation, California, is enclosed for use in the reference section of your library.

We are also enclosing a pamphlet describing the study and a Notice of Public Workshops and Hearings, which informs the public that these reports will be available for review in local libraries.

The review period for this document extends to June 14, 1991. We would appreciate your making the report available for the public.

Sincerely,

Walter Yep
Chief, Planning Division

A-115

CESPK-PD-A 5 April 1991

SUBJECT: American River Watershed Investigation, California, Draft Feasibility Report and Environmental Impact Statement/ Environmental Impact Report (EIS/EIR)

Commander, South Pacific Division, ATTN: CESPD-PD

1. Enclosed are 15 copies of the subject report; 15 copies of the supporting appendixes will be provided separately. Also enclosed are 10 copies each of an information pamphlet and Notice of Workshops and Public Hearings.

2. Five copies of the report have been provided to the Environmental Protection Agency for filing. A copy of the letter of transmittal is enclosed.

FOR THE COMMANDER:

Walter Yep
Chief, Planning Division

4 Encl
1. Draft report (15 cys)
2. Information Pamphlet (10 cys)
3. Notice of Workshops and Hearings (10 cys)
4. Cy letter to EPA

April 5, 1991

TO ALL INTERESTED PARTIES

Provided for your review and comment is the Draft Feasibility Report and Joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the American River Watershed Investigation, California (State Clearinghouse Number 89080710). This investigation was conducted under authority of the Flood Control Act of 1962, as amended by the Fiscal Year 1988 Continuing Appropriations Act (Public Law 100-262, dated December 22, 1987). This study was accomplished jointly by the Corps of Engineers and the State of California through the Department of Water Resources/The Reclamation Board as lead agencies under the National Environmental Policy Act and the California Environmental Quality Act, respectively.

The report describes flood problems and related water resources needs in the Sacramento area, potential solutions to those problems, and a plan tentatively selected for implementation. That plan would provide an estimated 400-year level of flood protection to much of the Sacramento area. It includes an 894,000 acre-foot flood detention dam near Auburn, California, and levee and related modifications at various locations around the Natomas area and along lower Dry and Arcade Creeks near Sacramento. Also included in the plan are biking and equestrian trails as part of levee improvements in the Natomas area.

A Notice of Workshops and Public Hearings and a pamphlet describing the studies to date and the tentatively selected plan will be provided to you separately.

Comments on the Draft Feasibility Report and EIS/EIR are requested by June 14, 1991. Please send your comments to Sacramento District, Corps of Engineers, ATTN: Planning Division, 650 Capitol Mall, Sacramento, California 95814-4794. If you have any questions or need additional information, please call the Corps' toll-free number (800) 227-0951 and leave your question or request on the recorder.

Wallace McCormack
President
The Reclamation Board
State of California

Laurence R. Sadoff
Colonel, Corps of Engineers
District Engineer

US Department of Transportation
United States Coast Guard

Commander
Eleventh Coast Guard District

Building 10, Rm 214
Coast Guard Island
Alameda, CA 94501-5100
Staff Symbol: (oan-br)
(415) 437-3514

16590
American River Gen'l
22 April 1991

U.S. Army Corps of Engineers
Sacramento District
Planning Division
650 Capitol Mall
Sacramento, CA 95814

Subj: AMERICAN RIVER WATERSHED INVESTIGATION CALIFORNIA

The Coast Guard has reviewed your Draft Feasibility Report and EIS for the American River Watershed. The project does not appear to modify any bridges under Coast Guard jurisdiction nor involve waterborne construction in areas of general navigation. Accordingly, we have no comments to offer. Thank you for the opportunity to review this project.

Sincerely,

W. R. TILL
Chief, Bridge Section
By direction of the District Commander

A-117

STATE OF CALIFORNIA - THE RESOURCES AGENCY PETE WILSON, Gc

THE RECLAMATION BOARD
1416 Ninth Street, Room 455-6
Sacramento, CA 95814
(916) 445-9454

MAY 10 1991

Mr. Craig Crouch
Senior Engineer
City of Sacramento
1391 - 35th Avenue
Sacramento, California 95822-2911

Dear Mr. Crouch:

Attached for your review is a proposed final draft of Amendment III to the State/Local cost sharing agreement for the American River Watershed Investigation.

The payment schedule included with this draft reflects a nonfederal increase of $900,000 bringing the total nonfederal study cost up to $3,650,000. The total study cost will be $7,300,000 upon approval of the third amendment to the Corps/ State feasibility cost sharing agreement.

Please notify us of your intentions to continue participation in the study by May 15, 1991. In addition, please have your Board adopt a resolution to The Reclamation Board immediately thereafter. A representative of the Board staff is available to attend your Board meetings and to answer any questions.

For further information, please contact me at (916) 445-9454 or Peter Rabbon at (916) 445-8984.

Sincerely,

ORIGINAL SIGNED BY
for Rodney D. Meyer
Raymond E. Barsch
General Manager

TRUSTEES
ROBERT SCHEIRER
RICHARD F. TARESH
ROY C. OSTERLIH
WILLIAM P. HUDSON
JAMES L. SPANGLER

OFFICERS
WILLIAM P. HUDSON, PRESIDENT
ROY C. OSTERLIH, VICE PRESIDENT
DONALD WHITE, SEC. - MANAGER

OFFICE OF
BOARD OF TRUSTEES OF
RECLAMATION DISTRICT No. 1001
1959 CORNELIUS AVENUE
RIO OSO, CALIFORNIA 95674
916 656-2318
916 633-2309

May 21, 1991

U. S. Army Corps of Engineers
Sacramento Division, Planning Division
650 Capitol Mall
Sacramento, California 95814

Gentlemen:

We are the local agency whose boundaries adjoin the north boundary of your study area and are responsible for flood control of approximately 32,000 acres. Reclamation District 1001 represents in excess of 400 landowners who, along with a myriad of other public and private agencies, have a vested interest in millions of dollars worth of improvements in this area.

This District feels very strongly that any changes in the flood control system, as outlined in your Draft Feasibility Report (i.e., raising 6,000 lineal feet of the south levee of the Natomas Cross Canal about one (1) foot) which constitutes a betterment of those facilities, should not discriminate or jeopardize in any manner, those facilities and/or level of protection now afforded landowners within Reclamation District 1001.

In attending the American River Watershed Investigative Study Management Team meetings, as well as the public workshops now being presented, we have heard the statement made that a failure (after completion of Corps proposed work on the south levee of the Natomas Cross Canal) of the north levee of the Natomas Cross Canal near Verona would be more likely. Providing additional levels of protection for the Natomas area, while increasing the likelihood of a failure to an integral part of our flood control works is grossly discriminatory and is unacceptable to landowners of Reclamation District 1001. The Trustees of this District oppose any betterment of a system, whereby the flood control system and lands within this District are subject to an increased danger of inundation.

The mitigation measures requested by the Board of Trustees of this District for the planned work within the Natomas area shall include some type of work or relief whereby the protection level of flood control structures of this District are not downgraded.

If I can be of any help on this matter, please let me know.

Yours truly,

Donald E. White

DONALD E. WHITE
Secretary/Manager

# County of Placer
## Board of Supervisors

175 FULWEILER AVENUE
AUBURN, CALIFORNIA 95603
916/889-4010 • FAX: 916/889-4108

BOARD MEMBERS
PHIL OZENICK
District 1
ALEX FERREIRA
District 2
GEORGE BELAND
District 3
SUSAN ROCCA
District 4
MIKE FLUTY
District 5

May 28, 1991

Colonel Lawrence R. Sadoff
District Commander
Sacramento District Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Sadoff:

I oppose the dry dam proposed in your American River Watershed Investigation Feasibility Report . The dry dam will ruin our American River Canyon without the benefit of water, power, or recreation for Placer County. Therefore, the dry dam is unsound, environmentally and economically.

Sincerely,

Phil Ozenick

Phil Ozenick, Supervisor
District 1

# Federal Emergency Management Agency

Washington, D.C. 20472

MAY 28 1991

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Mr. William H. Edgar
Executive Director, Sacramento
Area Flood Control Agency
926 J Street, Suite 424
Sacramento, California 95814

Dear Mr. Edgar:

We would like to thank you and Mr. Tim Washburn, also with the Sacramento Area Flood Control Agency (SAFCA), for participating in the meetings held on April 23 and 24, 1991. It was a pleasure discussing this very important project with you and Mr. Washburn, and with other interested individuals who attended the April 23 meeting.

We would also like to take this opportunity to officially request that you describe the steps that the SAFCA will take to ensure that adequate progress is made on the Sacramento metropolitan area flood-control improvements by November 7, 1992. Specifically, we would like to know what steps your agency will take toward completion of the necessary levee restoration and raising and the reauthorization of Folsom Reservoir for additional flood storage. As you know, your project must meet the requirements stated in Section 61.12 of the National Flood Insurance Program regulations (copy enclosed).

The information that must be submitted to us to satisfy the requirements of Section 61.12 is as follows:

Sacramento Area Not Including Natomas Area

1) Evidence that restoration of the Sacramento River levee system is complete and a finding by the COE that a combination of the levee restoration and upstream storage within Folsom Lake provides a minimum 100-year level of protection to the affected areas.

2) Congressional authorization of a revised operating plan for the immediate lowering of Folsom Reservoir on a permanent basis, or until such time as alternative upstream storage (i.e., Auburn Dam) is sufficiently functional.

Natomas Area

1) Congressional authorization to raise the levees protecting the Natomas area to provide at least a 100-year level of protection.

2) A finding by the COE that raising of the levees, in combination with the Sacramento River levee restoration and Folsom Reservoir Storage, provides a minimum 100-year level of protection to the Natomas area.



3) Appropriation of funds irrevocably dedicated specifically for protection of the Natomas area, not merely dedicated for flood protection in general.

4) Evidence that construction has been started on the critical features of the flood protection system, not merely on relocation works, such as bridge replacement.

5) Documentation showing the percent of funds expended and percent complete of each critical feature for the overall project, considering the existing levees protecting the Natomas area to contribute to the percent expended and complete. If the existing levees account for more than the 50 percent minimum, we will consider the percent expended and complete criteria met.

During our meetings, certain clarifications were made regarding our understanding of what portions of the Sacramento levee system are to be restored and what portions are to be raised. We would appreciate receiving a map which identifies the levees that SAFCA proposes to restore and raise so that we will understand the scope of your project. We look forward to hearing from you in the near future. If you have any questions, please let me know.

Sincerely,

John L. Matticks
Assistant Administrator
Office of Risk Assessment
Federal Insurance Administration

29 MAY 1991

CECW-PW (335-2-5a)

MEMORANDUM FOR DEPUTY FOR POLICY, PLANNING AND LEGISLATIVE AFFAIRS
OASA(CW)

SUBJECT: EPA Comments on the American River Watershed Investigation Regarding the Relationship Between the 404(b)(1) Guidelines and the Principles and Guidelines

1. The purpose of this is to provide our analysis of EPA's understanding, as expressed in their 21 December 1990 letter to OASA(CW), of the relationship between the Clean Water Act (CWA) Section 404(b)(1) Guidelines and the Principles and Guidelines (P&G) requirement of adopting the National Economic Development (NED) Plan, in commenting on the draft PGM and issue paper for the American River Watershed Investigation (ARWI).

2. EPA's understanding of the P&G is that the Army Corps of Engineers must first complete its 404(b)(1) Guidelines analysis to determine if there are any less environmentally damaging practicable alternatives that meet the basic project purpose (i.e., flood control), and then pursuant to the P&G, select from among those alternatives that alternative that maximizes NED. To address this concern in the ARWI, EPA suggested the following guidance, "The identification of less environmentally damaging practicable alternatives through the Section 404(b)(1) Guidelines alternatives analysis should precede the selection of the NED alternative. Alternatives with positive cost to benefit ratios should be considered as meeting the 404(b)(1) Guidelines practicability cost standard."

3. Under EPA's interpretation of Federal planning requirements, the NED plan for the ARWI would be defined as the plan that maximizes NED benefits selected from a range of least environmentally damaging practicable alternatives. By EPA's definition, such alternatives would be formulated without benefit of mitigation and without consideration of important factors such as overall system benefits, non-Federal project sponsorship, and public health and safety.

4. We do not agree with EPA's position. The Corps interpretation of P&G, in consonance with existing laws, is that the NED plan is identified from an array of alternatives formulated considering economic, environmental, and social impacts. Enclosure 1 contains the pertinent specific language from P&G and 404(b)(1) Guidelines.

A-120

CECW-PW
SUBJECT: EPA Comments on the American River Watershed Investigation Regarding the Relationship Between the 404(b)(1) Guidelines and the Principles and Guidelines

The P&G which govern all Federal water resources planning, require selection of the NED plan unless there are compelling reasons to the contrary. The NED plan is defined as the plan that reasonably maximizes net economic development benefits, consistent with protecting the Nation's environment where protecting the Nation's environment is to be provided through mitigation of the adverse effects of each alternative plan. Therefore, each alternative plan includes mitigation determined to be appropriate by the agency decisionmaker and in order for the alternative to be defined as the NED plan, it must meet and satisfy both economic and environmental considerations.

5. Plans formulated in accordance with P&G must consider all appropriate and justified measures to mitigate for adverse effects. Environmental considerations are an integral part of plan formulation. It is recognized that the final array of plans from which the NED plan is selected may or may not include any or all of the least environmentally damaging alternatives that EPA believes should be included. However, the final array of alternatives does include the true NED plan based upon an analysis that does not restrict the number of alternatives to be analyzed and constraints on the analysis should be kept to a minimum, i.e., all relevant variables, environment included, are subject to analysis.

6. We requested the views of the Office of Chief Counsel on this issue. They are of the opinion that the requirements of the 404(b)(1) Guidelines and P&G create an inherent tension that is unavoidable, while they do not propose to resolve this tension, they do provide advice on how the problem can be addressed while complying with our statutory responsibilities. The Office of Chief Counsel's full views on this matter is provided for your information as enclosure 2.

7. We agree that an environmental analysis must be performed as part of the plan formulation/evaluation process. A full array of plans must be formulated and outputs, environmental as well as economic, must be included in the analysis. The NED plan can only be properly identified when all the benefits and costs, including any preservation, avoidance, restoration, mitigation, etc. cost are subject to analysis.

CECW-PW
SUBJECT: EPA Comments on the American River Watershed Investigation Regarding the Relationship Between the 404(b)(1) Guidelines and the Principles and Guidelines

8. In the case of the American River flood control project we are requiring the 404(b)(1) Guidelines analysis in the EIS include a discussion of the practicability of alternatives less than the 200-year level of protection and an explicit comparison of impacts of each of the alternative levels of protection, including the concept of practicability with respect to P&G.

JIMMY F. BATES
Chief, Policy and Planning Division
Directorate of Civil Works

SAFCA

Sacramento Area Flood Control Agency

Contacts:
Bill Edgar or Greg Ohanesian
SAFCA 440-7606
Jolaine Collins or Christi Black
Deen & Black Public Relations 444-8014

FOR IMMEDIATE RELEASE

## SAFCA RECOMMENDS 200-YEAR FLOOD CONTROL DAM NEAR AUBURN

**Recommendations on Corps of Engineers' Plan for Flood Protection Along American River to be Presented to SAFCA Board at June 6 Public Meeting**

(May 31, 1991) SACRAMENTO -- The Sacramento Area Flood Control Agency (SAFCA) will recommend to its board next week that a 200-year flood control dam be constructed near Auburn as part of the U.S. Army Corps of Engineers' American River Watershed Control project, instead of the 400-year dam proposed by the Corps.

"The SAFCA staff recommendation affords 200-year flood protection to those living in the Sacramento flood plain, reducing a homeowner's risk of flooding during the life of a 30-year mortgage from 30 - 40 percent to 10 - 15 percent," said Bill Edgar, SAFCA's executive director. "Upstream storage, levee improvements and the interim reoperation of Folsom Reservoir are necessary to achieve a high level of flood protection for the Sacramento area."

The 430-foot dam would be "dry" except to hold back up to 545,000 acre feet of water threatening the safety of those living in the Sacramento-area flood plain. SAFCA recommends the facility be ungated, unless the Corps and the state determine that gates are necessary to maintain the integrity of the dam or the safety of the flood control system.

The flood control agency also suggests a requirement that canyon lands along the North and Middle Forks of the American River near Auburn be publicly maintained in order to provide and manage public recreation and to preserve future resource development.

SAFCA's recommendation does not preclude the flood control dam's future expansion for water, power and recreational purposes, subject to Congressional approval and funding.

(MORE)

SAFCA recommendations 2-2-2

SAFCA's plan contains five key recommendations, including:

- Levee improvements along the American River in the Natomas area, providing existing residents with the same level of flood protection afforded to the rest of the American River flood plain. In addition, the 200-year flood control dam provides everyone living in the flood plain with increased protection.

- The reoperation of Folsom Reservoir until the dam is completed, providing interim 100-year flood protection to residents living in the flood plain.

- A call for local agencies controlling urban land use in the Natomas basin and other parts of the flood plain to address the impacts of growth on wildlife, including the Swainson's hawk and the California giant garter snake.

- The Bureau of Reclamation should continue a study identifying the region's future water and power needs and evaluating feasible alternatives to meet those needs. One alternative may be to expand the flood control dam for water and power purposes. However, the study should not hinder or delay construction of the flood control dam.

- Construction of the flood control dam, levee improvements and the interim reoperation of Folsom Reservoir should not preclude any other flood protection measures, provided those measures are cost effective and justifiable.

SAFCA will present its recommendations to the SAFCA board of directors at a public meeting Thursday, June 6, beginning at 9:30 a.m. in the County Board of Supervisors Chambers, 700 H St., Room 1450. A meeting to receive comments on the recommendations and a public hearing on SAFCA's proposed flood control assessment will be held at the same location on Thursday, June 13, beginning at 5:30 p.m. The SAFCA board is scheduled to vote on the staff recommendations to the Corps' plan at 1:30 p.m., Thursday, June 20 at the Supervisor's Chambers. The public is invited to attend all meetings.

SAFCA's recommendation on the Corps' report will be included in the final feasibility study and final EIS/EIR which will assist Congress in developing the 1992 omnibus water bill.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
300 South Ferry Street
Terminal Island, California 90731

June 3, 1991

Colonel Lawrence R. Sadoff
District Engineer
Sacramento District
Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

Dear Colonel Sadoff:

We are providing our comments on the Feasibility Report and Draft Environmental Impact Report/ Environmental Impact Statement (DEIS) for the American River Watershed Investigation, California. The tentatively selected plan (TSP) would provide an estimated 400-year level of flood protection for much of the Sacramento area. It includes an 894,000 acre-foot flood detention dam near Auburn, California, levees, and related modifications at various locations around the Natomas area and along lower Dry and Arcade Creeks near Sacramento. The initial cost of the project is currently estimated at $836,000,000. In general, we conclude that the DEIS alternatives analysis, selection of the TSP, impacts analysis, and proposed mitigation are incomplete and do not accurately reflect the broader array of flood control options.

The main purpose of the project is to increase flood protection in the Sacramento area. Prior to 1986, it was thought that the existing flood control system (Folsom/Nimbus dams and levee systems) provided protection at greater than the 120-year flood event. Following record flows in 1986, it was determined that much of the Sacramento urban area lies within the 100-year flood plain. As stated on p. DEIS I-5, the TSP dam is designed so that it would neither "advance nor impede possible future expansion of the facility for water and power" (conversion to a multi-purpose, water storage dam). However, given the great cost of the TSP dam, and its storage potential, it seems likely that its construction would advance project expansion to include water storage and power generation. Simply put, tremendous political and economic pressure to operate the TSP dam as a multi-purpose dam would follow its construction. Therefore, the DEIS should discuss the effectiveness of existing instream temperature and flow guarantees in the lower American River, the lower Sacramento River, and Delta for the protection of fisheries, and whether operation of the TSP dam as a multi-purpose facility would affect instream temperatures or flows.

State of California

# Memorandum

To : 1. Projects Coordinator
Resources Agency

2. Ms. Annalena Bronson
The Reclamation Board
1416 Ninth Street
Sacramento, California 95814

Date : June 6, 1991

From : Department of Fish and Game

Subject: Draft American River Watershed Investigation, SCH 89080710, El Dorado, Sacramento, Sutter, Placer, and Yolo Counties

The Department of Fish and Game (DFG) has reviewed the subject report comprised of a Draft Feasibility Report and a *joint Draft Environmental Impact Statement (DEIS)/Environmental* Impact Report (DEIR). The project proposes construction of a dry, temporary detention facility near the North and Middle forks of the American River near Auburn, Placer County, a variety of levee improvements on the Natomas East Main Drainage Canal, the Natomas Cross Canal, the Pleasant Grove Creek Canal, Arcade Creek and Dry Creek in Sutter and Sacramento counties and lengthening of Fremont Weir and modification of the east levee of the Yolo Bypass, Yolo County. The document separates project issues by area of potential impact: Natomas Basin, Lower American River and Upper American River. The basis for much of the environmental information contained in the document is U.S. Fish and Wildlife Service (FWS) Coordination Act Reports as submitted to the U.S. Army Corps of Engineers.

The following comments have been prepared by the DFG as the agency exercising administration over the fish and wildlife resources of California under the authority of and in accordance with the provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). These comments recommended measures for the conservation and prevention of damage to fish and/or wildlife resources of the State.

Document review indicates wide discrepancy among information extracted from FWS reports that are used to determine resource values, identify project impacts, and develop appropriate mitigation measures. Of principal concern is the failure of this document to incorporate recommendations of the FWS for impact assessment and mitigation.

The document inadequately addresses the following issues within the Upper American River and Natomas areas:

1. Fishery resources have not been adequately defined, delineated, evaluated, or discussed. The fishery discussion is qualitative and incomplete and does not include a complete species listing.



2. Discussion of impacts to identified fishery resources is incomplete and inadequate.

3. *Discussion of mitigation measures for fishery* resources is incomplete and inadequate. Merely stating "Impacts to fisheries resources would be mitigated with a program to periodically restore any reaches of stream that might become degraded due to the project" (page VII-12, paragraph 7) typifies a total failure of this document to respond to potential project impacts and to develop meaningful mitigation measures.

4. Project impacts within borrow areas to both fishery and wildlife resources and potential mitigation measures have not been adequately discussed. Furthermore, the disclosure that gravel borrow will be necessary for the concrete structures of the proposed dam was not made in the initial DEIS/DEIR. The location and extent of borrow sites are not available for comment or consideration.

5. Project impacts to wildlife and water quality resources and appropriate mitigation measures due to realignment of Highway 49 have not been adequately discussed. Additionally, increased traffic volume and visitor use of the Auburn Canyon and build-out in the Cool-Georgetown areas due to straightening and improving this portion of Highway 49 are not evaluated.

6. Allowable uses of recreation lands after project completion have not been identified. The DFG recommends that project lands be open to recreational activities, including hunting and fishing.

7. Conclusions regarding project impacts to vegetation due to periodic inundation within the Upper Basin are erroneous and wholly inconsistent with conclusions of the FWS. Gradual degradation of vegetation caused by each inundation reduces the degree of change for the next inundation. This masks the total long-term habitat loss for wildlife.

8. Conclusions of impacts to wildlife populations as stated on pages 8 to 19 of the DEIS that "Most species will move to adjacent areas" is contrary to accepted biological principles and fails to evaluate both inter and *intra specific* competition and ultimate, long-term degradation of adjacent habitats due to periodic immigration of reservoir wildlife populations into adjacent habitats.

9. The failure to fully evaluate impacts to vegetation and wildlife populations due to periodic inundation of about 6,000 acres of wildlife habitat is a gross inadequacy and has led to the erroneous conclusion that project impacts within the Upper Basin are marginal.

10. The Swainson's hawk (Buteo swainsoni), giant garter snake (Thamnophis sirtalis gigas), valley elderberry longhorn beetle (Desmocerus californicus dimorphus), and winter-run chinook salmon (Oncorhynchus tshawytscha) are State or Federally-listed threatened or endangered species that occur within or are nearby the Natomas portion of the proposed project. Establishment of firm plans to avoid impacts on these species has not occurred.

11. Ultimate build-out of more than 29,000 acres in the Natomas area plus more development in the Meadowview and Pocket areas of southern Sacramento is a considerable loss of wildlife habitat that will result from culmination of the proposed flood protection without mitigation and creation of a management plan. FWS and California Department of Food and Agriculture assessments have shown that about 350 pounds of waste rice are left in harvested fields. The loss of 7,000 acres of rice land in the Natomas area would reduce the food available to wintering waterfowl by nearly 2.5 million pounds of rice. Similar loss of food available to wintering waterfowl would result from loss of more than 6,000 acres of other grains grown in the Natomas area. Other wetland species would suffer loss of 770 acres of wetland under the proposed project. Nearly 7,000 acres of new crops and over 2,400 acres of grassland and pasture that support rodents for Swainson's hawks would also be lost after full build-out of the floodplain protected by the proposed project. These farm lands possess some of the best soils in the central valley.

    The riparian habitat along the Sacramento River, wetlands, the farm land, and the canals that enable farming operations are key habitat for resident, migratory, and threatened or endangered wildlife species at Natomas. The ultimate loss of this floodplain habitat must be thoroughly discussed and all possible outcome and alternatives of the proposed project must be addressed.

12. The full impact of forming and constructing two or three more districts to collect and pump drain water now handled by irrigation district 1,000 is inadequately discussed as it pertains to wildlife, fisheries, and water quality. Neither



is the result of increased run-off within the floodplain with full development. Insufficient alternatives are presented to afford viable decision making.

13. Erroneous conclusions of impacts to vegetation and wildlife within the Upper American River Basin and Natomas area has subsequently led to grossly inadequate mitigation measures for project impacts to both vegetation and wildlife. FWS conclusions and recommendations more accurately depict potential project impacts to vegetation and wildlife populations, and we suggest that the conclusions and recommendations of this document reflect FWS recommendations, particularly the 1/3-Natomas plan and reevaluation of the 100-year alternative.

14. Table V-16, page V-40 of the Feasibility Report and all other discussion within these documents of impacts and mitigation measures for this project are not an accurate portrayal of this project.

15. Erroneous and understated mitigation requirements for fish and wildlife resources have led to understated cost analysis as depicted on page VII-16 of the Feasibility Report. Costs associated with the substantial amount of land required for mitigation as well as development, operations, and maintenance costs are not accurately included within this table.

16. Identification in this document of Unresolved Issues on pages 1 to 10 of the DEIS to include a major issue such as wildlife and vegetation mitigation is inappropriate. Full disclosure of alternatives is required.

17. Development of plans that address indirect growth inducing impacts must be resolved prior to submittal of final project documents and deferral of this issue as stated on page XI-2 to resolution only prior to construction is not acceptable.

The DFG has concluded that this draft document is inadequate and incomplete. Omissions are severe, and we suggest that a final document, based only on this review, is not acceptable. We recommend that all listed issues be fully discussed and resolved and that a draft document again be submitted for public review.

If the DFG were asked to make findings under the California Endangered Species Act based on proposed mitigation for impacts to threatened endangered species, findings of jeopardy would be necessary.



Thank you for the opportunity to review this project. If the DFG can be of further assistance, please contact Mr. David Zezulak, Associate Wildlife Biologist, or Mr. Jerry Mensch, Environmental Services Supervisor, Department of Fish and Game, 1701 Nimbus Road, Rancho Cordova, California 95670, telephone (916) 355-7030.

Howard A Sarasohn for

Pete Bontadelli
Director

Neumiller & Beardslee
A PROFESSIONAL CORPORATION
ATTORNEYS AND COUNSELORS
FIFTH FLOOR WATERFRONT OFFICE TOWER II
509 WEST WEBER AVENUE
STOCKTON, CALIFORNIA 95203

June 11, 1991

United States Army Corps of Engineers
Sacramento District
650 Capitol Mall
Sacramento, California 95814-4794

Attention: Planning Division

Re: Draft American River Watershed Investigation, Feasibility Report Part II Draft Environmental Impact Statement/Environmental Impact Report (April, 1991)

Dear Ladies and Gentlemen:

This office serves as special counsel to the Board of Supervisors of the County of San Joaquin concerning water matters and it is in that capacity that we have been instructed to comment on behalf of the County on Part II of the Feasibility Report entitled Draft Environmental Impact Statement/Environmental Impact Report.

In very general terms, we are concerned that the Draft Environmental Impact Statement/Environmental Impact Report ("the Report") does not contain a sufficient discussion of a myriad of critical environmental and social issues that we believe must be considered as part of a legally sufficient environmental review. Further, basic and fundamental policy options are disregarded or ignored on the basis of the writer's personal values instead of scientific or technical information that would amount to substantial evidence. These reasons culminate in San Joaquin County urging the Corps of Engineers to reject the Report until such time as it meets minimum legal requirements. Major revision of the Report will be necessary to achieve a legally sufficient document.

At the outset, the project description is legally insufficient. It is understood that an environmental review is fatally flawed if the project description is deficient. An accurate, stable and finite project description is the very



core of an informed and legally sufficient document. A curtailed or distorted project description may stultify the objectives of the reporting process. Only through an accurate view of the project may affected outsiders and decision-makers balance the proposal's benefit against its environmental costs, consider mitigation measures, assess the advantage of terminating the proposal and weigh other alternatives in the balance. In this case, numerous portions of the project which will have significant environmental impacts are ignored or avoided by a vague or inconclusive description. For purposes of this discussion, a few examples are highlighted. The construction of the dam would require 6 million cubic yards of aggregate material yet, according to the EIR "it is not yet known how many barn (sic) would be needed for dam construction." Further, "the specific method (for transporting the processed material has not yet been chosen." Also, the method of processing has not been determined making it impossible to comment on or consider the method.

At another point of the Report the writer concedes that it is unknown how Highway 49 will be routed. Furthermore the indirect impacts of growth made possible through the project were completely ignored. In this regard the Report was quite candid; stating that "for this Report, the land use forecast have been held to 2010 projects over the 100 year period of analysis because of the uncertainty of the long term socioeconomic forecasting." Time and time again, the Report dismisses significant impacts as being unimportant because it may be too difficult to find the answers. Further, alternatives to the project had been dismissed for unacceptable reasons. For example, "discussion of indirect impacts of an expanded project is beyond the scope of this analysis primarily because (1) these impacts cannot reasonably be foreseen at this time, and (9)(2)(sic) such an assessment would be exceedingly speculative."

Because of these deficiencies in the project design, important environmental issues cannot be considered with the detail that is required. For example, it is impossible to tell the amount and location of the excavation in what may be highly sensitive environmental areas. The reader cannot reasonably ascertain the potential environmental impacts from the processing or conveyor system because the Report does not disclose what systems will be used. Potential impacts concerning the rerouting of Route 49 are ignored because of the faulty project description. Indirect impacts are limited because it is apparently too much trouble to study them beyond an artificial date. To the same extent since the amount of

sediment load and other impacts is uncertain we cannot weigh the impacts to water quality as well as any jeopardy to wild life.

In short, the absence of a finite project description curtails a meaningful discussion of direct and indirect environmental impacts and in fact makes the Report a legally meaningless exercise. The defective project description prevents an apprehensive citizenry and public decision-makers from being able to intelligently balance the relative merits and trade-offs of the proposed project and causes the document to be a one-sided presentation in favor of the project instead of an independent neutral document. This approach fully frustrates the purpose of state and federal environmental laws and creates the need for substantial additional work.

Next, the Report fails to adequately describe and analyze the potential environmental impacts from the excavation activities. The Report seems to suggest that a conveyor system will be used. What is the length of the conveyor system? Over what property will the conveyor system be located? What is the noise that will be created by the conveyor system? Most conveyor systems are constructed of metal and are not enclosed. The sound of stone aggregate merrily bouncing on the conveyor system will be a tremendous noise generator. What assurances are there that the noise standards will not be violated? If the location of the conveyor system is undisclosed how can we tell whether or not residential neighbors will be impacted by the use? If the aggregate is conveyed by truck, how do we know that the roads can accommodate these trucks? How do we know that traffic hazards will not be caused by the large trucks carrying the aggregate? The Report also suggests that it is "assumed" that the processing plant will be located on the bluffs above the riverbed. Are the bluffs suitable and stable enough to accept the processing plant? What process will be used? Will any of the materials used in the process be hazardous or toxic as defined by either federal or state lists? In short, it is virtually impossible to provide meaningful comments to the excavation activity in the absence of a meaningful project description. Please note that under California law, providing a project description in the response to comments mandates that the EIR be resubmitted for further public comment. We believe that the Draft EIR should be modified to include this information and then subjected to further public review.

The indirect impacts of the project are greatly understated and are not properly analyzed. The Report



correctly states that the flood protection provided by the project will open vast amounts of land to development. However, at that point the Report fails to study those indirect impacts in sufficient detail. According to the Report, at least 48,000 acres of residential property will be taken out of the flood plain thereby removing the major obstacle to development and bringing about a massive conversion of farmland to residential and other uses. Assuming five houses per acre, this is a vast number of homes. What are the impacts of these homes to public facilities? The Report does not address this problem in sufficient detail. For example, simply using a commonly accepted number for trip generation of eight to ten trip ends per home per day, means that there will an additional 1.9 to 2.4 million trip ends a day in the area. I do not know how the Report can dismiss this indirect impact as not even being significant. This number, of course, does not even include non-residential uses such as commercial and industrial. In short, it is legally deficient for the document to dismiss indirect impacts of growth that are made possible only by removal of the lands from the flood plain by suggesting that local government will take care of these problems. The very purpose of the Report is to quantify the significance of impacts and provide meaningful mitigation measures. This approach illegally piece-meals the project and avoids a meaningful environmental discussion of impacts at this time.

The discussion of cumulative impacts is completely deficient. As already stated above, the project will cause a daily increase in trip ends from 1.9 to 2.4 million. In addition to that, 7,500 acres of productive agricultural land will be lost. Other cumulative impacts include air quality. The Report concedes that the land involved is currently an area of non-attainment. The inclusion of at least 2.4 million automobile trip ends per day will further contribute to the non-attainment of air quality standards. Yet the Report is virtually silent on all of the cumulative impacts that are created by the growth inducing nature of this project. In fact, the section entitled Growth Inducing does not even contain mitigation measures for the obvious impacts that will emanate from making this land available for development.

The development area in question is significantly used as a fly-away zone for migratory birds. There is absolutely no discussion of the loss of this fly-away zone for migratory birds nor is there a meaningful discussion of the potential loss of wetlands. The Report concedes that wetlands will be lost, which are critical to a meaningful fly-away for

migrating birds. California courts have quite recently ruled that large scale projects must consider the cumulative impact to the loss of wetlands in areas that are used by migrating birds. This Report is in clear violation of that court case and until such a study is completed, this document cannot be certified as being adequate.

Next, the discussion of a multi-purpose Auburn Dam is, very simply, intellectually dishonest. A multi-purpose dam is a valid alternative to the project. The Report is required to describe a range of reasonable alternatives to the project, or the location of the project, which could feasibly obtain the basic objectives of the project, and evaluate the comparative merits of the alternatives. The range of alternatives required in the EIR is governed by a rule of reason which requires the EIR to set forth only those alternatives necessary to permit a reasoned choice. The key issue is whether the selection and discretion of alternatives fosters informed decision making and informed public participation.

In this case, the focus of the EIR is arbitrarily narrowed so as to preclude the reasonable alternative. The Report makes the naked assertion that, "the TSP is a flood-control-only project and includes no features that are not necessary for flood control purposes". Why? Why is the focus of the alternative so limited as to not include a multi-purpose dam. This is a logical alternative to a single-purpose dam and yet is not included as an alternative. The Report then concludes that part of the problem is the fact that an assessment of indirect impacts would be exceedingly speculative. We find it amazing that the author of the Report can attempt to identify the indirect impacts of allowing 48,000 acres of residential property to develop but is unable to do an assessment of a multi-purpose dam because it would be "too difficult". This explanation is not persuasive and in fact conflicts with earlier statements. We believe a multi-purpose dam should be treated as an alternative to the project as it is a reasonable alternative. There is no evidence in this document to suggest that it is an unreasonable alternative. It appears the exclusion of one or more multi-purpose alternatives was simply for the purpose of attempting to complete the Report as early as possible. A desire for haste does not provide a foundation for excluding any reasonable and known alternative.

Next, the discussion of indirect irreversible impacts is legally insufficient. These impacts include the irrevocable loss of extensive productive agricultural land, the





elimination of significant wetlands that are necessary for migratory birds, and cumulative air pollution problems. These indirect irreversible impacts need to be set forth in the EIR so as to inform the public in the decision making.

Section ES-2 discussing related water resources needs does not mention the well-documented water resources needs from the American River of San Joaquin County. In addition, the executive summary does not discuss how the Draft Feasibility Report addresses these well-documented water resources needs of San Joaquin, El Dorado, and Sacramento Counties. This problem further impairs the ability of the Report to consider alternatives, and causes the Report to be prepared in a vacuum.

The discussion on the comparison of alternatives and the tentatively selected plan ignore the potential benefits to be gained from a multi-purpose storage facility. Federal Principles and Guidelines require that the Corps examine the potential for these benefits in order to determine the true National Economic Development (NED) Plan. Since the Corps failed to consider the potential of these benefits, the Report is flawed and should be revised to address these potential benefits. It is a fallacy to purport that the tentatively selected plan is the NED Plan when, in fact, the potential benefits which could be derived from a multi-purpose project, such as water supply, hydropower, and fisheries benefits have not been considered in the alternatives analysis. It is not known whether the TSP is in fact the NED Plan. No substantive discussion is included in the Report to explain the exclusion of analysis. The failure to include such a discussion distorts the Report's conclusions.

The procedure described for plan formulation, in particular, the statement discussing development of an alternative that maximizes the NED benefits is in sharp contrast with the planning objectives which appear to only maximize flood control benefits. The statement discussing incidental water supply and hydropower opportunities at Folsom Dam is not consistent with the evaluation of alternatives to maximize the NED benefits. In order to ensure an alternative which maximizes the NED benefits, an alternative evaluating a multi-purpose project at the Auburn site would be an absolute necessity. This is particularly true since the Federal Principles and Guidelines specifically recognize the NED benefits of water supply, hydropower, and fisheries benefits.

The statement insinuating that Congressional authorization for the study precludes the studying of a multi-purpose reservoir is misleading. The Congressional authorization merely indicates that the authorized USBR multi-purpose Auburn Dam may not be constructed. It does not state that a multi-purpose reservoir cannot and should not be studied or constructed. In fact, a multi-purpose reservoir should have been studied in order to meet the requirements of federal planning as required in the Principles and Guidelines. In addition, the statements alluding that there were no sponsors ready, willing and able to step forward for water supply and power generation is misleading as well. The voters in Sacramento County by a significant majority instructed the County Supervisors to do all within their power to support a multi-purpose facility at Auburn and other counties, such as Placer, El Dorado and San Joaquin, have also supported a multi-purpose facility at Auburn. Numerous cities and districts have joined in that support. Federal taxpayers and citizens of the State of California have been shortchanged because a multi-purpose facility was not studied. Therefore, the feasibility of such a facility cannot be correctly evaluated and compared with a flood control only facility since it was not studied. Because of this, the Draft Feasibility Report may well be recommending a project alternative which does not maximize the NED benefits and thus it is dishonest for it to be represented as such.

The table summarizing average annual benefits is flawed because it does not include benefit categories for hydropower, fisheries, and water supply associated with a multi-purpose project.

The plan selection criteria discusses the requirement of the NED Plan being recommended for federal action unless an exception is granted by the Assistant Secretary of the Army for Civil Works. In fact, the plan purported to be the NED Plan in the Feasibility Report is not by definition the NED Plan. Numerous benefits have not been studied such as hydropower, fisheries, and water supply, so labeling the recommended plan as the NED Plan is a fallacy. In fact, the Corps is recommending a plan which is not the NED Plan; therefore, it would require an exception to be granted by the Assistant Secretary of the Army, Civil Works, in order to be implemented.

In addition, the Report discusses efficiency as being measured by economic benefits. The Report states that by definition the alternative with the highest net benefits is





the NED Plan. The plan recommended by the Corps fails this criteria for two reasons. First, the Report failed to consider benefits available for a multi-purpose project such as hydropower, fisheries, and water supply. Second, an examination of Table V-17, Summary of Alternatives, on Page V-47, indicates that the net benefits for the tentatively selected plan are increasing when compared with that of the 200 year. This indicates that a larger project than the tentatively selected "NED" plan would yield larger net benefits and hence be a better project for the federal dollar. This is a reasonable alternative that is arbitrarily excluded. In other words, the Corps failed to study an alternative large enough to determine where the NED Plan lies and hence calling the tentatively selected plan the "NED Plan" is a fallacy. This problem could be magnified when one considers the failure of the Corps to evaluate other important benefits as well.

The discussion of the NED Plan under the risk and uncertainty category does not adequately address the uncertainty of the NED Plan due to lack of significant potential benefits. These benefits would include, but are not limited to, hydropower, water supply, fisheries and other wildlife benefits due to increased water supply available from an unstudied multi-purpose project. In addition, the risk and uncertainty discussion of the NED Plan fails to identify the fact that net benefits were increasing at the 400 year level. Therefore, the statement that the "NED size of 400 years adequately represents the band of potential optimal project sizes" is misleading and may well in fact, be incorrect. If, in fact, Plate 16 which depicts project benefits (associated with flood control only) is correct and alternatives larger than the 400 year plan were studied, this information should be clarified and presented in the Report so that the selection of the NED Plan could be shown more clearly.

The discussion about other water resource opportunities should be expanded to include more detail on San Joaquin County's future water needs. The discussion should include information regarding San Joaquin County's application for appropriation of a significant amount of water from the American River. In addition, many of the water resource opportunities presented within this chapter should have been studied and the potential benefits incorporated into alternatives to be studied in the Feasibility Report. The treatment of many of these important opportunities, such as, water supply, instream flows for fisheries and hydropower in a chapter which only discusses them generally, highlights the

inadequacy of the Draft Feasibility Report. These opportunities should be incorporated into project alternatives and studied. This should be accomplished prior to releasing the Final Feasibility Report.

*Table VIII-1 is not correct. The figures presented for* Folsom South do not include projected water use by San Joaquin County.

The discussion of a multi-purpose Auburn Dam project is misleading and grossly incomplete. Feasibility of a multi-purpose project at Auburn, not necessarily the full size Auburn, should have been addressed as an alternative in the Corps' Feasibility Report. Until this is accomplished, the public has no way of determining the value of such a project in comparison with other project alternatives, including the tentatively selected plan. This must be accomplished prior to releasing the Final Feasibility Report.

The conclusion that the tentatively selected plan maximizes net economic development benefits is incorrect. It is impossible to ascertain whether this is true or not without considering many of the numerous benefits that were left out of the study.

The conclusion indicating there is a need in the American River basin for additional water supply is correct. However, the statement in the Report that there is no federal sponsor to come forward for a multi-purpose project is not true. San Joaquin County and others are currently supporting a feasibility level study by the U.S. Bureau of Reclamation for a multi-purpose project at Auburn.

The conclusion that the tentatively selected plan formulated neither enhances nor precludes development of the Auburn project site for multi-purpose use is false. If a flood control only project is developed at that site, it would require a significant increase in expenditure of federal and local dollars over and above that needed to complete a multi-purpose project at the same site. Much of the money spent on the flood control only dam would be wasted. It is short-sighted to build only a flood control structure at that site and construction of such a project would make completion of a multi-purpose project at the same site extremely difficult.





In conclusion, this Environmental Impact Report is legally deficient, fails to even describe the project adequately, fails to discuss reasonable alternatives and otherwise misstates or underestimates potential environmental impacts.

Very truly yours,

THOMAS A. SHEPHARD, SR.
Attorney at Law

# *County of El Dorado*

**BOARD OF SUPERVISORS**

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Telephone (916) 621-5390

June 11, 1991

Colonel Laurence R. Sadoff, USA
U.S. Army Corps of Engineers, Sacramento District
650 Capitol Mall
Sacramento, California 95814-4794

Dear Colonel Sadoff:

I am writing on behalf of the Board of Supervisors, County of El Dorado, to formally comment on the Draft American River Watershed Investigation Feasibility Report.

El Dorado County was the fourth fastest growing county in the 1980's compared to other California counties with populations exceeding 100,000 persons. The development of new water supplies is among the many current challenges facing local governmental agencies in the county. The Auburn site is one of the few remaining feasible sites for a multipurpose project providing water and power benefits. Yet, as has happened many times in the past, an outside entity will take lands in El Dorado County for the benefit of non-county residents (flood control) to the detriment of county residents (water, power, recreation).

Appendix D to your Main Report discusses projected water supply demands in the American River Basin based on data provided by the California Department of Water Resources, U.S. Bureau of Reclamation, and local agencies. Supplemental water needs are indicated for San Joaquin County, Sacramento County, and El Dorado County totalling 439,000 acre feet by 2020. Despite these needs, the Main Report fails to adequately analyze either a minimum benefits pool, a multipurpose project, or alternative local water supply options.

The Main Report acknowledges that the Auburn Dam project would (1) provide water supply and hydropower; (2) be operated in accordance with flood control regulations during the fall, winter, and early spring; and (3) provide releases in late spring and summer to help raise the water-surface elevation of Folsom Lake for recreation and improve instream flow conditions in the lower American River. The multipurpose Auburn Dam project is an alternative which meets federal and state requirements for an alternative which must be



discussed in the Corps' environmental document, yet the Corps failed to analyze a multipurpose alternative.

The Main Report states that there are no non-Federal sponsors to fund construction costs allocated to water and power purposes. This is untrue. The American River Authority, of which El Dorado County is a member entity, made an offer in September 1988 to finance the water and power portions of a multipurpose water resources project. In addition, letters of intent to contract for water supply from a multipurpose water resources project were delivered to the Corps in early 1989. The El Dorado County Water Agency submitted such a letter indicating its intent to contract for 10,000 acre-feet of water supply from a multipurpose project on behalf of the Georgetown Divide Public Utility District.

Finally, the Corps states that "once flood control structures are in place, it is costly--and sometimes physically impossible--to modify them to provide a greater level of protection." The Board of Supervisors is concerned that the flood-control-only dam has been formulated in such a manner to impede or preclude development of the Auburn project site for multipurpose use.

The Board of Supervisors of the County of El Dorado concurs with concerns addressed through written comments submitted to you by the American River Authority (see June 3, 1991, letter by Robert E. Dorr, Chairman, American River Authority).

The Board of Supervisors looks forward to the Corps' response.

Very truly yours,

James R. Sweeney

JAMES R. SWEENEY, Chairman
Board of Supervisors

DEPARTMENT OF HEALTH & HUMAN SERVICES — Public Health Service

Centers for Disease Control
Atlanta GA 30333
June 11, 1991

Sacramento District
Corps of Engineers
ATTN: Planning Division
650 Capitol Mall
Sacramento, California 95814-4794

Dear Sir:

We have completed our review of the Draft Feasibility Report and Joint Draft Environmental Impact Statement (DEIS)/Environmental Report for the American River Watershed Investigation, California. We are responding on behalf of the U.S. Public Health Service.

We have reviewed the Draft EIS for potential adverse impacts on human health, and believe potential impacts have been adequately discussed. The proposed systematic monitoring program should ensure that restoration occurs as planned. We note that the program would also validate initial plan assumptions, provide for corrections of unsuccessful conditions, and provide feedback to regulatory agencies.

Thank you for the opportunity to review and comment on this document. Please insure that we are included on your mailing list to receive a copy of the Final EIS, and future EIS's which may indicate potential public health impact and are developed under the National Environmental Policy Act (NEPA).

Sincerely yours,

Kenneth W. Holt

Kenneth W. Holt, M.S.E.H.
Special Programs Group (F29)
Center for Environmental Health
and Injury Control

Kenneth W. Holt, M.S.E.H.
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DEPARTMENT OF
PUBLIC WORKS

DIVISION OF
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916 449-5271

June 12, 1991
91483:MR:rt

Mr. Bill Edgar
SAFCA
926 J Street, Suite 424
Sacramento, CA 95814

SUBJECT: REVIEW OF THE AMERICAN RIVER WATERSHED INVESTIGATION DRAFT FEASIBILITY REPORT

Dear Mr. Edgar:

Per your request we have reviewed the American River Watershed Investigation Feasibility Report dated April 1991 and have the following general comments. In general, we support the highest level of flood protection for the residents of Sacramento. However, we also acknowledge the political and economic realities of accomplishing a project. Therefore, we support SAFCA's effort at obtaining a high level of protection, 200 years or greater, while minimizing political and environmental oppositions against the project.

It would appear that this middle-road approach is the most accomplishable and timely solution and therefore, support SAFCA's staff report. However, we could not support a recommendation for protection at a less than 200 year level.

Lands For The Dam Site:

Of the 42,000 acres of land required for the 2.3 million acre foot multi-purpose project only 26,100 acres have been acquired to date. Part of this land was used to mitigate the impacts of the original project (permanent pool). This mitigation land should be credited to the mitigation requirements of the proposed flood control project. Other lands acquired for recreational purposes should also be credited against mitigation requirements of the proposed flood control project. In other words, the impacts of the original project for total loss of habitat in the canyons has, to a large degree, already been mitigated.

The EIR/EIS alternative for the no-project condition should excess these lands as not necessary. This would result in less land preserves and thus, result in a net loss to the environment. The Corps land needs for a dry dam would normally establish the take line at five feet above the high water mark. The Corps could purchase only flowage easements, allowing private ownership and development above this flood pool. Under the multi-purpose or minimum pool alternatives, the land in the canyons would be permanently lost. Under the dry dam alternative, they are useable 98 percent of the time. The legislation authorizing the dry dam would preserve lands much in excess of project needs as open space. The project receives no credit for this environmental enhancement.

Additionally we have the following specific comments:

II. 10 - 11: Sacramento River Flood Control Project

Magpie Creek is not listed within the Sacramento River Flood Control Project. The Magpie Creek Diversion Levees are U.S. Army Corps of Engineers Project Levees, and were constructed from the same plan-set as the Arcade Creek, Dry Creek, and Natomas East Main Drain Project Levees. Therefore the following paragraph should be included in the report:

Magpie Diversion

The diversion channel extends 7400 feet from the Sacramento Northern Railroad (SNRR) to Raley Boulevard. Project levees were built in two locations: (1) Levees exist along both sides of diversion channel starting at the SNRR extending 2,900 feet upstream, and (2) A levee exists along the west side of diversion channel starting at Raley Boulevard extending 1,200 feet downstream. The diversion project also widened channels and constructed appurtenant structures. These structures include a drainage pipe overflow for historic Magpie Creek cross-flow, pumping plant and the outfall pipes for the American River Flood Control District's Sump Number 7 (City Pumping Plant No. 157).

VII. 17: Interior Drainage Problems (third sentence)

It is not true that in "most cases interior flooding would be shallow and localized." Flood depths ranging from 4 - 10 feet are possible in the Morrison and Magpie Creek floodplains. However, we agree it would be much more localized due to the lack of volume on the smaller stream groups.

17: Interior Drainage Problems (Last Sentence)

The sentence should read: To help protect the Pocket area and Morrison Creek and tributaries floodplains the City is studying the flood problem and has asked the Corps assistance under their 205 authority. A preliminary cost estimate of $25 - $50 million indicates that a general investigation should be undertaken by the Corps.

VII. 18 - 19: Economic Benefits

The benefits derived for the project should account for the flooding that would result if Morrison or Magpie Creeks overflowed. Neither Morrison or Magpie Creek are capable of handling a 100-year event.

The report also is not clear as to what preproject conditions were assumed for Magpie or Morrison Creek. These preproject conditions should be explained.

DEIS 6 - 7: Lower American River 2nd Paragraph (first sentence)

This sentence should read: Drainage basins as noted ... in Dry and Magpie Creek drainage basins ...

DEIS 6 - 7: Lower American River (2nd Paragraph, Second Sentence)

This sentence should read: "In both these areas, local projects aimed at providing a higher level of flood protection are being planned". For Magpie Creek, the Corps of Engineers is conducting a study under their 205 authority. For Morrison Creek, the Corps is also conducting a study under their 205 authority, however, the preliminary cost of $25 - $50 million for improvements would justify a general investigation.

DEIS 17 - 19: Local Tributary Projects (Sentence two)

This sentence should read: The Morrison Creek Stream group, which is capable of flooding portions of south Sacramento and the pocket area ...

DEIS 17 - 19: Local Tributary Projects (Last Sentence)

This sentence should read: "Local studies have been initiated to identify solutions to the flooding problem on the Morrison Creek Stream Group. Currently the Corps of Engineers is doing the study under their 205 authority. However, the preliminary cost of $25 - $50 million for the improvements will more than likely justify a general investigation of Morrison Stream Group.

DEIS 17 - 20: South Sacramento Urban Levees and Tributary Projects (Sentence Two)

This sentence should read: This "group of waterways includes Morrison, Laguna, Elder, Unionhouse, Strawberry and Florin Creeks." The report should also address the north levee of Morrison Creek (commonly called the Beach Lake Levee) and the threat failure poses to the Meadowview and Pocket areas.

DEIS 17 - 20: South Sacramento Urban Levees and Tributary Projects (3rd Paragraph)

Elder Creek and Morrison Creek do not drain the same acreage. Neither do they run parallel. Elder Creek is a tributary to Morrison Creek.

DEIS 17 - 20: Magpie Creek Diversion Channel Improvement Project (1st Paragraph, Sentence 4)

This sentence should read: The U.S. Army Corps of Engineers and the State Reclamation Board completed construction of the Magpie Creek Diversion Channel in 1956. The American River Flood Control District widened the channel in 1966. The Magpie Creek Diversion Channel is currently owned by the State Reclamation Board. The levees are Corps project levees.

DEIS 17 - 21: Magpie Creek Diversion Channel Improvement Project (2nd Paragraph, last sentence)

Delete starting with ... without experiencing ..., since a serious flood risk has and does exist to the current property owners.

DEIS 17 - 24: Magpie Creek Diversion Channel Improvement Projects (After Paragraph 4)

Add the following paragraph: The agreement was originally executed with the understanding that the project would cost $3.5 million. This cost was based on very preliminary reconnaissance information contained in a 1985 report by Brown and Caldwell. In 1989, Dewante and Stowell further defined the project and estimated it would cost approximately $13.5 million. Because of this high cost, the City requested the Corps of Engineers to study the project under their 205 small project authority. Because of this higher cost, the original agreement to mutually share project cost is being renegotiated. McClellan AFB is participating in the study with the City of Sacramento.

DEIS 17 - 25: Raley Boulevard (Under Impact)

The bridge approaches could raise the depth of the existing floodplain of Magpie Creek upstream of Raley Boulevard. This potential impact will need to be mitigated through a proper design.

DEIS 17 - 26: Franklin Boulevard

The bridge approaches may increase the depth of the floodplain upstream of Franklin Boulevard. This potential impact will need to be mitigated through a proper design or upstream detention reducing water surface elevations.

If you have any questions please contact Terry L. Paxton at 449 6294

Albert E. McCollam, Jr., Division Manager
Flood Control and Sewer Division

# Sacramento Metropolitan Water Authority

A Joint Powers Authority

Gerald F. Schwartz
Chairman

Gene Robertson
General Manager

Joseph H. Sullivan
Executive Director

Members

City of Folsom

Carmichael
Water District

Citrus Heights
Irrigation District

City Water District

Fair Oaks
Water District

Golf Irrigation
District

Northridge
Water District

Omochumne - Hartnell
Water District

Rancho Murieta
Community Services
District

Reclamation
Water District

San Juan Suburban
Water District

Associate Member

Orangevale Mutual
Water Company

12 June 1991

Colonel Laurence R. Sadoff
U.S. Army Corps of Engineers
Sacramento District
Attn: Planning Division
650 Capitol Mall
Sacramento, California 95814-4794

Reference: American River Watershed Investigation,
draft Feasibility Report,
Parts I & II, dated April 1991

Dear Colonel Sadoff:

The Sacramento Metropolitan Water Authority, a joint powers public entity, was formed pursuant to the provisions of Article 1, Chapter 5, Division 7, Title 1 of the Government Code of the State of California. The Authority, representing twelve (12) water purveyors within the Sacramento region, contends that the above referenced draft report is deficient in the following three (3) major areas:

1) The multipurpose option was not adequately addressed.

2) Information dealing with the potential for expansion of the TSP is vague and inconsistent.

3) Reoperation of Folsom does not adequately consider the economic lost benefit to the water purveyors in the region caused by the loss of water supply and/or additional pumping costs required because of the lower water levels incurred.

The following detailed comments are submitted for your consideration and responce:

MULTIPURPOSE AUBURN DAM OPTION

Page VIII-13 denoted that "..the Auburn Dam project would (1) provide water supply and hydropower; ..". Page VIII-14 denotes "Initiating completion of construction would likely require significant additional studies, identifying qualified non-Federal cost-sharing sponsors and overcoming substantial opposition from numerous environmental interests."

Chapter VIII, and Table VIII-2 specifically, denotes that the American River Watershed region has a significant surface water shortfall. The economics of this shortfall are not addressed in this investigation. It would appear that this Chapter was originally intended to be collaborating documentation for the evaluation of the multipupose option. Justification for eliminating the multipurpose option, based on the water resource shortfall denoted in this Chapter, is not adequate and misguided.

Qualified non-Federal cost-sharing sponsors for the power and water portion of a multipurpose option have been available for some time. Both the American River Authority and the Sacramento Metropolitan Water Authority have offered funding plans to qualify as the non-Federal cost-sharing sponsors on the multipurpose option.

Justification for the elimination of the multipurpose option based on "..overcoming substantial opposition from numerous environmental interests.", is inconsistent with federal Principles & Guidelines.

Page IV-1 of the draft study, under PLANNING OBJECTIVES, also denotes:

* If possible, enhance water supply and hydropower opportunities at Folsom Dam and Reservoir and evaluate such opportunities elsewhere in the watershed incidental to the flood control objective.

Continuing on Page IV-2, the draft study also denotes:

* Develop the selected plan in accordance with the Federal objective of water and related land resources planning, which includes features to contribute to national economic development consistent with protecting the Nation's environment, pursuant to national environmental statues, applicable executive orders, and other federal planning requirements.

Again the economic of the multipurpose option are not adequately addressed. Benefits to be derived from the sale of power and water, which could be used to offset the cost of construction and annual maintenance costs, are not addressed, or even considered, in the rational for elimination of the multipurpose option.

EXPANDABILITY CHARACTERISTICS

Page VIII-14, ENGINEERING CONSIDERATIONS, "Several engineering considerations were critical in the selection of this new upstream



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detention location and design and formulation of alternatives which incorporate this feature. A number of damsites.....system safety."

Page III-7 states, "If the frequency of various size floods is underestimated, the various flood control measures implemented may later be found to be inadequate. Once flood control structures are in place, it is costly--and sometimes physically impossible--to modify them to provide a greater level of protection."

Page 2-2, DEIS, states, "Specifically, the development of a single-purpose flood control dam at Auburn should be undertaken in such a manner as to neither advance nor impede the prospects for developing water and power facilities at that site."

Page 2-2, DEIS, states, "The crest of the dam would be 2,700 feet (about 1/2 mile) long. The base would be about 400 feet wide, decreasing to about 25 feet at the dam crest. The foundation of the dam would extend 50 feet below the ground surface of the streambed."

To be completely and truly neutral, on expandability of the flood control project, the project must be designed and constructed in such a manner that with established design and engineering criteria modifications to the project could be accomplished. Appendices J-12 b. and M-6, would give the indication that expandability was given some detailed consideration, but no specific evidence was denoted. Examples of flood control facilities in the size proposed for the TSP are not provided, and probably not available. Utilizing the proposed method of construction for the TSP and extrapolating the "potential for expandability" is questionable.

REOPERATION OF FOLSOM

Reoperation of Folsom Dam and Reservoir is discussed in several sections of the draft report. On Pages IV-2 & 3, "POTENTIAL FLOOD CONTROL MEASURES", "Increase Flood Control Storage Space in Folsom Reservoir. - This measure would trade some water conservation storage in Folsom Reservoir for flood control storage. This measure was retained for further study mainly because it can be accomplished with no new construction for flood control and because reservoir storage can provide a more dependable level of flood protection than some other types of structural measures."

Page V-11 states, "Reoperation of Folsom Reservoir. - Increasing the seasonal flood control storage space in Folsom Reservoir would result in several major physical changes, including:

* Greater annual fluctuation of the reservoir water-surface elevation, with a net decrease from existing conditions. The greatest change would be from September through April, when the reservoir would be drawn down for flood control. In average and below-normal water years, the water-surface elevation would be lower in all months."

Page V-15 discusses the economic impacts. "Six agencies...obtain their water directly from Folsom Reservoir. These agencies would not lose any of their water supply, but El Dorado Irrigation District might experience some pump inefficiencies during critically dry years. Pumping would be required more often, resulting in increased annual costs of up to $62,500."

Reoperation of Folsom Reservoir has major economic impacts on the Sacramento Region. It is our understanding that the Corp of Engineers has completed, but not released, a independent study on the reoperation of Folsom Reservoir. It is also our understanding that the EIR/EIS on that study has not been completed. Reoperation of Folsom Reservoir is a major concern to this Authority. Many of the Authority members derive their water supply from Folsom Reservoir and the lower American River. Regional drought conditions these past five years have placed considerable emphasis on protection of these limited water resources. It should be made very clear in the subject feasibility report how reoperation will effect these water agencies and their customers. San Juan Suburban Water District, and its wholesale customers, would have considerable costs associated with pumping if the reservoir is low. Annual pumping costs denoted must be included in the cost of this project and borne by the flood control district. Flows in the lower American River must be protected to insure an adequate supply to those water districts which derive their water from that source.

The economic impacts of Folsom Reservoir Reoperation, either temporarily or permanently, as denoted in the subject feasibility report, are inadequate. The Authority reserves the right for further comments on this draft study pending the release of your Folsom Reservoir Reoperation Report.

On behalf of the Authority and its member agencies, we appreciate the opportunity to comment on this draft Feasibility Report on the American River Watershed Investigation. We look forward to your responce to the concerns and issues that we have raised.

Sincerely,

Gerald Schwartz
Chairman

# Placer County Water Agency


A Public Agency

BOARD OF DIRECTORS
R. G. Rude • Walter Ecksworth
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June 12, 1991
File No. Facilities
Auburn Dam

Colonel Lawrence R. Sadoff
District Commander
Sacramento District
Corps of Engineers
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Sadoff:

Placer County and the Placer County Water Agency have reviewed the American River Watershed Investigation Feasibility Report currently being circulated. It has been determined to submit for the record our position on the project as it is now proposed. A more detailed written comment on the report will be forthcoming.

The single-purpose dry dam proposal by the Army Corp of Engineers offers no benefits to the residents of Placer County. In the past the Placer County Water Agency and the County of Placer were discouraged from building the American Bar project. We were generally precluded from addressing at a local level solutions to our water needs having been persuaded that the U.S. Bureau of Reclamation would build a larger multipurpose dam. The Army Corp of Engineers' study is inherently flawed by its total failure to address as an alternative this multipurpose project.

A dry dam produces no revenue while a multipurpose dam produces power and water revenues. The multipurpose project provides a greater opportunity to improve the lower American River fishery and enhance downstream water quality. The counties of Placer, El Dorado, San Joaquin, and the Water Agencies and Districts in four counties have quantified their present and future water delivery needs, and concluded that the water component of a multipurpose can be funded by these local agencies.

For these reasons and others already expressed in prior forums, the Placer County Board of Supervisors and the Placer County Water Agency are opposed to the "flood control only" project as proposed by the Army Corp of Engineers. These agencies reaffirm their belief that a multipurpose facility can best meet the needs of the greatest number of people at the lowest cost per capita. The Placer County Board of Supervisors and the Placer County Water Agency could accept staged construction of a multipurpose facility, whereby the first stage was a "minimum pool" flood control facility impounding sufficient water to allow delivery of Placer County Water Agency Middle Fork Project waters through the Ophir Tunnel during the summer months when the water is needed. And further, stageability would include congressional authorization to expand the Auburn Dam to a full multipurpose facility; all lands necessary for such expansion; no National Recreation Area within the project land; and those engineering features necessary to facilitate further expansion.

On behalf of the Board of Supervisors of Placer County and the Placer County Water Agency, we urge your reconsideration of the proposed project.

Sincerely,

EDWARD HORTON
Acting Chairman, Board of Directors

May 10, 1991
c:\wp51\corr\army91

*Water Conservation Is A Moral Obligation*

COUNTY OF
EL DORADO

COMMUNITY DEVELOPMENT DEPARTMENT
PLANNING DIVISION

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June 13, 1991

Walter Yep, Chief
Planning Division
U.S. Army Corps of Engineers
Sacramento District
650 Capital Mall
Sacramento, CA 95814

RE: American River Watershed Draft Feasibility Report
Environmental Impact Statement/Environmental Impact Report

Dear Mr. Yep:

This letter is in response to the Draft EIS/EIR prepared for the American River Watershed study prepared by the U.S. Army Corps of Engineers and California Reclamation Board.

El Dorado County has distributed the EIS/EIR to all concerned County agencies. The attached comments have been prepared after reviewing these agencies' comments and are being submitted to address the County's concern on the Draft EIS/EIR. These comments address areas within the environmental document that either directly or indirectly affect El Dorado County and it's general population, or areas within the document that have not been adequately covered, are incorrect, or need to be evaluated.

If there is any question on the content or intent of these comments, please contact Dick Clark at (916) 621-5828, or Elizabeth Eddins at (916) 621-5355. Than you for the opportunity to comment on the American River Watershed Investigation EIS/EIR.

Sincerely,

Steven Hust
Principal Planner
Environmental Review Section

COMMENTS ON THE AMERICAN RIVER WATERSHED INVESTIGATION

DRAFT EIS/EIR

Page DEIS 1-5
It is stated that the flood control only facility "would be designed so as to neither advance nor impede possible future expansion of the facility for water and power". This is a false conclusion. It is clear that the proposed dam advances a multipurpose dam for the following reasons:

1. The facility will be gated, allowing water to be backed up behind the dam for any amount of time.

2. The facility could be expanded and retrofitted to function as a multipurpose dam with less effort and expense than constructing a completely new dam. This simple fact advances expansion of the facility for water and power. It is false for the EIR to state that this project is neutral with respect to water and power options in the American River Basin.

Since a full Environmental Impact Statement is being done on the re-operation of Folsom Dam, the preparation of the Final EIS for American River Watershed Investigation should be delayed until the Folsom Re-operation EIS is finaled. Significant new information relevant to the findings of the ARWI EIR/EIS will be brought to light by the Folsom EIS, so the two studies should be done more concurrently. Approval of this ARWI EIR/EIS without incorporating the information from the Folsom EIS would in effect be "piecemealing" the environmental review process for American River flood control.

Because the information on environmental impacts from the re-operation of Folsom Dam has not been adequately incorporated into the ARWI EIS, the cumulative impacts of the TSP project alternatives, and Folsom re-operation have not been adequately addressed in the ARWI EIS. Such cumulative impacts include impacts to fisheries, plant life, water supply, water quality, recreation wildlife, endangered species, and socioeconomic.

Following are comments on specific sections of the ARWI EIR/EIS:

Land Use

Page DEIS 4-14
The DEIR/EIS states that "The number of gravel bars needed to fulfill the aggregate requirement, the aggregate processing, the production site, and the mode of transporting the aggregate would be identified in the final EIS/EIR".

This information on aggregate extraction is required by CEQA to be circulated for public and agency review. The final EIR would need to repeat the entire circulation process that the document is currently undergoing, since there will be new information on significant environmental impacts in the FEIS/FEIR, as well as additional mitigation measures proposed.

Furthermore, the DEIR/EIS states that "No direct land use impacts would result from acquiring and transporting the aggregate to construct the TSP". Since there is no information contained in this document on the proposed aggregate extraction method, the method of transporting the aggregate, and on the impacts this would have on the environment, this statement is unsubstantiated. Unsubstantiated, conclusive statements such as this are a clear violation of CEQA and NEPA. What is the method proposed for extraction and processing the aggregate? What environmental impacts will result from the mining operations? Which gravel bars (specifically) will be mined? Will the aggregate be inspected for gold deposits? How will the aggregate be transported? How many vehicle trips will be required over the construction period from the mining site to the construction site? Will any aggregate be used in reconstruction of Highway 49? How much? What impacts will mining and transport of aggregate have on water quality, geology, soils, fish, vegetation, wildlife, air quality, drainage, recreation, land use, endangered species, cultural resources, traffic, noise, visual resources, cumulative impacts, and socioeconomics?

The DEIR/EIS does not include any information on the growth-inducing impacts which the Highway 49 realignment will have on El Dorado County. The proposed bridge would make access to the Cool/Pilot Hill area from the I-80 Corridor physically easier and would substantially reduce travel time. Many of the sharp curves would be removed because the substandard road would be replaced with a wider, straight bridge. The DEIR is required under both NEPA and CEQA guidelines to disclose how the improved access to El Dorado County will affect land uses in the area.

Hazardous/Toxic Waste

Page DEIS 5-2, Chapter 8
There is the potential for hazardous substances used during construction of the dam to be released into waterways. The DEIR should disclose the types of hazardous substances which could be used during construction and aggregate mining, and identify the impacts that discharge of the pollutants could have on the environment. Mitigation measures for handling and clean-up of toxic materials at the construction site should be developed.



Drainage and Water Quality

Page DEIS 6-1, Chapter 6
The DEIR/EIS states on page 6-15 that "the sedimentation associated with operating the flood control dam would not significantly affect water quality in the American River". However, there is no further information given to support this conclusive statement. What is the volume of material likely to be washed and eroded off the canyon during a worst-case flood event? What data support the conclusion that this volume of material would not significantly impact the water quality of the river? Are there any mitigation measures which could be incorporated into the project to reduce the impacts from landslides and sedimentation during a flood event? What effect will aggregate extraction from the river have on water quality?

The proposed mitigation measures should be more specific. What construction activities should be limited to low-flow periods? What constitutes a "low-flow period"? How often should water quality parameters be monitored during construction? Water quality concerns that need to be addressed in the aggregate mining operation within the Middle Fork of the American River to evaluate impacts shall include: The method(s) in which rock will be presorted to specific size - will this include crushing, reloading, temporary stockpiling within the river channel?; source of water for washing gravel; amount of water that will be used for the washing operation; toxic materials released by this crushing and washing operation into the american River (i.e. mercury, arsenic); impacts of increased silt being transported downstream due to the gravel washing and mining operation.

Air Quality

Page DEIS 7-1, Chapter 7
The DEIS/EIR does not include a discussion of the existing air quality conditions in El Dorado County, and does not disclose how the project will affect pollutant levels in the County, which is a non-attainment area for PM10 and ozone. Growth inducement created by the improvement of Highway 49 will create air quality impacts which have not been addressed in the document. Why did the document address this impact for the Natomas area and not for El Dorado County?

Air quality impacts from construction activities have not been adequately addressed in the DEIR/EIS. How many vehicle trips will be required during aggregate transport? What effect will aggregate transport have on air quality in the area? What effect will the rock crushing operation have on air quality?

The mitigation measures proposed for air quality impacts are inadequate under California statutory and case law. They must be specific, implementable actions which are mandatory. They are too loosely worded to be effective. How will it be ensured that

construction vehicles are properly tuned and maintained? Who determines if it is "feasible" to fit construction vehicles with emission reduction equipment? What does "feasible" mean in this context? Mitigation measures which include the words "where feasible" are ineffective. What kinds of construction activities would be restricted or banned on days when air quality violations are expected? Who will determine if there is an air quality violation expected? Who will determine if activities should be restricted versus banned - what criteria will be used for making this determination?

There is nothing in the project description about installing a rail or conveyor system to transport aggregate to the dam site. Where will this rail/conveyor system be constructed? Will it result in any environmental impacts? How much aggregate could such a system transport? What percentage of the total aggregate need could be transported by this system? If this rail/conveyor system is seriously proposed as a mitigation, much more specific and detailed information on it should be included in the DEIR/EIS.

Chapter 8 - Fish, Vegetation and Wildlife

Page DEIS 8-5 Table 8-3, Acreage of HEP
Table 8-3, Acreage of HEP Cover Types in the Project Area as Determined by FWS. The table identifies no Riparian Scrub-shrub in the Upper American River. This is false. This habitat exists throughout this portion of the river and associated tributaries within the project impact area.

In table 8-3 and 8-4 - Why was pool-riffle habitat not taken into consideration? This aquatic habitat is extremely important in the Upper American River watershed.

Page DEIS 8-17
Second Paragraph - The County does not believe that the following statement in this paragraph is correct: "The contractor could not identify any wetlands above the high water mark." After reviewing Fish and Wildlife Service's draft National Wetland Inventory, aerial photography and USGS maps , it is apparent that wetland do exist within the impact zone of the proposed dam. The County is requesting that this area be resurveyed with all maps and field data sheets included in the final document.

To further emphasize the existence of wetlands below the 950 foot elevation on page DEIS 8-18, first paragraph under Upper American River, it is stated "Many macro- and microhabitats occur throughout, including seeps, springs, small ponds, and pools, rock outcrops, limestone outcrops, talus slopes, cliffs, crevices, and caves." Seeps, springs, small ponds and pools all would meet the Federal definition as wetlands or waters of the United States.



Page DEIS 8-21
Last paragraph - Upper American River. This is an opinionated paragraph with no data provided within the environmental document to prove the conclusion. Changes in the management of the Upper American River could occur easily which would greatly increase the fisheries within the system. If this is not true, please address this in the document.

Page DEIS 8-23
Second paragraph - Upper American River. State how the vegetation would be affected by the project. This should include siltation impacts, land slides, water inundation, etc.

Page DEIS 8-27
Third paragraph - Upper American River. The document states, "There would be no direct construction impacts to fisheries in the Upper American River." Impact associated with the removal of the gravel in the Middle Fork American River were not addressed and need to be evaluated adequately in this section.

Page DEIS 8-37
Third paragraph - Upper American River. The negative effect(s) on higher food chain wildlife species because of losses to lower food chain species due to inundation need to be evaluated.

Cultural Resource

Page DEIS 10-1, Chapter 10
The document states on page 10-7 that identification of the historic properties within the study area which will be affected will not be completed before issuance of the final EIS/EIR. However, CEQA requires that environmental resources which will be affected be fully disclosed in the EIR, and that this information be circulated for review and comment. Stating that the cultural resources which will be affected will be determined by future study, which will in turn determine the course of mitigation, is a violation of CEQA. This information should be put in the DEIR/EIS and circulated for public review.

Transportation

Page DEIS 12-1, Chapter 12
The DEIR does not adequately address construction related impacts. The DEIR should specifically analyze haul roads in the upper American River area which would most likely be used. The haul routes which would result in the least impacts should be determined. A transportation plan which contains information on haul routes, on the number of trucks per day, and on traffic congestion and safety impacts should be done as part of the DEIS/EIR and not relegated to future study after the environmental document is certified. This information is vital to determining the significance of the impact and developing adequate mitigation.

The proposed mitigation measures are inadequate because they defer environmental assessment until after the EIR is certified. Reliance on illusory mitigation measures such as future studies and the subsequent formulation of plans, in this case traffic engineering studies and transportation plans prepared by contractors, is clearly a violation of the disclosure and mitigation requirements of CEQA. On what basis has it been determined that the proposed truck traffic mitigation will reduce the potential impact to a less than significant level?

The statement in the DEIS/EIR that the proposed Highway 49 realignment will not result in impacts to El Dorado County is false. The Corp's preferred alternative at River Mile 23 would eliminate a number of sharp curves and replace a portion of Highway 49 with a wide, straight bridge. The reason why this will result in additional traffic from growth inducement is explained in the land use comment of this letter. The fact that access from Western El Dorado County to the I-80 Corridor will be made physically easier by the proposed bridge means that the capacity of this stretch of Highway 49 will be increased.

Construction of the flood control dam will create the need for additional haul roads. The DEIR should disclose how many miles of additional roads will need to be constructed, both for construction of the dam site, for construction of the new Highway 49 alignment, and access to aggregate mining activities. Where will these additional roads be constructed? What environmental impacts will this construction have? Will the roads be re-vegetated when they are no longer used? What type of soil erosion control will be used to prevent erosion problems?

How will traffic be rerouted and managed during the reconstruction of Highway 49? Will Highway 49 be closed during construction? For how long? Where will traffic be rerouted to? What impacts will this have on Salmon Falls Road? On emergency access? How will these impacts be mitigated?

A more detailed analysis of traffic impacts in downtown Auburn is needed. If Highway 49 is realigned, traffic volumes will increase due to improved road conditions. What impacts will these increased traffic volumes have on traffic patterns, traffic safety, and traffic capacity in Auburn?

## Noise

Page DEIS 13-1, Chapter 13
The DEIR states that the extent of noise generated by construction activities cannot be determined until the numbers and types of transport equipment are known. The DEIR/EIS should consider a worst-case scenario in this case and estimate the amount of construction traffic which will be generated. This information would not be difficult for an engineer to estimate in



enough detail to do a noise analysis. This would allow adequate disclosure of noise impacts in the EIR/EIS and provide enough information on potential significant impacts so that adequate mitigation measures could be developed. To state that lack of attainable information prevents analysis of impacts and mitigation is in violation of CEQA.

The mitigation measures in this chapter are inadequate under CEQA. They are full of "weasel words" such as "where practicable", "to the maximum practical extent". Most of the mitigation measures are not worded as mitigations, but as mere suggestions. Such wording of mitigations is not acceptable under CEQA, since they do not require specific implementable actions. For example, the mitigation which states that "preventing nighttime construction near noise sensitive receptors can effectively reduce public concerns" should be reworded to state that construction activities will not be conducted during certain specified hours. All the mitigations in this section should be rewritten in a similar manner.

Table 13-2 states that the TSP would create significant increase in traffic noise along the Highway 49 realignment. There is no discussion of this impact in the text. What is the projected traffic volume (post-project area buildout) on this realignment? What are the noise contours for these volumes? Are there any noise receptors along the alignment? What is the significant noise impact referred to in the chart? What mitigation measures are proposed?

## Recreation

Page DEIS 14-1, Chapter 14
The recreational impact section of this document is grossly inadequate.

Construction related impacts on the upper American River recreational resources are not adequately addressed. There is no description of the proposed conveyor system in the project description. This conveyor system is continually referred to throughout the document but has not been adequately described anywhere. Which roadway or trail alignment will this conveyor be placed on? If there are a number of proposed routes, they should be disclosed in the document. Without disclosing the location. There is no way for the reader of this document to know what the impact of this conveyor system on recreational resources will be. How long is construction expected to last? What kind of noise will mining and construction activities generate, and what effect will this noise have on recreational enjoyment of the area? What kind of restrictions would be placed on boating along the Middle Fork during construction? What effect will the pits left by gravel extraction have on whitewater boating use? Will any existing whitewater rapids be destroyed by gravel mining? It is difficult to comment on mitigation measures for impacts to recreation, since there is not enough information presented about these impacts in the draft EIR/EIS.

Socioeconomic

Page DEIS 15-1, Chapter 15
There is no data to support the conclusion stated on page 15-19 that there will be no growth inducement in El Dorado County from the highway relocation. The reasons why this statement is false are stated under the Land Use and Traffic sections of this comment. The analysis of socioeconomic impacts on the Upper American River is inadequate because of this false assumption made regarding growth inducement. The effects on population, housing, water supply, sewage system, solid waste, emergency services, schools, and the economy should be analyzed using the assumption that improved access to El Dorado County will be growth inducing.

Visual Resources

Page DEIS 16-17, Chapter 16
The DEIR discloses some new information about landslides, stating that there are areas along the river which have the potential to landslide and block water flow in the river. This type of landslide would result in more than visual impacts. However, no where else in the document is this significant impact discussed. This type of information should be discussed in more detail in a section of the document dealing specifically with soils and geology.

Growth Inducing Impacts

Page DEIS 18-1, Chapter 18
This section of the DEIR should include an analysis of the impacts on El Dorado County from improved access on Highway 49. The reasons why the bridge replacement will result in improved access are explained in the Land Use and Traffic comments. The DEIR/EIS falsely states that growth inducement would only occur if an alternative route is adopted from the one proposed.

Relationship Between Short-Term Use and Long-Term Productivity

Page DEIS 20-1, Chapter 20
The DEIR/EIS does not disclose the adverse effect that inundation of the American River Canyons will have on long-term ecological productivity of the area. Inundation of the Canyons could destroy the organisms on the lower end of the food chain (insects, worms, rodents, etc.), in turn, adversely affecting the organisms higher up the food chain and reducing the ecological productivity of the area. To state the natural resources upstream of the dam site would remain productive over the long-term is unsubstantiated and false. The ecosystem upstream of the dam could be severely damaged by temporary inundation. The



damage would be even more severe under a possible worst-case scenario, in which the high water could remain behind the dam for an extended period of time. Such a scenario could result from a large landslide blocking the river channel or closure of the dam gates in the case of a downstream emergency. The effects of these worst-case scenarios have not been described in the DEIR/EIS.

Irreversible Changes Which Could Occur

Page DEIS 21-4, Chapter 21
On page 21-4 the DEIR/EIS states that there would be no long-term irreversible impacts from the TSP. There could be long-term irreversible effects from inundation on wildlife habitat, recreational resources, visual resources, water quality, soil erosion, noise, traffic, and population growth.

Appendix G - Section 404 EVALUATION

Page G-4
Section 3(1)(A)(1) UPPER AMERICAN RIVER. Is it feasible to obtain gravel material from an upland quarry? If it is not feasible, what are the constraints?

Page G-5
Section 3(1)(B)(1) UPPER AMERICAN RIVER. Significant effects, both physical and biological, will occur due to the proposed gravel extraction operation in the Middle Fork American River. This section does not adequately address these impacts. Studies are required to analyze downstream fisheries, gravel transport dynamics, and other effects associated with gravel removal.

Page G-7
Section 3(2)(A)(1) UPPER AMERICAN RIVER. The temporary effect of the stockpiling of gravel, haul road placements, and Highway 49 construction needs to be addressed. This section should also address impacts associated with the temporary retention of water upstream of the dam.

Page G-8
Section 3(2)(C)(1) UPPER AMERICAN RIVER. The temporary effects of the stockpiling of gravel, hauling road placement, Highway 49 construction, and construction pads need to be addressed

Page G-9
Section 3(3)(A)(1) UPPER AMERICAN RIVER. The question asked is,"Would the discharge result in unacceptable levels of turbidity?" The document states, "there is not sufficient data available to predict increases or decreases in sediment loads attributable to operation of the flood control dam." This data needs to be developed to address long-term impacts associated with the proposed dam. How can long-term impacts to adjacent wetlands, wildlife, and recreation be adequately addressed without this information?

Page G-9
Section 3(3)(B)(1) UPPER AMERICAN RIVER. Long-term impacts on turbidity need to be addressed.

Page G-11
Section 3(5)(B)(1) UPPER AMERICAN RIVER. Long-term secondary impacts need to be addressed to fully determine impacts associated with Section 404 activities . A significant concern that has not been addressed are the lower food chain impacts associated with the water impoundment during flood water retention (e.g. burrowing animal life, insects, reptiles). The loss of these lower food chain species will affect higher order wildlife species. This effect needs to be evaluated both long-term and short-term effects.

Page G-13
Section 3(5)(E)(1) UPPER AMERICAN RIVER. The following statement in this portion of the report is untrue: "The dam construction and gravel excavation are unlikely to impact wetlands under the jurisdiction of Section 404 of the Clear Water Act. This is due to the fact that the gravel bars would not be expected to have hydric soils." In the "FEDERAL MANUAL IDENTIFYING AND DELINEATING JURISDICTIONAL WETLANDS", dated January 10, 1989 in the Section entitled "Problem Area Wetlands", Section 425, Part G - "Vegetated river bars and adjacent flats", it specifically addresses these type of gravel bar habitats. If the areas are frequently inundated for one or more weeks during the growing season, they are wetlands. "The soils often do not reflect the characteristic field indicators of hydric soils".

Observations by the County have verified that during the spring runoff these gravel bars are completely inundated for at least three weeks. This needs to be reevaluated in the EIS/EIR.

Page G-14
Section 3(5)(F)(1) UPPER AMERICAN RIVER. "No vegetation shallows have been identified within the gravel extraction or dam areas". This is an incorrect statement. A number of vegetated areas are located in the Middle Fork of the American River within the extraction area. This area needs to be reevaluated under the current Federal Wetland Identification Manual.

Section 3(5)(6)(1) UPPER AMERICAN RIVER. "Would the discharge significantly affect any riffle and pool complexes?" The answer to this in the document states "Dam construction could potentially impact riffle-pool complexes adjacent to the gravel extraction areas below Cherokee Bar to the confluence of the North and Middle Forks. This should be changed to <u>will</u> significantly affect the riffle and pool complexes. Impacts associated with haul roads, construction pads, excavation operation, need to be further addressed. Additional impacts that have to be addressed are the effects associated with the stopping of downstream flows below the proposed dam during maintenance operations.





Page G-14
Section 3(5)(H)(1) UPPER AMERICAN RIVER. "If the discharge involves wetlands, vegetated shallows, or riffle pool complexes, would the work require direct access or proximity of the water resources in order to fulfill its basic purpose?" Impoundment of water, no matter how temporary, needs to be addressed. This would effect both upstream and downstream wetland habitat.

Page G-15
Section 3(5)(J)(1) UPPER AMERICAN RIVER. "Are there any measures proposed which would reduce or avoid significant impacts on the aquatic ecosystem?" The EIS/EIR does not fully address what measures have been incorporated into the project. The document's answer to this question is, "All work would be confined to the smallest area possible" is completely inadequate. The associated impact to the fill placed by this proposed project are significant and need to be fully addressed to evaluate appropriate mitigation and avoidance measures.

Page G-15
Section 3(6)(B)(1) UPPER AMERICAN RIVER. "Would the discharge significantly degrade aesthetic, recreational, or economic values?" Long-term impacts have not been addressed. Effects due to periodic inundation needs to be fully investigated to evaluate the long-term impacts.

Page G-16
Section 3(6)(C) "Is the proposed discharge site the least environmentally damaging practicable alternative?" The EIS/EIR doesn't adequately address wildlife or fisheries impacted. That which is mentioned in the document needs to expanded upon. The documents needs to address periodic inundation effects on the lower levels of animal and insect community. Effects at this level of the food chain will cause significant effects at the higher levels. The effects of this are not addressed adequately to evaluate impacts.

Page G-30
Section 3(8)(A)(1) UPPER AMERICAN RIVER. "Would the disposal result in fluctuation of water elevation or modification of stream flow?" Water level fluctuation due to the impoundment of water behind the dam needs to be addressed.

Page M-5-25, Geotechnical Investigations
It is stated that "should a dry dam concept be adopted, the possibility of a large slide damming the river and creating essentially an ungated structure will need to be considered." This possibility has not been addressed for the proposed site at River Mile 20.1. What is the likelihood that a slide of this magnitude could occur? What would the effect of this scenario be on inundation of the canyon? What size pool would be created? What is the amount of time the pool would exist? What kinds of impacts would such a scenario have on environmental resources?

Page M-5-27, Geotechnical Investigations
The DEIR/EIS states that three known landslides have the potential to cause a hazard to dams located at River Mile 20.1. What kind of hazard is created by these landslides? Will these landslides result in any significant environmental or safety impacts? How will these impacts be mitigated? Of the landslides will be removed, how will the spoils be disposed of? Similarly, how will the fill material in the three ravines downstream of the left abutment be disposed of? How many vehicle trips will be required to dispose of spoils form the construction site? What will be the environmental impacts of all these vehicle trips? What is the likelihood that a seismic event could be triggered by the dam and water impoundment under a worst-case scenario? What parameters have been incorporated into the dam design to make it seismically safe?

There is not enough discussion in the DEIR/EIS of public safety impacts created by the dam . This document does not analyze the fact that failure of a dam due to earthquakes is higher under floods less than 400-year magnitude, since these would be much more frequent. The possibility of failure is most definitely "reasonable" when floods of less than a 400-year magnitude are considered in the equation. What precautions should be in place to provide adequate warning and evacuation to prevent loss of life and property during a failure? The DEIR/EIS contains no mitigation for public safety impacts which could be created by the project, even though there could be significant hazards created.

Another public safety concern is fire hazard created by construction activities. The DEIR should disclose that increased activity in the construction area and mining area could result in increased susceptibility of the area to wildfires. Mitigation measures for this hazard should be disclosed.

STATE OF CALIFORNIA — PETE WILSON, Governor

STATE LANDS COMMISSION

JT McCARTHY, Lieutenant Governor
JY DAVIS, Controller
THOMAS W HAYES, Director of Finance

EXECUTIVE OFFICE
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CHARLES WARREN
Executive Officer

June 13, 1991

Ms. Carol Whiteside
State Projects Coordinator
The Resources Agency
1416 Ninth Street, Room 449
Sacramento, CA 95814

Corps of Engineers, Sacramento District
Attn: Planning Division
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Sir and/or Madam:

Staff of the State Lands Commission (SLC) has received the Draft Feasibility Study and Draft Environmental Impact Statement/Environmental Impact Report (DEIS/EIR) for the American River Watershed Investigation (SCH No. 89050710). The Corps of Engineers and the State Reclamation Board-Department of Water Resources are Lead Agencies under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA), respectively. Based on our review of the document, we offer the following comments.

Agency Jurisdiction

Upon admission to the Union in 1850, California acquired nearly 4 million acres of sovereign land underlying the State's navigable waterways. Such lands include, but are not limited to, the beds of more than 120 navigable rivers and sloughs, nearly 40 navigable lakes, and the 3 mile wide band of tide and submerged land adjacent to the coast and offshore islands of the State. The SLC manages all ungranted sovereign lands, and also has limited oversight responsibility for sovereign lands legislatively granted in trust to local jurisdictions (Public Resources Code Section 6301).

The state's interest in all sovereign lands are held subject to the Public Trust for maritime commerce, navigation, fisheries, open space, and preservation of natural environments, among others. The SLC is particularly concerned with the natural resources and public water related recreational opportunities of lands under its jurisdiction, including their place in a regional context.



In the study area, the State holds fee title to the bed of the Lower American River from its confluence with the Sacramento River to Nimbus Dam. This area, but for the lower four miles which were granted in trust to the City of Sacramento, pursuant to Chapter 519, Statutes of 1863, is managed by the SLC. Additionally, the Sacramento River is sovereign public trust land under SLC jurisdiction.

Certain alternatives for flood control in the Sacramento area may directly involve sovereign lands, as described above, of the State of California. Any proposed construction, such as bank riprap, located within these waterways would be subject to the SLC's permitting authority and the Commission would be a Responsible Agency under the California Environmental Quality Act (CEQA).

Many aspects of the tentatively proposed and alternative flood control project could affect surface water flow amounts, timing, and quality. Such impacts can impair the State's sovereign ownership and Public Trust resources; the SLC is, therefore, also a Trustee Agency, responsible for managing the public trust values associated with its ownership of sovereign lands.

Scope and Content of Environmental Analysis

*Alternatives*

We are concerned that the designation and "screening" of alternatives is improperly narrow. Notwithstanding the guidelines for water projects given on page IV-2 of the Main Report, environmental laws and regulations direct that one of the fundamental objectives of the environmental analysis process is to inform decision-makers and the public. To achieve this objective, a broad range of alternatives should be evaluated. Alternatives that minimize harm to the environment, even though some project purposes may not be met, are especially important to analyze fully.

As an example of the deficiencies in the alternatives analysis is the out of hand rejection of non-structural measures, specifically flood plain development restrictions. Given the induced growth caused by any of the selected alternatives and the potential for environmental impacts from this growth, flood-plain zoning to regulate new development should be examined in combination with other means to protect existing development. A related weakness in the discussion of alternatives is the lack of analysis of the intangible benefits of natural habitats associated with the pre-project environmental conditions.

The relationship between the Special Study on the Reoperation of Folsom Dam and Reservoir ("temporary" reoperation), referenced on Page I-6 of the Main Report, and the evaluation of permanent reoperation as a flood control alternative in this Feasibility Study

is not clear. The last sentence of 4th Paragraph, page I-4, indicates that environmental studies on temporary reoperation are not yet complete. Was the Special Study used as a basis for evaluating environmental impacts of permanent reoperation? Are impacts different for "temporary" reoperation than for permanent operation?

It appears that alternatives which may reduce operations of Folsom for consumptive water supply purposes were avoided. The State Water Resources Control Board, in recognition that current flow conditions in the Lower American River are inadequate to protect Public Trust Resources, has decided to review American River water rights, including those held by the Bureau of Reclamation. We again urge that the search for flood control alternatives be sufficiently broad to meet the requirement of full disclosure and reasoned decision-making, especially in light of the uncertainties of future Bureau operations.

*Growth -Inducing Impacts*

As Trustee for riverine resources in the lower American River, we are concerned with any project which would further degrade aquatic conditions. Fisheries and other riverine resources, already severely stressed by current conditions, cannot endure further diversions from the river or worsening of the flow regime regulated by Folsom operations. Growth-inducing impacts of flood control which would exacerbate water supply conditions in the lower American should be analyzed and avoided.

*Safety*

Page 3-12 of the DEIS/EIR, No. 3, states that "In Principle, levees are less safe than dams as retention facilities." It may be that the consequences of dam failure are so overwhelmingly severe that, on the whole, maximizing the conveyance of flood waters downstream and out of the system rather than retaining them is regarded as a safer solution; however, improbable events do occur.

If you have any questions regarding these comments, please contact Dr. Diana Jacobs at (916)445-5034 or Curtis Fossum, Senior Staff Counsel, at (916) 322-2277.

Sincerely,

Dwight E. Sanders, Chief
Division of Environmental
Planning and Management



cc: Charles Warren, Executive Officer
Curtis Fossum
Diana Jacobs

United States
Environmental Protection
Agency

Regional Administrator
75 Hawthorne Street
San Francisco CA 94105

Region 9
Arizona, California, Hawaii
Nevada, Pacific Islands

# ENVIRONMENTAL PROTECTION AGENCY

Colonel Laurence R. Sadoff
District Engineer
U.S. Army Corps of Engineers
Sacramento District
650 Capitol Mall
Sacramento, California 95814

18 JUN 1991

Dear Colonel Sadoff:

The Environmental Protection Agency (EPA) has reviewed the Draft Environmental Impact Statement for the project entitled **Feasibility Report and Draft Environmental Impact Statement and Environmental Impact Report American River Watershed Investigation, Sacramento, California.** Our review is provided 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.

In response to flood risks in the Sacramento area, the Corps of Engineers (COE) proposes to provide an estimated 400-year level of flood protection. The proposed project includes a 498 foot high, 890,000 acre-foot capacity flood detention dry dam near Auburn, California; levee and related modifications around the Natomas area, lower Dry Creek and Arcade Creek; and recreation trails as part of the levee improvements in Natomas.

Temporary Folsom Reservoir reoperation for increased flood storage is being proposed by the COE as a separate federal action outside this EIS to provide 100-year flood protection until the proposed dam project is operational. This 100-year level of flood protection is necessary to avoid increased flood insurance rates when the moratorium on Zone A99 Flood Insurance rates expires in November 1992. The Natomas area would not be protected by temporary Folsom reoperation. Other related projects in the Sacramento area include: Sacramento River Flood Control System Evaluation (levee repair); Sacramento Metropolitan (levee improvements), which will be combined with the proposed American River project at the design stage; Bureau of Reclamation's multipurpose Auburn Dam; Westside Yolo Bypass Levee Study; and Bureau of Land Management American River National Recreation Area Study.

We appreciate the COE's efforts to explain the proposed action and its consequences to EPA. Over the past two years, your staff and that of the Division have spent many hours in person and over the telephone answering questions about this important project. EPA has met with the COE on several occasions (May 15 (conference call), May 23, June 5) since receipt of the

DEIS in order to discuss our concerns and questions about specific issues. We have recently been informed that local sponsors may request the 200-year protection upstream dam as the selected plan. Although this and additional information have been received from your staff, our comments are necessarily based on the information in the DEIS in the form in which it was released for public review.

EPA recognizes the critical need for long-term flood protection in the Sacramento area. We support the protection of existing property and structures from flood damage and believe that protection method(s) should be selected which will, with mitigation, also minimize damage to the natural environment. NEPA requires full discussion of significant environmental impacts and disclosure to decisionmakers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment (40 CFR section 1502.1). The NEPA process is intended to assist public officials make decisions that are based on understanding of environmental consequences, and take actions that protect, restore, and enhance the environment (40 CFR section 1500.1).

We acknowledge the COE's substantial efforts to reconcile the needs of conflicting interest groups and to provide solutions to this serious, complex problem. However, this DEIS and Feasibility Report do not fully inform the public and decisionmakers of the potential impacts to the environment and the measures the COE and local sponsors would implement to minimize those impacts. Consequently, we have rated this document 3 - Inadequate Information (see attached "Summary of the EPA Rating System"). EPA has not provided an environmental rating for the proposal due to the inadequacy of information regarding significant environmental impacts and the consequent inability for our agency to determine the full impacts of the tentatively selected plan and its alternatives.

The COE has stated their intention to seek a 404(r) Clean Water Act exemption from Congress. To comply with 404(r) exemption requirements, the COE must fully consider the 404(b)(1) Guidelines in this EIS. EPA is obligated to comment on whether the proposal is in compliance with these Guidelines. Because of the lack of adequate information in the DEIS, EPA is unable to make a positive determination of compliance. We are unable on the basis of this EIS to determine the least environmentally damaging practicable alternative which fulfills the project purpose of flood protection.

A significant omission in the DEIS is the lack of information on the potential environmental impacts of interim flood protection. Interim protection project impacts may combine additively and/or synergistically with permanent project impacts to cause far greater impacts than projected for permanent protection projects evaluated independently. In order to determine the least environmentally damaging flood protection

system, the public and decisionmakers must be aware of the cumulative impacts of interim protection projects in conjunction with permanent protection alternatives. EPA believes the evaluation and choice of interim and permanent flood protection should be made at the same time in a single comprehensive draft EIS.

EPA believes that severe environmental impacts would be likely to occur from conversion of a flood control only dry dam to a multipurpose dam on the American River. We remain very concerned that the COE project not facilitate operation as or construction of a multipurpose dam without explicit federal environmental review of that project. We seek legally binding assurances in the EIS and Record of Decision that the COE considers conversions and structural or operational modification of the proposed flood control only dry dam to be major changes which would require Congressional authorization and an environmental impact statement (EIS).

The DEIS fails to comply with NEPA and CEQ's Regulations for the implementation of NEPA because:

* It does not "rigorously explore and objectively evaluate all alternatives (40 CFR section 1502.14(a))." For instance, the DEIS provides only a minimal analysis of 100-year protection alternatives and non-structural alternatives. We remain concerned that National Economic Development (NED) Guidelines have driven the alternatives analysis process in a manner which limited full consideration of some potentially less environmentally damaging alternatives.

* It does not adequately discuss compliance with environmental statutes, including the Clean Water Act and the Clean Air Act (40 CFR sections 1502.16, 1506.2(d) and 1508.8). For instance, the DEIS does not demonstrate compliance with the 404(b)(1) Guidelines or water quality standards nor air quality conformity pursuant to the Clean Air Act.

* It does not adequately describe the full range of potentially significant environmental consequences, often for reasons of incomplete data collection or inadequate analysis (40 CFR sections 1502.16, 1502.22, 1508.7, and 1508.8). One area of inadequacy is the evaluation of the environmental consequences of removing 6 million cubic yards of aggregate material from gravel bars in the Middle Fork of the American River; another is the evaluation of the impacts of permanent Folsom Reservoir reoperation on water management of the Central Valley Project.

* It does not adequately discuss the means to mitigate adverse direct, indirect, and cumulative impacts (40 CFR 1508.20). While the DEIS outlines possible mitigation for

direct impacts, mitigation for indirect and cumulative impacts is not described. Furthermore, there is limited information on the probability of mitigation implementation and the responsible parties.

On the basis of these and other issues regarding NEPA compliance, EPA believes the COE should revise the DEIS and reissue it in draft form for public review. If the issues identified in our comments are not satisfactorily resolved prior to publication of a final EIS, EPA will consider this project a candidate for referral to the President's Council on Environmental Quality (CEQ) in accordance with 40 CFR Part 1504.

We appreciate the opportunity to review this important environmental document and are available to discuss these issues with you further. If you have any questions or wish to meet with us, please call Ms. Deanna Wieman, Director of the Office of External Affairs (415) 744-1015, FTS 484-1015, or Dr. Jacqueline Wyland, Chief of the Office of Federal Activities (415) 744-1584, FTS 484-1584.

Sincerely,

Daniel M. McGovern
Regional Administrator

Enclosure: (26 pages)

91-095
000631

cc: COE, Sacramento, Walter Yep
COE, San Francisco, Frank Dunn
OASA, Washington, D.C., Morgan Rees
BOR, Sacramento, Lawrence Hancock
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FWS, Sacramento, Wayne White
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RWQCB, Region 5, William Crooks
ARB, Jim Boyd
SACOG, James Williams
City of Sacramento, Mayor Anne Rudin
SAFCA, Bill Edgar
HQ EPA: OFA, OWP

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 alterna tive 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 public health or welfare or environmental quality. 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 recommended for referral to the 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 avail able to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analyzed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

*From EPA Manual 1640 Policy and Procedures for the Review of Federal Actions Impacting the Environment.

COMMENTS

NATIONAL ENVIRONMENTAL POLICY ACT

A. Inadequate Information

EPA believes the DEIS fails to fulfill its purpose as defined pursuant to the National Environmental Policy Act (NEPA). The DEIS does not adequately assess the potentially significant environmental impacts of the proposal.

Folsom Reservoir Reoperation

It is our understanding that temporary (10-year) Folsom Reservoir reoperation is being considered to achieve 100-year flood protection during construction of the selected alternative. The COE has stated that information on potential impacts of temporary reoperation, adequate to fulfill NEPA requirements, will not be available until 1992. Logically, temporary reoperation alternatives and their impacts are likely to be very similar to permanent reoperation alternatives. Therefore, we question that the current EIS contains adequate information on permanent Folsom Reservoir reoperation when the COE has not completed its analysis of impacts for a "short" 10-year reoperation period.

We believe that interim flood protection impacts may combine additively and/or synergistically with the permanent project impacts. In order to select the least environmentally damaging flood protection system, the public and decisionmakers must be aware of the cumulative impacts of both interim and permanent protection alternatives. Therefore, the impacts of temporary and permanent reoperation should be fully evaluated and disclosed in the present DEIS.

For example, the DEIS indicates significant impacts to fisheries (5-40% annual loss) caused by permanent Folsom Reservoir reoperation. While the DEIS does not extrapolate to estimate total cumulative impacts, this value seems likely to approach 100 percent fisheries loss over the life of the project. If 5-40% annual loss also would occur with temporary Folsom Reservoir reoperation, an upstream dry dam alternative preceded by temporary (10-year) Folsom Reservoir reoperation would result in severe fisheries losses combined with permanent losses to habitat of the upper American River Canyons. On the other hand, implementation of other combinations of temporary and permanent protection alternatives may provide adequate long-term flood protection with fewer, less severe cumulative impacts to the environment.

While congress directed the COE to evaluate the feasibility of Folsom Reservoir reoperation for interim flood protection, EPA is concerned that Folsom Reservoir reoperation not be considered the sole alternative for interim flood protection. EPA encourages the COE to expand the scope of analysis to include other potential alternatives for interim flood protection and to evaluate these alternatives in combination with permanent flood protection measures to determine the least environmentally damaging flood protection system. It is most important that the analysis of cumulative impacts of combinations of temporary and permanent flood protection options be disclosed and compared in one document so that the COE and Congress may make a well-informed decision.

Borrow Area/Aggregate Mining

The COE proposes to mine approximately 6 million cubic yards of aggregate material for dam construction. The DEIS indicates this material would be extracted from gravel bars located along the Middle Fork of the American River between Murderers Bar and Cherokee Bars (DEIS pg. 4-14, 6-14; Appendix G pg. G-4). Up to 38,400 tons of sediment could be generated over 3 years and areas of the stream bottom could be dredged to significant depths (DEIS pg. 6-14). The potential number of gravel bars needed to fulfill the aggregate requirement, the processing and production site(s), the mode(s) of transporting the aggregate, and the potential impacts to water quality, air quality, and fish and wildlife have not been analyzed or disclosed to assess the feasibility of the proposed alternative. Furthermore, alternative sources have not been identified.

EPA understands the COE is currently studying these factors. We believe this information is essential for determining the overall environmental impacts of the proposed project and for selecting the least environmentally damaging practicable alternative. We remain very concerned with the potential physical alterations, water quality, wetland, and air quality impacts connected with the proposed aggregate mining operations. The information the COE is gathering should be incorporated into the revised draft EIS.

Disparities Between U.S Fish and Wildlife Service and Corps of Engineers Environmental Impact Analyses

It is our understanding that there are still major disagreements between the COE and US Fish and Wildlife Service (USFWS) in regards to upper American River inundation impacts (DEIS pgs. 8-31 to 8-48; Main Report pg. X-2 Table X-1) and no action (without project) conditions on the lower American River (DEIS pg. 8-23). We believe it is critical that there be

agreement on the extent of impacts in order for decisionmakers and the public to make decisions based on an understanding of environmental consequences, and to take actions that protect, restore, and enhance the environment. Should the COE and USFWS continue to disagree regarding the level of impact and quantity of mitigation required, the revised DEIS should provide an explanation in the text and a table clearly illustrating the differences in the agencies' assumptions and numerical conclusions.

Other Areas of Inadequacy

The items listed below have either not been analyzed, completed or included in detail in the DEIS.

a. Fish, wildlife, and vegetation impact analyses for the 100-year (FEMA) levee and 100-year (FEMA) levee/storage alternatives (DEIS pg. 8-67).
b. Potential impacts of a number of features of the preferred alternative (additional NEMDC channel, ramping of certain levees) (DEIS pg. 8-24) and of the 150-year alternative (bridge replacements, relocation of Western Pacific Railroad) (DEIS pg. 8-50).
c. Potential impacts of flood events under "without project" conditions. EPA believes more quantitative estimates of these impacts are necessary for comparison purposes.
d. Potential impacts of levee construction on endangered species (DEIS pg. 9-5).
e. Highway 49 relocation alternatives analysis. The alternatives analysis has been inappropriately deferred to CALTRANS and local sponsors (DEIS pg. 8-25).
f. U.S. Fish and Wildlife Service Coordination Act Report (DEIS pg. 8-47). The DEIS only includes a summary of the draft Coordination Act Report.
g. Final Mitigation Plans (DEIS pg. 8-39).
h. Historic site survey (DEIS pg. 10-7).

Highway 49 Relocation

As noted earlier, we are concerned that the impacts of Highway 49 relocation have not been analyzed and disclosed as is appropriate if relocation is a consequence of the selected flood protection system. If the COE has determined that their federal action will not necessitate relocation and that they will neither fund nor facilitate relocation, this conclusion should be in the revised DEIS to close out this issue.

B. Purpose and Need

The COE states that its objective is a project that neither advances nor impedes future options for developing water and power facilities on the American River (Main Report Summary pg. 8). We commend the COE for eliminating "advance features" for penstocks, for example, which would have facilitated hydropower generation absent an evaluation of alternatives for power generation.

However, EPA remains concerned that the construction of any dam at the proposed site is likely to influence the selection of this site for a hydropower and water supply facility (comment sent to COE in HQ EPA/OFA letter dated December 21, 1990). Although all of the dam's current features are necessary for flood protection, it appears that the dam could be used for water storage with no major modifications. In addition, details of the dam design retain some features compatible with detention but supportive of enhancements for conversion to storage use.

Furthermore, the COE demonstrates in their argument in favor of dam site mile 20.1 (BOR Auburn Dam site) that previous dam construction facilitates additional construction since environmental impacts would be minimal at sites already greatly impacted by previous construction (Appendix G, pg. G-6). Other statements in the DEIS lend additional credence to the prediction that the detention dam may lead to expansion. For instance, the DEIS states that one of the advantages of using roller-compacted concrete and the dam site at Mile 20.1 is that they lend themselves to expansion of the dam (Appendix M, pgs. 6-16, 6-18). For all of these reasons, it therefore appears reasonable to predict that the detention dam may lead to future proposals for expansion.

EPA believes that substantial adverse environmental impacts would occur from conversion of a flood control only dry dam to a multipurpose dam. We remain very concerned that everything possible be done to assure that the COE project not facilitate construction of a multipurpose dam without explicit federal environmental review of that project. For example, existing COE regulations allow the COE to add water supply as a project purpose without the approval of Congress, if modifications would not involve major structural or major operational changes (ER 1105-2-100, 28 December 1990, Section III Postauthorization Changes, a. Water Supply (1) Legislative Authority, pg. 2-44). Therefore, we request legally binding assurances in the EIS and Record of Decision that the COE considers conversions and structural or operational modification of the flood control only dry dam to be major changes which would require Congressional authorization and an environmental impact statement (EIS).

C. Alternatives Analysis

Planning objectives as specified by Congress (Public Law 87-874, October 23, 1962; Public Law 100-202, December 22, 1987; Main Report pgs. I-4 and I-5) include the enhancement of incidental water supply and hydropower in Folsom Reservoir and development of the National Economic Development (NED) plan (Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies, March 10, 1983 pursuant to Section 103 of the Water Resources Planning Act, as amended; Main Report pg. IV-1). We understand these are authorized objectives. Nevertheless, we are concerned that these objectives may have unnecessarily limited the scope of flood control measures considered acceptable and feasible, especially if these measures are evaluated solely against the NED criteria of completeness, effectiveness, efficiency and acceptability (Main Report pg. IV-2). We acknowledge that the COE analyzed measures and alternatives which do not meet all the planning objectives or NED criteria. Yet, the question still remains as to whether some flood control measures (features which were used to create alternatives, such as raising levees and floodproofing) were unnecessarily and therefore inappropriately eliminated from detailed consideration.

The COE has not persuasively demonstrated that eliminated flood control measures (Main Report Chapter IV) are not practicable or feasible. Rejected flood control measures, while they may not individually provide full FEMA level of flood protection, may be used in combination with other measures to provide the necessary flood protection with fewer environmental impacts than the proposed project. For example, the DEIS does not describe the extent to which flood proofing and other nonstructural measures (Main Report pgs. IV-7 and 8) could be used in combination with other measures or alternatives to reduce the flood risk to existing and future developments. The twenty-seven alternatives initially screened focused on combinations of levees, dams, modified Folsom Reservoir storage, and modified Folsom Dam spillway measures and different levels of flood protection. Many measures mentioned earlier in the document (e.g., raising Folsom Dam) were eliminated from consideration prior to the alternatives analysis process. Many of these measures have been discounted as economically infeasible or environmentally damaging with little supporting data. The revised DEIS needs to provide adequate data to substantiate these conclusions and/or to further explore these options. Levels of protection, costs and impacts of flood control measures which were dropped need to be provided.

It is our understanding that State and local sponsors have requested a minimum 200-year level of flood protection because of

urbanization already within and beyond the 100-year flood plain and expected growth in the Sacramento area. We hope the COE will continue to work with project sponsors to evaluate mechanisms beyond levee and dam construction available to State and local sponsors to provide 100-year or greater levels of flood protection. These actions should be described in the revised DEIS in accordance with the provisions of the NEPA regulations to consider alternatives beyond those for which the Federal sponsor has direct authority (40 CFR Section 1502.14(c)) and to ensure compliance with the 404(b)(1) Guidelines. We believe this approach is further supported by Executive Order 11988 on Flood Plain Management and Executive Order 11990 for Protection of Wetlands, which exhort Federal agencies to provide leadership and take action to restore and preserve the natural and beneficial values served by flood plains and to consider alternatives to avoid adverse effects and incompatible development in flood plains and wetlands.

We are concerned that the COE appears to have made multiple conservative assumptions which collectively eliminate all alternatives available for 200-year protection except for detention dams. We therefore urge the COE to reevaluate those assumptions (e.g., COE vs FEMA flood level calculation methods, capacity of available upstream storage, operation of Folsom Reservoir, channel geometry) in light of the basic project purpose of flood protection.

The DEIS states that there are potential impacts to wetlands and fisheries from permanent reoperation of Folsom Reservoir as proposed in the 100-year storage, 100-year levee/storage, and 150-year levee/storage alternatives. We recommend the COE evaluate, as part of the alternatives analysis, alternative reoperation schemes which may minimize potential downstream impacts (e.g., different operational assumptions, full use of reservoir space for flood control, use of dead storage space, reservation of a block of water for fish and habitat uses, seasonal releases, different riprap/levee alternatives). NEPA requires the EIS to rigorously explore and objectively evaluate all reasonable alternatives, including those reasonable alternatives not within the jurisdiction of the lead agency (Section 1502.14 (a) and (c)). The lack of COE jurisdiction over the operation of Folsom Reservoir does not obviate analysis of a full range of reoperation alternatives.

It is our understanding that the proposed upstream dry dam may be operated in tandem with Folsom Dam with many potential operational schemes available (Appendix L). The DEIS should state whether the COE examined different tandem operation scenarios and what the potential cumulative environmental impacts of these would be. We note that operation of Folsom Dam for

flood control is already difficult and imprecise (DEIS pg. 3-12). We request that the revised DEIS clearly demonstrate that tandem operation of the two dams would not in fact exacerbate an already complicated flood control system and not worsen water quality in the American River, Sacramento River and San Francisco Bay/Delta.

D. Environmental Consequences (General)

The DEIS does not adequately assess the potentially significant environmental impacts of the proposal. Furthermore, there is inadequate information in the DEIS to determine which alternative may be the least environmentally damaging practicable alternative which fulfills the project purpose of flood control as necessary to demonstrate compliance with the 404(b)(1) Guidelines. We note that the 100-year protection alternatives do not appear to be evaluated as thoroughly as the tentatively selected plan (e.g., DEIS pg. 8-67).

E. Cumulative Impacts Analysis (General)

The COE has held land use forecasts at year 2010 growth projections over the 100-year life of the project. The reason given is the uncertainty of long-term socioeconomic forecasting (DEIS pg. 4-1). In the case of incomplete or unavailable information, NEPA requires federal agencies to utilize the rule of reason and to disclose the fact of incomplete or unavailable information when evaluating reasonably foreseeable significant adverse impacts on the human environment, and to obtain that information if the overall costs of doing so are not exorbitant (40 CFR Part 1502.22). We note that the DEIS describes development in South Sutter County, not included in the land use forecasts, which projects conversion of 17,000 acres in north Natomas to residential in the next 50-60 years (DEIS pg. 18-2). Although we concur that it is difficult to ascertain future land use changes over 100 years, we believe it is reasonable to assume that some growth will continue beyond 2010 or the period covered by current local land use plans. The COE must consider the reasonably foreseeable future events anticipated to occur between years 20 and 100 consistent with the project life of 100 years.

F. Mitigation

We are pleased that the COE is committed to full mitigation for direct impacts of the selected alternative. However, we are very concerned that the COE does not plan to mitigate for indirect impacts. The DEIS does not appear consistent in this respect with the February 7, 1990 guidance provided by General Hatch in his transmittal of the EPA/COE MOA on Mitigation to COE offices. That MOA does not distinguish between direct and indirect impacts. Although we understand that mitigation for

direct impacts only is a COE policy, we request the COE address the derivation of this policy and whether it is consistent with the understanding reached between HQ EPA and the COE during the CEQ referral of COE NEPA Regulations.

State and local responsibility for indirect impact mitigation does not obviate the necessity for the COE's DEIS to fully disclose mitigation measures for indirect and cumulative impacts and evaluate the feasibility of their implementation, even if they are outside the jurisdiction of the COE (40 CFR Sections 1502.14(f), 1502.16(h), 1508.8, and 1508.20; March 16 1981 CEQ Memorandum - Questions and Answers About the NEPA Regulations, Question 19 Mitigation Measures). Therefore, mitigation plans should be described in the revised DEIS.

We believe up-front mitigation for cumulative impacts or establishment and contributions to development of a mitigation bank, would provide effective and flexible means to compensate for specific resources likely to be degraded or destroyed by the project.

## WATER RESOURCES

### A. Section 404 of the Clean Water Act

#### Compliance with Section 404

The DEIS states that the proposed project is only in partial compliance with the CWA, and seeks an exemption through Section 404(r) from further regulation by Federal or State water quality agencies (DEIS pg. 23-2). For the reasons discussed below, EPA does not believe that the COE has demonstrated compliance with the Clean Water Act (CWA) under Sections 230.10(a-d) and 230.12(a)(3) of the 404(b)(1) Guidelines. Due to the potentially significant impacts to the aquatic environment, EPA believes Congress should not exempt the proposed project from compliance with the regulations under Section 404(r) of the CWA.

#### 404(r) Exemption

The COE has stated they will seek a 404(r) exemption from Congress. To comply with 404(r) exemption requirements, the COE must fully consider the 404(b)(1) Guidelines in their EIS. EPA is obligated to comment on whether the proposal is in compliance with these Guidelines. Because of the lack of adequate information in the DEIS, EPA is unable to make a positive determination of compliance. Council on Environmental Quality (CEQ) guidance directs that EPA's position regarding compliance with the 404(b)(1) Guidelines be documented in the FEIS cover sheet and summary and attached in full to the body of the FEIS

submitted to Congress (CEQ Memorandum for Heads of Agencies, Guidance on Applying 404(r), November 17, 1980).

**Project Purpose**

As stated in the DEIS, the purpose of the proposed project is to:

> 1) provide greater levels of flood protection for the Sacramento urban area; 2) enhance recreation opportunities in the study area incidental to the flood control objective; 3) if possible, enhance water supply and hydropower opportunities at Folsom Dam and Reservoir and evaluate such opportunities elsewhere in the watershed incidental to the flood control objective; and 4) develop the selected plan in accordance with the Federal objective of water and related land resources planning, which includes features to contribute to the national economic development consistent with protecting the Nation's environment (Main Report, pgs. IV-1 and 2).

EPA believes that the basic project purpose is flood protection for the Sacramento area. As we have stated previously, if the primary project purpose included water supply and hydropower, the scope of this EIS would have to be expanded to evaluate the impacts of alternative means of achieving those purposes. Secondary benefits of the project (i.e., recreation, enhanced water supply and hydropower) therefore should not be utilized in the selection of alternatives for the proposed project in a way which limits the range of alternatives or eliminates consideration of practicable alternatives which still achieve the basic project purpose. Requiring that all secondary benefits be achieved by every alternative would artificially reduce the number of alternatives. The 404(b)(1) Guidelines and NEPA alternatives analysis are designed to give full consideration to all practicable alternatives that could reduce environmental impacts and meet the basic objectives for which a project was contemplated. In this case, that stated objective is flood protection.

It appears that the proposed project incorporates benefits from future development (locational benefits) (Main Report, pg. V-14). It is our understanding that locational benefits are benefits received from the ability to change land uses (e.g., agriculture to residential development) as a result of the proposed project. We urge the COE to exclude future development benefits from the project benefit analysis because their inclusion expands the project purpose from one of flood

protection of existing property to one of flood protection plus facilitation of future development.

**Alternatives Analysis and Practicability**

It appears that the plan selection and alternatives analysis was performed pursuant to the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (National Economic Development (NED) Guidelines) prior to analysis pursuant to the Clean Water Act Section 404(b)(1) Guidelines. Although EPA remains concerned with the sequential relationship of the NED plan selection and compliance with the 404(b)(1) Guidelines, the DEIS retains an adequate range of flood protection levels (100-year to 400-year) for detailed evaluation. However, as stated above, EPA believes the COE may have inappropriately limited the flood control measures and number of feasible alternatives retained for further study. Measures which may be less-damaging but which may satisfy the basic project purpose have been dropped without adequate information for the public or decisionmakers to determine whether these measures are practicable under Section 404.

The DEIS describes Sacramento as one of the few cities in the country where the need for a high level of flood protection is compelling due to the extensive residential development in the floodplain. Although the COE provides some evidence of communities with greater than 100-year protection, it is unclear whether such higher protection is becoming standard practice under COE policy. We note by contrast that the County of Sacramento is proposing flood protection in the North Natomas area (Corps Public Notice 9000479) for a 100-year storm event. The COE should provide further data to document the need for the proposed high level of flood protection, as compared with most communities having the FEMA 100-year level of flood protection.

EPA supports public health and safety and acknowledges the need for local support of the selected flood protection alternative. Nevertheless, in the case of a project requiring a Section 404 permit, a permit can only be issued for the least-damaging practicable alternative which provides a reasonable level of flood protection. The COE should document whether there are less environmentally damaging flood protection alternatives, even though they may not be supported by the local sponsor or satisfy NED requirements.

Specific Comments

1. Downstream flood control measures are not considered practicable since no combination of these measures would achieve the minimum level of protection which the state and local

sponsors established as the appropriate flood control planning parameter for this project (Appendix G pg. G-22). As stated earlier, the lack of local support is not sufficient rationale for a finding that specific measures are not practicable for providing flood protection pursuant to the Guidelines.

2. The elimination of alternatives which raise Folsom Dam is not well justified (Main Report pg. IV-5). The revised DEIS should include a more thorough discussion of the costs, impacts and level of additional flood protection provided by raised Folsom Dam alternatives and demonstrate the non-practicability of these alternatives.

3. Cross levees and cross canals are Natomas area flood control measures dropped from further consideration. These measures were rejected based upon potential severe construction impacts caused by a new levee versus spot improvements (Appendix G pg. G-29). There is inadequate information in support of these conclusions. The DEIS should provide information on costs and environmental impacts. In addition, should cross levees result in increased localized flooding, the DEIS should describe potential measures which may be available to alleviate these impacts (i.e., pumping).

4. The DEIS eliminates the use of flood easements in favor of lengthening Fremont Weir (Appendix G pg. G-29). Flood easements are described as less damaging but not practicable since the affected landowners are opposed to this approach and unwilling to accept a non-structural solution. Lack of local support is not sufficient justification for dropping the non-structural alternative from analysis pursuant to the Guidelines or NEPA. Use of other solutions should be addressed.

5. The revised DEIS should address whether potential dam sites at miles 19.0 and 19.2 were rejected based upon potential interference with future hydropower operation during a flood event. Appendix M (pgs. 5-35 and 5-36) states that power plants at a future dam at the mile 19.0 or 19.2 dam sites could be inundated by Folsom Lake during a flood. Consideration of inundation of future power plants is not consistent with the proposal of a flood control only facility.

Cost/Benefit Analysis

An alternative which may be more costly than another alternative but which is still cost effective is considered practicable under the 404(b)(1) Guidelines. Although the NED plan may have the greatest net benefit, all the other alternatives have positive benefit/cost ratios.

The costs of the proposed project are unclear. The Executive Summary states that costs for several features of the Tentatively Selected Plan are not part of the estimates for comparisons with the other alternatives (Pg. 10). These costs and the reason for their exclusion should be fully disclosed in the revised DEIS. Table 1 should also be corrected to reflect actual costs. The benefit/cost should be provided in text and tabular form for each alternative evaluated.

The DEIS should clearly describe whether the benefit/cost analysis was based on existing conditions or build-out (DEIS pg. 4-2). The inclusion of benefits for future development is not justified unless future development is evaluated in the impact analyses. Indicate whether annual costs are incorporated into the cost/benefit ratio (Executive Summary pg. 12, Table II). Costs and benefits of recreation components should be evaluated separately from the project as they are not part of the overall basic project purpose of flood protection.

The environmental mitigation costs do not include land costs (Executive Summary pg 12, Table II; Appendix C-3, Table II-1). All costs associated with the project must be included to determine the practicability of the project. The cost of mitigation may represent a significant cost or risk in the selection of a practicable alternative so as to make that alternative less desirable or practicable.

Water Quality and Endangered Species

To comply with the 404(b)(1) Guidelines, the proposed project must not violate water quality standards, toxic effluent standards, or jeopardize the continued existence of federally listed species or their critical habitat (40 CFR 230.10(b)). As discussed below under water quality standards, EPA is concerned with the potential impacts of temporary or permanent reoperation of Folsom Reservoir on operation of other Central Valley reservoirs and on compliance with water quality standards and protection of beneficial uses of the Sacramento River system, including the American River.

The proposed project may result in adverse impacts to federally listed species. Levee work within Natomas and a reduction in American River flows (Appendix G pg. G-20) may result in losses of elderberry plants, and may therefore adversely affect the federally listed valley elderberry longhorn beetle. Federal candidate\State listed giant garter snake and State listed Swainson's hawk may also be severely affected by the proposed project and induced growth within the Natomas area. Close coordination with the US Fish and Wildlife Service and California Department of Fish and Game should continue to ensure

that the continued existence of the valley elderberry longhorn beetle is not jeopardized by the project and to avoid impacts to sensitive species.

**Significant Degradation**

The DEIS does not adequately identify the acreage of direct and indirect impacts to waters of the United States, including wetlands, for the proposed alternatives. New features have been added to the tentatively selected plan which may increase the previously determined acreage (DEIS pg. 8-24). Furthermore, the 100-year (FEMA) levee and 100-year storage/levee alternatives have not been fully documented and evaluated for potential impacts and mitigation (DEIS pg. 8-67). The COE should provide a table which clearly states acreage of waters of the United States by type and the direct and indirect impact for the existing condition, no action, and alternatives.

The DEIS does not fully identify jurisdictional wetlands within the project area. Lack of on-site verification may result in modification of jurisdictional acreage for the Natomas area (DEIS pg. 8-13). Furthermore, wetland acreage in agricultural production should be included within the jurisdictional determination if it could be affected by the proposed project. These agricultural wetland areas may not qualify under the agricultural 404(f) exemption or the Prior Converted Regulatory Guidance letter. If this is the case, these areas may be considered wetlands subject to Section 404 and may require a 404 permit for fill activities.

The wetlands delineation for the lower American River focused on wetlands above the average high water line from Goethe Park to the confluence of the American and Sacramento Rivers (DEIS pg. 8-15). The revised DEIS should clearly demonstrate that there are no impacts (direct or indirect) to wetlands or waters of the United States anticipated below the high water line or upstream of Goethe Park. These areas should be included within the wetland delineation if they will be affected by the proposed alternatives.

The DEIS states that identification of jurisdictional wetlands for the Upper American River focused on the inundation zone created by the 200-year alternative (DEIS pg. 8-17). It is unclear if the contractor was unable to or chose not to identify wetlands above the high water mark. We understand that the jurisdiction of tributaries has not been completed because of the difficult access to these areas. The revised DEIS should contain a final jurisdictional determination including all wetlands and waters of the United States within the project area for the various alternatives.

The DEIS states that dam construction and gravel excavation are unlikely to impact wetlands under 404 jurisdiction (Appendix G pg. G-13) in part because of the lack of hydric soils in the gravel bars. Lack of hydric soils within the stream is not atypical for river systems and does not necessarily remove the area from 404 jurisdiction. The area may qualify as a problem area wetland, requiring other factors be utilized in their identification. Furthermore, even if the area is not defined as wetlands, the area may be regulated as waters of the United States. All activities associated with the project, including temporary haul roads and construction staging operations, should be included in the evaluation for impacts to waters of the United States.

The COE analysis of fishery impacts caused by temporary Folsom Reservoir reoperation scenarios result in a range of 4.3-31% mortality for the 590,000 acre-foot temporary reoperation alternative (DEIS pg. 8-65). Details of the analysis should be provided in the revised DEIS. Fishery impact values differ between the USFWS and COE analyses. The revised DEIS should explain the difference and clearly state the assumptions used in the analysis of Folsom Reservoir reoperation impacts. Indicate whether the use of upper reservoirs and regulation of Folsom Reservoir for flood control and aquatic resources were considered as assumptions of this alternative. We understand that fish losses represent an annual loss. The revised document should estimate the expected cumulative fisheries loss over the life of the project.

Specific Comments

1. During floods and/or high flow events, channel and slope erosion is expected to occur (Appendix G pg. G-9). The DEIS states however, that there are insufficient data to predict increases or decreases in sediment load attributable to operation of the flood control dam. NEPA requires federal agencies to utilize the rule of reason and to disclose the fact of incomplete or unavailable information when evaluating reasonably foreseeable significant adverse impacts on the human environment, and to obtain that information if the overall costs of doing so are not exorbitant (40 CFR Part 1502.22). The potential loss of riparian, wetland and aquatic habitat caused by increased erosion and degradation of the upper and lower river channels should be fully evaluated.

2. Although the dam construction may not result in a permanent decrease in the diversity of plant and animal species within the upper American River Canyon (Appendix G pg. G-11), associated periodic inundation may affect the diversity in this area and should be noted and evaluated in the revised DEIS.

3. The proposed upstream dam may obstruct wildlife movement within the riparian/stream corridor. These potential impacts should be addressed in the revised DEIS.

4. The DEIS appears inconsistent in its statements regarding sediment deposition behind the upstream dam. Appendix L (pg. L-10) states that an estimated 26,000 acre-feet of sediment over the next 100 years may be deposited in the lower reaches of the upstream reservoir near the new dam. This appears to be in conflict with the statement in the DEIS (pg. 2-4) which states that only small amounts of sediment would be expected to reach the facility. The revised DEIS should address this inconsistency. The DEIS also states that the area behind the dam would look much as it does today (Main Report pg. VII-1). It is not clear whether this would be the case. Even if deposition of material was below the new upstream dam, impacts to the aquatic environment and transport of silts to Folsom Lake seem likely.

Mitigation

There is inadequate information on proposed mitigation for EPA to be assured of full compensation for losses of acres, values and functions of the aquatic environment. Mitigation for the proposed project has not been finalized and is proposed to be included in the Final EIS/EIR (DEIS pg. 8-39). We believe this information is sufficiently important to require its publication in the revised DEIS. Furthermore, there is significant disagreement between the USFWS and COE in regards to the extent of impacts. It is therefore difficult to determine the amount and type of mitigation required.

The proposed mitigation for temporary upstream inundation impacts of the preferred alternative is up-front habitat management of 1400 acres plus a post-flood remediation program to replace losses which may occur in excess of the up-front mitigation (DEIS pg. 8-45). Periodic reestablishment of vegetation in the habitat mitigation areas will be provided for in the Operation and Maintenance Manual for the proposed project (Main Report pg. VII-14). EPA is concerned that this mitigation may not be adequate since it may not fully compensate for losses of acres, values and functions. In addition, mitigation which must be continuously replaced or maintained over time is not considered by EPA successful or adequate mitigation.

B. Water Quality

Water Quality Standards

The DEIS does not address water quality impacts to the Sacramento River system which may result from temporary or

permanent reoperation of Folsom Reservoir. Potential changes to the timing, quantity, and temperatures of in-stream flows could result in water quality impacts in this system. In discussing the environmental impacts of several project alternatives, the Main Report states that reoperation of Folsom Reservoir would require reoperation of other reservoirs in the Central Valley Project (CVP) and State Water Project (SWP) to meet other system demands, which in turn could affect water temperature in the Sacramento River system and adversely affect its anadromous fishery (Pg. VI-5). This statement is repeated in the document but never expanded upon. Furthermore, Table VI of the Main Report contains a qualitative rating of relative environmental impacts of the various alternatives; however, losses to salmon due to elevated water temperatures are not explained. These salmon may include species that are protected under the Endangered Species Act.

The DEIS does not explain what operational changes at other facilities in the Central Valley may contribute to the above adverse impacts. As a federal agency responsible under the Clean Water Act (CWA) for fully protecting beneficial uses, the COE must demonstrate that it has considered construction and operation alternatives that do not increase water temperatures or adversely affect the anadromous fishery in apparent violation of the CWA. The COE should evaluate all alternatives or mitigation providing full protection for beneficial uses and not merely describe the extent of non-compliance with CWA responsibilities.

We urge the COE to evaluate the effect of temporary and permanent Folsom Reservoir reoperation on the operations of other Central Valley facilities and on the ability of the Bureau of Reclamation (BOR) and COE to meet current and reasonably foreseeable future water quality standards for the American and Sacramento Rivers. This evaluation should explain what operational rules were used in optimizing operation of the various facilities for power generation, water supply, and flood control in the Sacramento River system, including the American River; the extent of potential impacts to water quality; and what measures would mitigate for these impacts.

**General Comments**

The COE states that sedimentation associated with operating the flood-control dam would not significantly affect water quality in the American River due to the relatively infrequent flooding and the volume of material likely to enter the stream in connection with a flood (DEIS pg. 6-15). However, the DEIS states that approximately 38,400 tons of sediment from construction is anticipated over the 3 year construction period (DEIS pg. 6-14). This value does not include sedimentation from

aggregate mining activities in the upper American River or increased sedimentation from temporary inundation and rapid drawdown of flood waters. It appears that natural slope failure may be hastened by filling and emptying of the reservoir (Appendix M pg. 7-6). This could contribute significant quantities of silts and sediments to the stream system, resulting in losses of habitat and degradation of the aquatic system. We note that soils above the proposed dry dam are considered erosive and unstable (USFWS Draft Coordination Act Report, February 1991, Auburn Area, Volume II). Furthermore, the COE claims that lowering the Folsom Dam spillway and increasing storm-related releases will result in more severe sedimentation impacts in the lower American River than under the preferred alternative (DEIS pg. 6-19).

We are very concerned with the potential impacts of possible sedimentation on water quality, the aquatic environment, Folsom Reservoir, and the American River. The COE has not persuasively demonstrated that the above increases in sedimentation will not have significant environmental impacts or that proposed mitigation will reduce such impacts to a less-than-significant level. We urge the COE to provide adequate information and mitigation commitments in the revised DEIS to ensure protection of water quality and beneficial uses. This information should include a discussion of the operation and management of required sedimentation basins and describe the potential impacts from these activities.

Contaminants may be present in the gravel to be excavated (Appendix G pg. G-10) as a result of past gold mining activities (DEIS pg. 5-2). EPA believes the results of sediment testing should be incorporated into the revised DEIS. Testing should be done now to determine if increased inundation or aggregate excavation will result in water quality impacts. Alternate aggregate sources may be needed. We are concerned that temporary inundation and flooding of old mining sites and dredge spoils may result in sulfuric acid formation and leaching of hazardous/toxic materials (DEIS pg. 5-3). The potential increase in sulfuric acid, heavy metals and salts should be analyzed in more detail in the revised DEIS.

The COE predicts that: 1) water quality standards may be exceeded, 2) impacts on aquatic resources from temporary construction impacts will occur (DEIS pg. 6-14) and 3) urban runoff caused by induced growth will increase (DEIS pgs. 6-18, 6-21). EPA believes that the proposed mitigation measures may not be sufficient to reduce these impacts to less-than-significant levels. We urge the COE to investigate other mitigation measures which could be used to avoid, minimize or compensate for impacts to water quality.

Appendix G, Section 404 Evaluation, states that violation of water quality standards (pg. G-15) or introduction of contaminants which would adversely affect water quality is not anticipated (pg. G-33). These statements appear to conflict with information provided in the Main Report and DEIS.

### Water Supply

The COE should determine whether the BOR intends to seek an alternative water supply if Folsom Reservoir becomes unavailable for meeting CVP contracts. If so, the impacts of a new water supply project as a "reasonably foreseeable future action" should be discussed in the revised DEIS.

## AIR QUALITY

The Sacramento area has serious air pollution problems which the proposed project may increase. Sacramento County is currently designated nonattainment for ozone, carbon monoxide and fine particulate matter. Given the potential significant impacts to air quality we are concerned with cumulative air impacts and the adequacy of mitigation. The revised DEIS must clearly demonstrate that the proposed action would not delay timely attainment of National Ambient Air Quality Standards (NAAQS) or contribute to violations of the NAAQS.

### Conformity Pursuant to the 1990 Clean Air Act Amendments

The DEIS lacks a conformity demonstration as required by Section 176(c) of the Clean Air Act. Although the DEIS provides a general assessment of impacts and acknowledges significant future air quality impacts, it does not provide supporting evidence that proposed alternatives meet the conformity requirements of 1990 Clean Air Act Amendments. Section 176(c)(1) provides that:

> No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve any activity which does not conform to an implementation plan after it has been approved or promulgated under section 110...Conformity to an implementation plan means:
>
> (A) Conformity to an implementation plan's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards, and achieving expeditious attainment of such standards;

(B) That such activities will not--

(i) cause or contribute to any new violation of any standard in any area;
(ii) increase the frequency or severity of any existing violation of any standard in any area; or
(iii) delay timely attainment of any standard or required interim emission reductions or other milestones in any area."

Assessment of Air Quality Impacts

The DEIS does not provide a substantive analysis of whether the projected direct and indirect impacts will interfere with expeditious attainment of national ambient air quality standards or contribute to standards violations in the Sacramento Valley. We note that the DEIS predicts increases of oxides of nitrogen (NOx) and oxides of sulfur (SOx) emissions due to construction activities and growth (DEIS pg. 7-15 and 7-16). This air quality analysis should address the cumulative effects on air quality expected from development identified to occur once flood protection is provided to the Sacramento area.

1) The analysis should discuss changes in population, employment, vehicle miles traveled, and additional trips taken. Transportation projects proposed as mitigation for transportation impacts should be accompanied by an analysis of their impacts on air quality, particularly where these projects might induce development in other parts of the region. These transportation projects should be part of a conforming transportation plan.

2) The analysis should project potential emissions increases in carbon monoxide (CO), hydrocarbons (HC), particulate matter (PM-10), and NOx resulting from increased population, increased vehicle miles traveled, added trips, as well as added point and area sources of air pollutants.

3) The analysis should also discuss the ozone impacts resulting from increased emissions of HC and NOx and identify CO hot spots in consultation with the local agencies. It should further discuss the impacts of the NOx and SOx emission increases on the related ambient air quality standards.

Mitigation of Impacts to Air Quality

The COE should develop with local agencies a mitigation plan to ensure conformity with the Clean Air Act. The memorandum of understanding (MOU) proposed in the DEIS can serve as the instrument for developing this mitigation plan. The MOU portion

for air quality mitigation should be expanded to include Yolo, Solano, Placer, and El Dorado Counties in addition to Sacramento and Sutter Counties. EPA is willing to work with MOU participants to develop a mitigation plan and to ensure that mitigation measures are implemented.

ADDITIONAL SPECIFIC COMMENTS ON DEIS

1. The COE and FEMA utilize different methods to calculate the 100-year floodplain and the level of flood protection provided by flood protection facilities. Consequently, FEMA 100-year flood protection is 85-year flood protection as defined by the COE (Executive Summary pg. 3). To reduce confusion, we recommend the revised DEIS include both the COE and FEMA flood protection levels concurrently in text and tables which indicate different protection levels.

2. The impact analysis often combines alternatives and potential impacts when presenting information in tables. In addition, qualitative descriptions of potential impacts are the only evaluation provided. For example, the DEIS states that the 100-year alternatives will have similar impacts to, but of less magnitude, than 150-year alternative impacts. The magnitude of the differences for each alternative and supporting data is not provided (DEIS Table 8-6, pg 8-19; Table 9-3, pg. 9-25;pg. 8-66). We recommend the COE describe each alternative's impacts separately. The goal of full disclosure is to give decisionmakers adequate information to compare and distinguish between the potential impacts of the various alternatives.

3. Executive Summary Pg. 9. Construction of a pedestrian, bicycle and equestrian trail in Natomas and high-intensity day-use facilities near the mouth of the Natomas East Main Drainage Canal is proposed. The revised DEIS should clearly identify the extent recreational facilities affect the design of the proposed flood control project and/or result in fill within waters of the United States. For example, indicate whether the recreational features influence the placement or size of levees, or other designs for flood control. If the recreational components of the project result in fill within waters of the United States, an alternatives analysis of these components must also be provided in the revised DEIS.

4. Executive Summary Pg. 13, Table III. The second (future) Natomas interior drainage pumping impacts have not been provided in the DEIS. If they are part of the proposed project, they need to be addressed in the revised DEIS.

5. Main Report Pg. II-17. The description of the current flood insurance situation is unclear in regards to residential and

commercial development. As stated, it appears that the FEMA moratorium is valid only for non-residential development and therefore residential development is currently under full FEMA flood protection requirements. The revised DEIS should include a clear explanation of existing FEMA requirements and constraints.

6. Main Report Pg. III-19. We recommend the COE include the 200-year floodplain in their floodplain damages inventory. The COE should also include non-monetary floodplain values (e.g., riparian habitat) in the damages inventory.

7. Main Report Pg. IV-5. The document states that the filling of the proposed upstream dry dam by an event of 400 years would last approximately 12 days. This period of inundation is not consistent with other statements in the DEIS.

8. Main Report Pg. IV-6. The COE has estimated that use of existing upstream reservoirs would cost $625 million. The revised DEIS should indicate the time period over which this has been calculated.

9. Main Report Pg. VII-2. The Main Report states that the sluice gates are to be closed only to retard flow from the dam in the "extremely unlikely event of an emergency affecting downstream system safety" and is not anticipated (pg. VII-13). If this is the case, the COE should fully document and support their position that these gates are an essential and necessary safety feature.

10. Main Report Plate 21. Highway 49, as shown on Plate 21, removes the tight switchbacks from the road thus potentially reducing commute time. The COE should outline their arguments on why this proposed design may not induce growth.

11. DEIS Tables 1-2 and 1-3 Impact Summary. We recommend adding the no action alternative to these Tables. The no action alternative should include an estimate of existing short-term and long-term flood impacts (e.g., 100, 200, 400-year flood impacts to riparian habitat) to the American River corridor that can be compared to the potential impacts (e.g., loss of riparian habitat) caused by the project alternatives.

12. DEIS Pg. 1-5. The DEIS states that the tentative selected plan would be designed to preserve water and power options in the watershed. The revised DEIS should outline the specific design features preserved.

13. DEIS Pg. 1-9 (Table 1-4). The DEIS indicates three years of monitoring of revegetated areas would be required for mitigation. This is insufficient for determining success of mitigation. A

minimum of 5 to 10 years of monitoring after implementation of mitigation should be required to assure mitigation success. The frequency of monitoring within this period should be determined in consultation with resources agencies.

14. DEIS Pg. 2-5. We request that the COE explain why the East Levee Road requires a 30-foot wide top and 60-foot wide base. The revised DEIS should describe existing widths and evaluate whether impacts to waters of the United States can be lessened with a smaller footprint.

15. DEIS Pg. 2-6; Appendix G Pg. G-5. The borrow site for the Natomas work should be identified in terms of location and potential impacts to the environment. The revised DEIS should state if the site is existing or new.

16. DEIS Pg. 2-7. The revised DEIS should explain why the bottom width of the setback levee for the Fremont Weir is 140 feet. Indicate whether impacts to waters of the United States can be lessened with a smaller footprint.

17. DEIS Pg. 2-8. The development of intensive day use facilities and habitat restoration measures may be in conflict. Increased human use can result in degradation of wildlife habitat and reduce the value of the site to wildlife. The revised DEIS should indicate whether the recreational development of proposed habitat is part of the mitigation package. If so, this may not be appropriate.

18. DEIS Pg. 2-8. The revised DEIS should state whether the rerouting of the existing bike trail at Del Paso Boulevard will result in additional impacts to waters of the United States or wetlands.

19. DEIS Pg. 3-5. Values for lengthening of Fremont Weir and widening the northern Yolo Bypass (e.g., 750 feet for 150-yr protection) do not appear consistent with other parts of the document. For instance, lengthening of Fremont Weir to 600 feet (DEIS Pg. 3-7) is not consistent with Table 1-1 (500 feet, DEIS Pg. 3-7).

20. DEIS Pg. 3-7. Although the expected probability methodology and computed probability method may be recognized in the US Water Resource Council Bulletin 17B, the revised DEIS should note that FEMA does not utilize the COE's methodology of using expected probability in determining flood frequency analysis.

21. DEIS Pg. 3-13. We are concerned that the COE discounts the benefits of anticipatory releases based on forecasting. We believe that advanced flood management programming may be finely

tuned to approach optimum storage and release operations in a cost-effective way. There may in fact be potential for advanced flood management programming, regardless of the alternative flood protection selected.

22. DEIS Chapter 4. Tables and figures illustrating land use data (Table 4-2, Figures 4-1 and 4-2) should be reviewed for consistency with the text and other data tables. It is unclear how the future development of south Sutter County (northern Natomas) is being incorporated and utilized in the impact analyses.

23. DEIS Pg. 4-3. Land in the Yolo Bypass is included only for purposes of hydraulic mitigation. The revised DEIS should indicate whether the proposed project will conflict with the proposed wildlife habitat enhancement/creation proposed in the Yolo Basin by the Corps and local entities.

24. DEIS Pg. 6-5. For ease of comparison, we recommend including Federal and State standards in Table 6-2, pg. 6-5.

25. DEIS Pg. 7-14. The DEIS describes the estimated project air pollutant emissions for levee construction in Natomas and dam construction in the Upper American River (pgs. 7-14, 7-15). For ease of comparison, we recommend the COE also include estimated project air pollutant emissions for levee construction in the lower American River which would take place under the 150-year and 100-year levee alternatives.

26. DEIS Pg.8-2, Table 8-1. Potential impacts to waters of the United States caused by gravel extraction need to be included in this table.

27. DEIS Pg. 8-2. We strongly recommend that Tables 8-1 and 8-2 include the no action alternative (e.g., existing flood impacts) and temporary Folsom Reservoir reoperation impacts (pgs. 8-2, 8-3).

28. DEIS Pg. 8-3, Table 8-2. This table should include indirect impacts associated with temporary inundation and potential increased erosion.

29. DEIS Pg. 16-16. Since this is the preferred alternative, EPA recommends the visual simulation of the 400-year alternative be included.

30. DEIS Pg. 24-1. The DEIS states that some dam leakage may occur as a result of the maximum credible earthquake, but total failure would not occur. We recommend that the revised DEIS provide more discussion of the relative safety of the selected

plan compared to other alternatives. Discuss whether a larger dam on a complex foundation has greater likelihood of incorporating important weaknesses due to fault zones, talc seams, serpentine bodies, adverse jointing orientations, and greater potential for landslides and earthquakes induced by reservoir inundation.

Conditions that exist at the Auburn Dam site will affect the dam proposal. Discuss whether the following Auburn site foundation conditions affect dam safety: weak planes, tabular bodies and masses of gouge, sheared rock, talc, talc gouge, serpentine and weathered dike rocks as well as numerous sets of joints. We note that other gravity dams have failed, such as the St. Francis Dam in Southern California (1928), which collapsed after a foundation blow-out. Insofar as the reoperation of Folsom Reservoir and modification of the spillway do not rely on additional high dams, please discuss the relative safety of these options.

31. Appendix C Pg. C-3 Table II-1. This table inappropriately includes advance features. This table should be corrected. As stated in previous discussions with the COE, EPA believes that if the proposed dam is constructed such that expendability is enhanced beyond that of a standard dam design for flood protection, other project purposes beyond flood protection would need to be addressed in the current DEIS.

32. Appendix G Pg. G-3. The 400-year flood protection alternative and 200-year flood protection alternative are considered the same except for dam height and storage capacity. The revised DEIS should indicate whether the footprint for the two alternatives differ. The evaluation of the 200-year versus a 400-year alternatives should indicate which alternative is more easily expanded (financially and technologically) for other project purposes. Discuss federal and state cost-sharing arrangements as regards future benefits.

33. Appendix G Pg. G-5. The DEIS states that recontouring of gravel extraction sites will occur as practicable. The revised DEIS should state whether excavations will result in depressions in the river after extraction. EPA is concerned that depressions may trap fish after high flood flows and cause their die off. The revised DEIS should evaluate other impacts which may result should such depressions remain.

34. Appendix G Pg. G-13. The DEIS indicates approximately 700 acres of habitat would be lost due to periodic inundation over the 100 year life of the project. The revised DEIS should specify the type of habitats (wetland, upland) which will be lost or altered.

35. Appendix G Pg. G-14. The revised DEIS should clearly state whether the footprint of the dam is within waters of the U.S, whether or not it is in a special aquatic site.

36. Appendix G Pg. G-14. The extraction of gravel is not a water dependent activity requiring direct access or proximity to the American River in order to fulfill the basic project purpose of flood protection. To comply with 404(b)(1) Guidelines, the availability of upland gravel sites should be addressed.

37. Appendix G Pg. G-30. EPA believes the cumulative effects analysis is too narrow. Future development within the Natomas area should also be addressed.

FAX TRANSMISSION ASAP

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| DATE | : 6/13/91 | | |
| PAGES | (Including Cover) 33 | | |
| SUB-JECT | American River DEIS - EPA Press Release | | |
| NOTE | and EPA comment letter. Hard copy is being mailed overnight express to the Colonel's office. | | |

STATE OF CALIFORNIA — Pete Wilson, Governor

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JUN 14 1991

In Reply Refer
to:333:KDM:18721

Colonel Laurence R. Sadoff
Sacramento District
U.S. Army Corps of Engineers
Planning Division
650 Capitol Mall
Sacramento, CA 95814-4794

Dear Colonel Sadoff:

DRAFT FEASIBILITY REPORT AND ENVIRONMENTAL IMPACT REPORT/ENVIRONMENTAL IMPACT STATEMENT (EIR/EIS) FOR THE AMERICAN RIVER WATERSHED INVESTIGATION

The April 1991 Draft Feasibility Report and EIR/EIS for the American River Watershed Investigation describes alternatives to address the flooding problems along the American and Sacramento Rivers. The tentatively selected plan proposes 400-year flood protection, principally by construction of an 894,000 acre-foot (af) capacity flood detention facility, on the North Fork American River near Auburn (page 7). The maximum estimated reservoir outlet capacity would be about 70,000 cubic feet per second (cfs) through eight outlets. The proposed mode of operation for the flood protection facility is for two of the eight outlet gates to remain open. Thus, the minimum outlet capacity would be up to about 17,500 cfs. The reservoir would periodically inundate up to 6,000 acres (page IV-5) within the reservoir site, but would require fee title ownership of only 2,060 acres (page VII-2) for the reservoir site and roads. However, about 20,620 additional acres of flowage and other easement would also be required. The plan would neither advance nor impede future options for developing water and power facilities (page 8).

Discussion

Water right Permits 16209, 16210, 16211, and 16212 (Applications 18721, 18723, 21636 and 21637) were issued to the U.S. Bureau of Reclamation (Bureau) in 1971 for storage of up to 2,500,000 acre-feet per annum and direct diversion use of up to 6,900 cfs for hydroelectric power generation at Auburn Dam. The time to complete construction and use of water under the permits has expired. The Bureau submitted petitions for approval of a new development schedule; however, the State Water Resources Control Board (State Board) has not acted on the petitions because a final project has not been identified.

1. Any dead storage volume at the proposed Auburn flood detention facility will require an appropriative water right permit from the State Board. Rebuilding of the Coffer Dam and use of the existing diversion tunnel will probably not involve storage of water for at least several years.



2. The tentatively selected plan proposes construction of a dam developing a reservoir having an 894,000 af capacity. The report does not adequately describe the reservoir routing time for the average or maximum credible storm frequency within the basin. Preliminary review indicates that if all of the reservoir gates are open and 70,000 cfs is discharged from the reservoir, it will take at least seven days to discharge the full reservoir storage capacity. If only two outlets are open, it will take at least twenty-six days to discharge the 894,000 af. During a series of successive storm events, the reservoir will partially refill; and discharge of the complete reservoir contents may not occur without retention of additional water in storage requiring an appropriative right. March 1986 is an example of this type of occurrence.

3. Any hydroelectric power generation at Auburn Dam must be accomplished under an appropriative water right permit.

4. Page VIII-12 describes the potential economic feasibility of substituting flood control space in Folsom Reservoir with flood control space in Auburn Reservoir. The two proposals which are described would reduce Folsom Reservoir flood control storage by between 100,000 to 200,000 af. The report concludes that the estimated costs appear to outweigh the economic benefits. If, however, the flood control storage is reduced in Folsom Reservoir and the water supply pool enlarged, then water use under the Folsom Reservoir permits may increase. If consumptive use from Folsom Reservoir increases beyond the permitted amounts due to coordinated operation of the Folsom and Auburn facilities, then additional appropriative rights may be required for Folsom Reservoir.

5. The Auburn flood detention facility has been designed to detain peak flood flows for regulated release into the American River during and after the flood peak has passed. This is likely to enhance the quantity of water available for downstream uses including export diversions, such as the State and Federal Water Projects at the Delta pumping facilities. Further, it is likely to increase the length of time that the export projects can operate at peak capacity. Since the flood control project may affect and/or enhance other appropriative rights, the Auburn project should be reviewed to determine whether the dam site should be listed as a point of diversion under other appropriative right permits if constructed without its own appropriative permits.

6. The potential sedimentation and sloughing of canyon walls from drawdown of inundation zone is listed as not known (page V-40). The report suggests that a survey be conducted at the time of occurrence; and revegetation be accomplished, as appropriate. Since the project will periodically inundate 6,000 acres within the reservoir site, and will affect a total of 22,600 acres of land, it appears that sedimentation issues should be addressed more directly now. What is the expected frequency of 25 percent, 50 percent, 75 percent, etc., filling of the reservoir? How many acres of land will be affected? Will revegetation occur between flood events? Will the U.S. Army Corps of Engineers be required to remove all trees and other vegetation within the zone of inundation? What is the substrate material within the zone of inundation? Will wave action reduce the substrate to more friable material subject to erosion?

7. The report states that the potential for reservoir-induced seismicity (RIS)--seismic activity caused by the filling of a reservoir--is very low for a flood-control only dam since large volumes of water are not regularly impounded over long periods of time. Several factors are involved in the calculation of RIS, and principal among these factors are the speed of filling and the weight of water after filling. RIS has been observed after drought when reservoirs are refilled. Was the effect of rapid water elevation changes within the reservoir assessed? If so, how?

Recommendations

Based upon our initial review of the April 1991 draft document, the Division of Water Quality and Water Rights (Division) recommends that:

1. Additional general information regarding water rights be included in the EIR/EIS.

2. Division staff believes that under several different operating scenarios, flood control operation of the proposed 894,000 af Auburn Reservoir would involve collection of water to storage near Auburn, requiring an appropriative water right under existing State law. Therefore, the tentatively selected flood detention facility should be constructed pursuant to the Bureau's permits or an appropriative water right obtained by the U.S. Army Corps of Engineers.

3. Required petitions for extensions of time and changes to the existing Bureau water right permits for the Auburn Dam Project be identified, and a schedule for action upon all necessary petitions be included in order that water rights requirements be fully disclosed and to ensure that operation of the flood control project does not impede future options for development of Auburn Reservoir for water supply and power purposes.

4. Any additional Bureau water rights required at Folsom Dam, due to the proposed flood protection operation at Auburn, be identified. We note that the Auburn project may enhance hydroelectric power production at Folsom Dam and any enhancement should be reviewed to ensure that adequate water rights exist prior to operation in an enhanced mode.

If we can be of further assistance, I can be contacted at (916) 324-5730. The staff person currently assigned to this matter is Katherine Mrowka, and she can be contacted at (916) 324-5701.

Sincerely,

Roger Johnson
Assistant Division Chief
Division of Water Quality
and Water Rights

# ENVIRONMENTAL DEFENSE FUND

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June 14, 1991

Col. Laurence R. Sadoff
District Engineer
Sacramento District
U.S. Army Corps of Engineers
650 Capitol Mall
Sacramento, California 95814

RE: American River Watershed Investigation, California, Feasibility Report

Dear Col. Sadoff:

The Environmental Defense Fund ("EDF") submits the following comments on the U.S. Army Corps of Engineers' ("Corps") Draft American River Watershed Investigation Feasibility Report ("FR") and Draft Environmental Impact Statement/Environmental Impact Report ("DEIS"). EDF has previously submitted extensive comments to the Corps which were critical of the Corps' analyses of both the flood risk to the Sacramento area and alternative options for avoiding or reducing potential damage to the area resulting from flooding. Unfortunately, these criticisms have not been adequately addressed in the Draft FR. As a result, the Corps continues to advocate a costly and environmentally unsound approach to flood damage reduction, which will delay implementation of more readily available alternatives to reduce the flood risk to the Sacramento area.

Attached to these comments is a review by Dr. Philip Williams of the Draft FR and of a separate Corps' response to an earlier critique by EDF of the Corps' flood risk and alternatives analyses. Dr. Williams' review shows that the Corps continues to fail adequately to respond to key issues that affect the calculation of the risk of flooding to Sacramento and the assessment of steps that can be taken to reduce that risk. Among these key issues are: (1) the Corps' failure to ensure proper flood-control operation of Folsom Dam; (2) the Corps' failure to account for the actual operation of upstream reservoirs which serve to reduce flood risk; (3) the Corps' use of a methodology for calculating flood risk that skews that risk higher than actual

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computed probabilities; and (4) the Corps' exaggeration of the costs and discounting of the benefits of non-dam options (such as levee improvements) which could greatly reduce potential flood damage to the Sacramento area. Proper accounting for these and other factors would greatly reduce flood risk in a timely and cost-effective way and very likely could lead to development of flood damage reduction measures that would provide 200-year flood protection without construction of an upstream dam.[1]

Rather than reiterate all prior criticisms of the Corps' analyses, the following comments focus on key areas in the Draft FR where the Corps' failure adequately to consider the factors EDF has previously raised biases its conclusions in favor of an upstream dam at the Auburn site.[2] In addition, other comments pertaining to the inadequacies and omissions in the Corps' environmental analysis are also included.

Proper Operation of Folsom Dam

An objective review of the actual operation of Folsom Dam during the 1986 flood shows that the dam was not properly operated in compliance with mandated flood control operations.[3] Required releases were delayed for several days, necessitating later releases in excess of the Lower American River levees design capacity.

[1]The attached letter, dated May 31, 1991, and the documents referred to in the letter in Attachment A are incorporated into these comments. The referenced documents have previously been submitted or otherwise should already be available to the Corps, but EDF will provide copies upon request. The earlier EDF critique was submitted by letter dated August 13, 1990, from the National Wildlife Federation, EDF, Natural Resources Defense Council, Friends of the River, American River Coalition, and California Natural Resources Federation to the Hon. Robert W. Page, Assistant Secretary of the Army (Civil Works). The Corps' response is contained in a letter dated April 5, 1991, from G. Edward Dickey, Acting Principal Deputy, Assistant Secretary (Civil Works), Department of the Army, to Thomas J. Graff, EDF (referred to herein as "Dickey letter").

[2]An alternative similar to that advocated by EDF is identified by the Corps, (DEIS, pp. 3-9ff.), but rejected without real analysis.

[3]See, e.g., U.S. Bureau of Reclamation, Preventing A Crisis (May 1986), p. 17, Fig. 11. This figure shows that inflows into Folsom Reservoir exceeded outflows for approximately two and one-half days, and that storage reached over 800,000 acre-feet before releases of 115,000 cfs were made.

This delay in mandated releases caused a serious and avoidable encroachment into Folsom Reservoir's flood control space. The Corps' Reservoir Regulation Manual for Flood Control for Folsom Dam equates a 12-hour delay in the initiation of flood control releases with the loss of 100,000 acre-feet of flood control space, and states that "it is essential that the need for releases be determined at the earliest possible time and that action to initiate releases be taken as soon as possible."[4]

The Draft FR attempts to justify the delayed releases -- which placed Sacramento at serious risk -- by citing concern over avoiding damage to recreational facilities in the Lower American Parkway and uncertainty over weather conditions, at a time when high precipitation and flood flows were being experienced throughout northern California. (FR, p. III-10). Elsewhere, the Draft FR candidly admits that "during periods of drought, as in the past 5 years, there may be a natural reluctance to release what otherwise would be valuable water supplies until it is clear that such releases are necessary." (DEIS 3-13). The Corps' apparent willingness to permit erosion of required flood control protection for water supply or other considerations is contrary to the flood control regulations controlling operation of Folsom Reservoir. These regulations do not give the Corps discretion to compromise Folsom Reservoir's flood control function for other purposes. A proper analysis of the flood risk to the Sacramento area should assume proper operation of Folsom Dam, and the Corps should take all necessary steps to ensure such operation.[5]

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[4]Folsom Dam Reservoir Regulation Manual for Flood Control, Part B, p.1 (emphasis added).

[5]The Corps admits that the 1986 flood peak was less than the reservoir design flood ("RDF") peak flow for Folsom Reservoir. (FR, p. III-11). It attempts to avoid the obvious conclusion that proper operation of Folsom Reservoir could have handled that flood without excess releases by arguing that the 6-day runoff volume for the 1986 flood exceeded the 6-day RDF by 17 percent. (Id.). However, as noted elsewhere in the Draft FR, storms in the American River basin tend to peak sharply and then dissipate relatively quickly. (DEIS p. 3-13). The greater importance of the flood peak to reservoir operations is further illustrated by the fact that a 6-day inflow of 100,000 cfs, which equates to 1,200,000 acre feet, has a 6-day volume which is even greater than the 6-day volume of the 1986 flood, but could be passed through Folsom Reservoir without exceeding releases of 115,000 cfs.





Upstream Reservoirs

A second area of major importance to the proper analysis of the flood risk to the Sacramento area is the effect of upstream reservoirs in regulating flood inflows into Folsom Reservoir. The Corps' analysis appears to be based upon an unrealistic scenario in which upstream reservoirs are simultaneously at maximum storage coincident with a major flood event. In contrast, Dr. Williams' analysis is based upon the actual operation of upstream reservoirs over the last 30 years. The Corps skirts around direct response to Dr. Williams' analysis by citing hypothetical reasons why upstream reservoirs would not have a significant effect on controlling flood flows. (E.g., DEIS, pp. 3-11).

However, other Corps' analyses substantiate the significant effect of upstream reservoirs in regulating flood flows. The Corps' analysis of the Probable Maximum Flood, the extreme flood used for spillway design, shows that upstream reservoirs have significant surcharge storage available at time of flood peaks. (FR, p. K-55). The FR also concludes that allowance for "dead pool space" for sediment would not be required for its proposed detention dam because "[e]xisting upstream reservoirs would catch most of the suspended sediment." (FR, p. VII-8). This conclusion appears to be in direct conflict with the Corps' statement elsewhere that upstream reservoirs would not have an appreciable effect on flood flows because they capture only a small percentage of total basin runoff. (E.g., DEIS p. 3-11).

As with the issue of Folsom Dam operation, the difference between the Corps' analysis of upstream reservoir effects and Dr. Williams' analysis is substantial. The Corps attributes somewhat less than 50,000 acre-feet of storage to upstream reservoirs for events through a 100-year flood, and no storage for rarer floods (FR, p. III-4). Dr. Williams' analysis shows available upstream storage generally to be at least 200,000 acre-feet with significant volumes being stored during the initial four days of a flood.[6] The difference obviously could have a significant effect both on determining the flood risk to Sacramento and on designing appropriate strategies to address that risk.

Flood Risk Computation

The Corps does not dispute that the "expected probability" methodology it uses results in a higher estimated probability of flood events than does the "computed probability" methodology used by the Federal Emergency

[6]See Letter to J. Krautkraemer, EDF, from Philip Williams, March 5, 1990, p. 2. This letter has previously been submitted to the Corps.

Management Agency ("FEMA"). Indeed, the Corps acknowledges that the computed probability approach is "the least biased estimate for regulatory purposes."[7]

The Corps' rationale for using expected probability is the asserted need to adopt conservative assumptions to ensure adequate sizing of flood control structures, thereby avoiding the need for later modifications. (FR, p. III-7). However, since the use of expected probability is premised on the design of additional flood control capacity, the Corps' "policy decision" to use expected probability reveals the agency's underlying bias toward reservoir flood control storage over a series of incremental cost-effective improvements in the present flood management system for the Sacramento area. As recognized in the FR, use of the expected probability methodology increases the estimated flood risk by about 15 percent. (FR, p.3).

Levee Improvements

A key component of a "non-dam" option is to repair and upgrade levees along the American River to at least their original design capacity of 152,000 cfs. The Draft FR, however, understates the benefits and overstates the environmental consequences of this approach. The Draft FR asserts that in general levees are not the preferred way to provide flood protection to urban areas, DEIS, p. 3-12, but the Corps presents no valid reason why adequately constructed and maintained levees along the Lower American River could not safely convey sustained flows equal to at least their original design capacity of 152,000 cfs. Indeed, the existing levee system has historically protected Sacramento from significant flood events, and the proposed strategy for flood damage reduction along the Sacramento River relies on upgrading of the levee system.

The Corps also cites adverse environmental effects associated with the upgrading of levees along the Lower American River as a basis for rejection of this option. (E.g., FR, p. VI-4). While it is true that levee design and construction can have such adverse effects, the Corps has failed to consider new approaches to channel designs which are more environmentally sensitive. (See, attached Williams letter, p. 6). Moreover, the habitat loss and required mitigation associated with an upstream detention dam, as identified by the U.S. Fish and Wildlife Service ("USFWS"), exceed those associated with upgrading of downstream levees. (Compare, e.g., FWCA Report pp. 26, 38 with p., 44).

The analysis in the Draft FR shows that levee improvement can be an extremely cost effective strategy for flood damage reduction for the

[7]See Dickey letter (cited in fn. 2), attachment at p. 6.





Sacramento area. For example, the Corps' own analysis shows that its "100-Year (FEMA) Levees" alternative has a benefit/cost ratio of 3.8 to 1, with a total first cost of only $237 million. The Corps' analysis of the "levees only" option understates its benefits; if the proper assumptions regarding Folsom Dam operation, the effect of upstream reservoirs, flood risk computation, and other factors identified in Dr. Williams' analysis were used, the "levees only" alternative would provide far greater than 100 year protection, further increasing the benefit to cost ratio.

Inadequate Environmental Analysis

The FR's environmental analysis attempts to minimize the impacts of Auburn dam alternatives on the upstream canyons. USFWS, the principal federal agency with responsibility for management and protection of fish and wildlife resources, has identified major upstream impacts in its February 1991 Draft Fish and Wildlife Coordination Act Report, requiring substantially greater mitigation than proposed by the Corps.[8] Of particular concern is the Draft FR's cursory treatment of over 700 acres of wetlands that USFWS concludes will be lost as a result of upstream impoundments (FWCA Report at p. 27, Table 1).

The principal environmental impacts associated with non-dam options, other than those associated with levee upgrading which are discussed above, result from reoperation of Folsom Reservoir. However, a proper analysis of the actual flood risk and of alternative flood management strategies would show that a high level of flood protection could be achieved without such reoperation.[9] To the extent reoperation were a selected strategy, higher levels of flood protection could be provided with significantly less additional flood control space in Folsom Reservoir than the Corps represents, reducing any potential environmental impacts.[10]

The Corps' analysis also assumes that water supply will take precedence over instream flow needs in the Lower American River, and that any water "shortfall" resulting from reoperation of Folsom Reservoir would

[8]United States Department of the Interior, Fish and Wildlife Service, American River Watershed Investigation, A Detailed Report on Fish and Wildlife Resources Draft February 1991 (hereinafter "FWCA Report").

[9]See attached Williams letter p. 2; Letter to J. Krautkraemer from P. Williams, March 5, 1990.

[10]The actual changes in frequency and magnitude of downstream flows resulting from reoperation cannot be meaningfully analyzed due to the continued unavailability of the Folsom Dam reoperation study.

be incurred by instream uses. However, as USFWS correctly points out, one way to mitigate for dam reoperation is to ensure that adequate instream flow requirements are met. While such mitigation may have a cost in terms of water supply for other uses, that cost could be considered in analyzing the relative benefits and costs of different alternatives.

The Draft FR also fails to discuss several important environmental impacts. There is no discussion of the long-term inundation that could result from closure of the proposed gates on the upstream detention dam. Nor is there discussion of the environmental impacts associated with the extensive mining activities associated with dam construction. While the DEIS indicates that these impacts will be addressed in the final EIS/EIR, (DEIS p. 4-14), this approach precludes meaningful analysis, and at a minimum will require recirculation of a revised DEIR. (40 CFR sec. 1502.9). The DEIS also indicates that identification of historic properties in the study area will not be completed before issuance of the final EIS/EIR, (DEIS p. 10-7), depriving the public of any opportunity to comment on this issue in violation of NEPA and CEQA. (See Grazing Fields Farm v. Goldschmidt, 626 F.2d 1068, 1073 (1980)).

Finally, EDF does not believe that it is possible for the construction of a dam at the Auburn site to be "neutral" on the issue of a multipurpose Auburn dam. The presence of a dam in the upstream canyons will inevitably bias future decisions in favor of permanent storage. However, the Draft FR provides only summary and inadequate analyses of the massive environmental losses that would result from permanent inundation of the upstream canyons.

Inadequate Opportunity to Comment

The FR and accompanying documents are lengthy and raise complex and important technical issues. By letter dated May 9, 1991, the Planning and Conservation League ("PCL"), Friends of the River, and the American River Coalition requested an extension of time to permit thorough public review of these documents. This request was rejected.

In addition, EDF on May 21, 1991, requested additional material from the Corps in order to enable it to review certain background assumptions and information relevant to the Draft FR. EDF received a response to that request on June 12, 1991, which indicated that certain information (including information relevant to the Corps' assessment of the effect of upstream reservoirs) was not in a form that could readily be made available. While the Corps' response invited EDF to meet with Corps personnel and offered to make the requested information available for review, this obviously is not possible within the time frame provided to respond to the Draft FR.





The limited time period provided for review of the FR does the public a disservice. While EDF recognizes the need to act promptly to resolve the issues relating to improved flood damage reduction for the Sacramento area, the delay to date is largely the result of the Corps' failure to meet earlier deadlines. We note also that it took the Corps almost eight months to respond to the environmental organizations' August 13, 1990 letter, referred to above, raising issues concerning the Corps' technical analyses.

Accordingly, EDF reiterates the request of PCL and others that the comment period for the Draft FR be extended to ensure adequate opportunity for thorough public review.

Conclusion

The Corps' analytical approach favors construction of a large upstream dam over more readily implementable and cost-effective incremental alternative measures that could significantly reduce potential flood damage in the Sacramento area. Many of the benefits attributable to an upstream detention dam could be achieved in a more cost-effective way with non-dam alternatives, a fact the Corps recognizes in its Draft FR.[11] These non-dam options are "practicable alternatives" as used in the section 404(b)(1) guidelines, precluding implementation of the proposed upstream dam options. (See 40 CFR sec. 230.10(a)).

The need to pursue cost-effective, incremental improvements to reduce the flood risk to the Sacramento area is particularly important given current fiscal realities. Recent experience has shown that even if a project succeeds in obtaining authorization, appropriations for construction have been difficult to obtain.[12] Relying on a costly upstream dam as the means of reducing flood damage along the American River thus likely will leave the Sacramento area at flood risk for a considerable time into the future.

The proposed project also raises significant issues of equity. Given limited federal and state funds available for flood damage reduction assistance, it does not represent sound policy to provide a huge federal

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[11] "For levels of flood protection less than about 150 years, alternatives that do not include a flood control dam appear to be more cost effective." (FR, p.V-38). For the reasons previously stated, the actual level of protection provided by the Corps' "150 year" alternative would be far greater.

[12] See, e.g., Statement of Thomas J. Graff before the Sacramento Area Flood Control Agency (January 10, 1991) at p. 3; Letter to W. Edgar, SAFCA, from J. Krautkraemer (February 1, 1990).

and state subsidy to a project that would provide four times the federal minimum level of flood protection. Such a policy provides a strong incentive for the local community to favor unnecessarily costly projects to the detriment of other communities that may need additional flood damage prevention.

As the foregoing comments indicate, there continues to be substantial disagreement between the Corps and EDF on critical technical issues concerning flood risk and alternative flood damage reduction strategies for the Sacramento area. While we would welcome the opportunity to meet with your staff to discuss these issues further, a more constructive approach to their resolution would be to have an independent review conducted to evaluate the differences. EDF would welcome the opportunity to cooperate with such a review.

Sincerely yours,

John W. Krautkraemer
Senior Attorney

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PETE WILSON
GOVERNOR
STATE OF CALIFORNIA

THE RESOURCES AGENCY

Air Resources Board
California Coastal Commission
California Tahoe Conservancy
California Integrated Waste Management Board
California State Lands Commission
Energy Resources Conservation and Development Commission
San Francisco Bay Conservation and Development Commission
State Coastal Conservancy
State Lands Commission
State Reclamation Board
State Water Resources Control Board
Regional Water Quality Control Boards

June 14, 1991

U. S. Army Corps of Engineers
Colonel Laurance R. Sadoff
District Engineer, Sacramento District
Attention: Mr. Mike Welsh
650 Capitol Mall
Sacramento, California 95814-4794

Dear Mr. Welsh:

The State has reviewed the Draft Feasibility Report and EIS/EIR, American River Watershed Investigation, California, El Dorado, Placer, Sacramento, Sutter, and Yolo Counties, submitted through the Office of Planning and Research.

We coordinated review of this document with the California Highway Patrol, the Air Resources Board, the Native American Heritage and State Lands Commissions, the State Water Resources Control Board, the Central Valley Regional Water Quality Control Board, and the Departments of Conservation, Fish and Game, Parks and Recreation, Transportation, and Water Resources.

Please take particular note of the comments by both the State Lands Commission and the Department of Fish and Game. The State Lands Commission addresses concern that "the screening of alternatives is improperly narrow." In addition, they have identified deficiencies in the alternatives analysis in the "out of hand rejection of non-structural measures, specifically, flood plain development restrictions." I would urge you to review their comments carefully and note with particular concern the areas where inadequate information is provided. Second, I would also call your attention to comments from the Department of Fish and Game which identifies a "wide discrepancy among information" and inadequate attention to 17 identified issues in the EIS.

The Department of Transportation has responded directly to you with their concerns about this project.



While we realize that time is of the essence and adequate flood control is critically important for Sacramento, we also cannot allow decisions to be made without full and complete environmental review.

We would urge your careful review and consideration of these points so that adequate information can be provided and reviewed appropriately.

We thank you for this opportunity to comment on this most important project.

Sincerely,

Carol Whiteside
Assistant Secretary for
Intergovernmental Relations

Attachments

cc: Office of Planning and Research
1400 Tenth Street
Sacramento, California 95814
(SCH 89080710)

and streamside habitat over the life of the project, while the U.S. Fish and Wildlife Service estimates a cumulative loss of 1,866 acres of wildlife habitat. Most of these losses of natural habitat would occur within the existing Auburn State Recreation Area. The 200-Year Flood Protection alternative would have similar, but lesser, impacts on natural resources.

The plan calls for the acquisition and management of 1,462 acres at the Knickerbocker Creek area as mitigation for the loss of wildlife habitat. As the land is now in public ownership and already provides excellent wildlife habitat, the Department does not consider this mitigation proposal adequate for either habitat loss estimate. An adequate mitigation proposal should entail protection of similar nearby habitat types in danger of conversion through development. Following the formula used by the Corps, such protection should involve a minimum two acres of habitat protected for each acre lost. Suitable areas for protection occur along the South Fork American River and the Cosumnes River.

Cultural Resources: The report cites the survey done by the University of California at Davis (UCD) for the U.S. Bureau of Reclamation's multipurpose dam as its source of information. The UCD survey documented 1,589 historic and 125 prehistoric cultural sites that could be impacted by the multipurpose dam. Most of these sites are from the gold mining period and are located in the canyons upstream of the dry dam site.

Impacts of the TSP and the 200-Year Flood Protection alternative on cultural resources are expected to be significant, especially along the Middle Fork of the American River, where gravel for the dam would be mined, and on the Highway 49 realignment.

The Corps and local sponsors have agreed with the State Historic Preservation Officer to complete Section 106 review of historic properties that could be impacted by the project before the final EIR/EIS is approved. A mutually agreeable management plan would be developed to cover inventory, evaluation, and, presumably, mitigation of cultural resources. Mitigation costs would be limited to one percent of the total project costs.

The Department expects the plan to call for the formal recording of all the historic sites that would be affected by the selected project, and assessment of these sites to see if they qualify for classification as a Historic Mining District under the National Register of Historic Places. Cultural sites should be preserved, but where protection is not feasible, mitigation should include the protection of threatened off-site cultural resources. The off-site cultural resources should be of a similar nature and importance as those destroyed by the project. The Department has a number of cultural resource protection projects that could qualify for such mitigation, and organizations such as the Archeological Conservancy can assist the Corps in identifying other possibilities.





Recreation: The TSP would have significant impacts on recreation at Auburn SRA.

Construction Impacts

The greatest impacts of this project will be construction related. The plan calls for the mining of gravel bars on the Middle Fork of the American River from the Confluence Area up to Kennebeck Bar.

Two of the main areas used by recreationists are the Confluence Area and Mammoth Bar. These gravel bars provide the primary area for most day-use activities. The elimination of these bars will displace approximately 160,000 users per year with few options to relocate. The areas to be relocated are farther upstream and do not have the carrying capacity to accommodate the dislocated users.

The method of conveyance for the extracted material, a conveyor belt along Quarry Road, will also have significant impacts on recreation. Quarry Road is one of the few multi-use trails within the project area and provides for hiking, equestrian, and off-road bicycle use.

Aggregate mining would also change the character of the lowest 15 miles of the Middle Fork from riffle runs to long, ddep pools with short, cascading drops between. This would reduce the value of the river for recreational rafting and could also increase the Department's exposure to lawsuits by creating "dangerous unnatural conditions".

Mitigation

The only way of partially mitigating the gravel extraction impacts is to preserve the Confluence Area and Mammoth Bar gravel bars. This would preserve approximately 160,000 user-days per year of recreational use. In addition, both areas should be improved to provide parking, sanitation, and river access facilities. The provision of additional facilities is required to accommodate recreation displaced from other sites within the project.

Quarry Road will have to be closed to the public during construction of the project. When construction is complete, the staging area at the start of Quarry Road should be expanded and improved, and a picnic site should be developed farther along the trail/road.

To mitigate the loss of Quarry Road during project construction, a similar multi-use trail should be developed, possibly along the North Fork of the American River to Lake Clementine, or along the ridge separating the two forks of the river.

Operational Impacts

The operation of the flood control facilities will have minimal impact on recreational activities. This is due to low recreational use during flood season. The primary operational impacts will be on the facilities at Lake Clementine.

Lake Clementine accommodates roughly 125,000 users annually. The lake has a marina and 22 boat-in campgrounds. The upper lake has additional campsites and a large beach area for both campers and day users.

Flood flows will create an impoundment pool significantly higher than the current lake level of 715 feet elevation. If not mitigated, the marina and all sanitation facilities will have to be removed.

Another impact will be the affect of the impoundment pool on trails. It is likely that the repeated inundation will deteriorate the stability of trails and dirt roads, making them unsafe or unusable.

Mitigation

At Lake Clementine, the marina and the public restrooms must be modified to safely withstand immersion.

To mitigate trail damage from periodic flooding, funds must be allocated to provide for trail rehabilitation.

Managing Agency Needs

The study assumes the continued management of the project by DPR and retention of all currently held public lands. There is no guarantee this will happen.

Auburn SRA is operated by the California Department of Parks and Recreation (DPR) on a year-to-year contract basis with the United States Bureau of Reclamation (BOR). The funding for this contract is provided by the ongoing "construction" budget associated with the multi-purpose Auburn Dam project. By legal agreement, BOR will transfer management, development, and operational responsibilities for recreation to DPR upon completion of the BOR multi-purpose project. DPR has the responsibility for developing recreational facilities associated with the multi-purpose project.





The Draft Feasibility Report and EIR/EIS do not state whether or not the BOR's multi-purpose project will have to be de-authorized in order to authorize the proposed project. If de-authorized, BOR funding to DPR for operation of the SRA will cease, and fiscal responsibility for development of recreation facilities by either DPR or BOR will be relinquished.

Presently, no agency has a formal commitment to operate and develop the proposed project if completed. DPR has stated a willingness to transfer its BOR project commitments to a new project. This action would require the approval of the California Legislature, the California Department of Finance, and a general plan amendment for the unit.

Due to the "flood control only" designation of the project, there is currently more land in public ownership than required for flowage easements. Most flood control projects provide a minimum of buffer lands around the full-pool elevation. At Auburn SRA, large amounts of the existing property could be declared surplus and sold to private developers. This could lead to a significant decline in the natural, scenic, and recreational resources of the area.

Mitigation

This whole issue needs resolution prior to plan approval. Formal commitments must be made to provide for the retention of currently held public lands, a managing agency, and future recreation development funds.

Esthetic Impacts

One of the main attractions of the project area for recreationists is its scenic quality. If this quality is changed as a result of the proposed project, a decrease in both the use and quality of the recreational experience could be expected. The Draft EIS addressed this impact to a minimum degree, but a more definite assessment of vegetation losses will be needed before it can be adequately predicted.

Mitigation

As mentioned previously, a more detailed study is needed on this issue. If it is determined that there would be significant losses in the main use areas, a revegetation program with native inundation tolerant species should be established.

The EIR/EIS should include a discussion of mitigation for recreation impacts at the upper American River and Auburn SRA.

For further information regarding these comments, please contact Bruce Kranz, District Superintendent, American River District, at (916) 998-0205.

Richard G. Rayburn, Chief
Resource Protection Division

I-3295R

Attachment

cc: Inland Region
American River District

A-189



Auburn Dam Project

California Department of Parks and Recreation

January 9,1969

The California Department of Parks and Recreation (DPR) supports an Auburn Dam project. This position is consistent with our October 1984 testimony before a Auburn-Folsom joint task force.

The 1984 testimony supported the multi-purpose project as there were no alternatives proposed at that time. Our current position is supportive of any project alternative that would maintain stable, adequate water levels at Folsom Reservoir.

The Department is currently involved in evaluative studies on project related impacts to the recreational resources at both Folsom SRA and Auburn SRA. Until these studies are complete, different project alternatives analyzed, and mitigation alternatives developed, DPR will not support a specific project alternative.

ORIGINAL SIGNED BY

Date

*Henry R. Agonia, Director*
*California Department of Parks and Recreation*

UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF THE SECRETARY
Office of Environmental Affairs
600 Harrison Street, Suite 515
San Francisco, California 94107-1376

June 21, 1991

ER 91/383

Colonel Laurence R. Sadoff
District Engineer, Sacramento District
Corps of Engineers
650 Capitol Mall
Sacramento CA 95814-4794

Dear Colonel Sadoff:

The Department of the Interior has reviewed the Draft Feasibility Report (Report)/Draft Environmental Impact Statement (DEIS)/Environmental Impact Report (EIR) and Appendices for the American River Watershed Investigation. The following comments are provided for your use and consideration.

WATER RESOURCES

The Bureau of Reclamation (Reclamation) is concerned with the potential impacts of the Tentatively Selected Plan (TSP) and other alternatives on its authorized responsibility for the operation of the Central Valley Project (CVP). This includes impacts on the operation of several reservoirs including Folsom Dam and Reservoir to meet flow requirements in the lower American River, the Sacramento River, and the Delta; impacts on existing lands acquired and facilities constructed for the authorized Auburn Dam; and impacts on the possible future construction of a multipurpose Auburn Dam currently under restudy and reformulation.

Alternatives

Although water needs other than flood control are acknowledged in the Report, it is assumed that the multipurpose Auburn Dam, as previously authorized, will not be built. Thus, alternatives were limited to providing flood control benefits. Such an assumption limits the reasonable alternatives evaluated. In our opinion, that assumption is invalid.

The expandable dam concept, to accommodate other water supply needs, was only discussed briefly. More evaluation is needed on the potential and cost of an expandable dam to complete the analysis.

Economics

Of 27 initial flood protection alternatives, 6 action alternatives and a No Action alternative were carried forward into the plan formulation process.

The six action alternatives, including Federal Emergency Management Agency (FEMA) protection alternatives, are known as:

- 100-year (FEMA) Levees
- 100-year (FEMA) Storage
- 100-year (FEMA) Levees/Storage and Spillway
- 150-year
- 200-year
- 400-year

The 400-year alternative has been identified as the National Economic Development (NED) alternative which maximizes net economic benefits. Three of the six action alternatives affect the operation of Folsom Reservoir by increasing the seasonal flood control storage space thereby reducing water supply yield, hydropower generation, and dependable capacity of the CVP. All six action alternatives adversely impact fish and/or wildlife resources and their habitats along the lower American River. Neither the Report nor the accompanying appendices clearly indicated whether these impacts have been properly accounted for by increasing the cost of an alternative or reducing its benefits. Although mitigation for the loss of fish and/or wildlife and their habitats is addressed, there is no recognition that these impacts could affect the recreational use of the American River Parkway.

Three alternatives, 100-year (FEMA) Storage, 100-year (FEMA) Levees/Storage and Spillway, and 150-year, increase the seasonal flood control storage space in Folsom Reservoir by 190,000 acre-feet, 70,000 acre-feet, and 250,000 acre-feet, respectively. In addition to reducing water supply yield, power generation, and dependable capacity of the CVP, San Juan Suburban Water District and El Dorado Irrigation District, which obtain water directly from Folsom Reservoir, might experience increased pumping costs because of lower reservoir water levels.

Projected water- and power-related impacts for these three alternatives are quantified in the Report in tables V-8, V-10, and V-12, respectively, where it is indicated under a column labeled "Mitigation" that reimbursement would be made for water or power supply losses, as appropriate. It is unclear, however, whether these impacts have been added to the costs of alternatives (or deducted from benefits). Neither the text in the Report nor the appendices is explicit on this matter.

There are indications, however, that adverse water and power impacts may have been accounted for by including them in cost estimates for the alternatives as discussed in the following three paragraphs.

Table IV-3 (appendix C) lists costs for six alternatives, but only four appear to correspond to alternatives carried forward into the plan formulation process. The two which do not correspond are 100-year (FEMA) flood protection with a dam at Auburn and 500-year flood protection. Two of the other four listed in table IV-3 (appendix C) are an alternative to offer 100-year (FEMA)

flood protection without a dam at Auburn and 150-year flood protection. Both of these alternatives list "Resources Replacement" as a cost item. Unfortunately, the term is nowhere explained, but it could refer to the cost of replacing water and power lost by the three alternatives (100-year [FEMA] Storage, 100-year [FEMA] Levees/Storage and Spillway, and 150-year), as outlined above. If this is the case, then adverse impacts on CVP water supply and power have been properly taken into account.

The annual costs of the six action alternatives listed above are summarized in table V-17 of the Report, but no cost components are provided. The annual costs of the 100-year (FEMA) flood protection without a dam at Auburn (table IV-3, appendix C), is $14.9 million. This corresponds closely to the $15 million annual costs of the 100-year (FEMA) Storage alternative summarized in table V-17 of the Report. The annual costs of the 150-year flood protection alternative shown in tables V-17 (Report) and IV-3 (appendix C) are identical. This would tend to confirm that costs of water and power impacts on the CVP had been added to the costs of flood protection alternatives, as appropriate. On the other hand, annual costs of 200-year and 400-year flood protection alternatives shown in tables V-17 (Report) and IV-3 (appendix C) differ by some 10 percent. Without discussion in the text we can only speculate, however, whether the adverse impacts on CVP water and power accomplishments were considered.

Costs for 100-year (FEMA) flood protection without dam in table IV-3 (appendix C) show a separate breakdown for features to protect the flood plain of the American River and the Natomas area. All costs for the American River are composed of "Cultural Resource Mitigation" and "Resource Replacement." As presented in the Report, all three 100-year (FEMA) alternatives include construction of features described as "Downstream from American River" and "Natomas Area" while the 100-year (FEMA) Levee and 100-year (FEMA) Levee/Storage and Spillway include features for "Main Stem American River." If 100-year (FEMA) without dam in table IV-3 (appendix C) refers to the Storage alternative, are costs "Downstream from American River" classified as "Natomas Area" costs? If not, how can this alternative correspond to the Storage alternative in the Report?

The three alternatives with adverse CVP water supply and power impacts also entail losses in recreational usage at Folsom Reservoir and along the lower American River. As the DEIS/EIR points out, neither recreation at Folsom nor water-dependent recreation along the lower American River is an authorized project purpose. No mitigation is proposed for lost recreational opportunities, and, to the best of our knowledge, no monetary estimate to account for the reduction in Folsom/American River recreational accomplishments has been added as a cost of the three alternatives. Although recreation may not be an authorized project purpose, nonetheless it is real, and impacts on these opportunities should be not be ignored in the cost calculus.

Appendix A of the Feasibility Cost Sharing Agreement Between the United States of America and the California State Reclamation Board (Board) and the California Department of Water Resources for the American River Watershed Investigation, California, addresses scope of studies, work tasks, and responsibilities. One task to be accomplished by the Corps of Engineers (Corps), Institutional Studies, consists of determining the financial and legal arrangements required to implement the recommended plan. In part, the



task states, "A financial capability analysis will examine whether the potential non-Federal sponsor for construction has the organizational, legal, and financial capability to undertake the required financial obligations for construction by Congress." The financial analysis of the capability of a non-Federal sponsor to participate in the proposed project seems superficial for a feasibility-level report, particularly in view of the magnitude of anticipated costs.

The Report indicates that the Water Resources Development Act of 1986 requires the non-Federal sponsor for flood control to: provide all lands, easements, rights-of-way; perform relocations; make a 5-percent cash contribution; and operate and maintain the project. In addition, 50 percent of the construction cost of recreation facilities and all of their annual operation and maintenance costs must be assumed by a non-Federal sponsor. It is stated that the State of California, through the Board, has legal authority to fulfill the flood control cost-sharing and financing requirements and intends to pay 70 percent of the required non-Federal share of costs. The Sacramento Area Flood Control Agency (SAFCA) intends to pay the remaining 30 percent of the non-Federal share. The Report identifies no non-Federal entity to share in the recreation costs of the proposed project. Non-Federal first costs for flood control are $221.4 million and for recreation are $10.2 million.

The draft Report states that the Board will rely on appropriations by the California legislature to pay the State's share of non-Federal costs. No yearly schedule of required appropriations is provided, nor is any commitment by the legislature to appropriate necessary funds in a timely manner indicated. The Report also notes that the Board will be responsible for project operation and maintenance and that State law requires the Board to pass the costs of project operation and maintenance to local beneficiaries.

No direct identification of local beneficiaries nor an indication of their willingness to accept these costs is provided. Actual maintenance would be performed by local agencies which obtain their funding through benefit assessment districts. The Report indicates that SAFCA, as representative of local beneficiaries, plans to form an assessment district and secure necessary financing for the local share of costs when the project is authorized by Congress.

No indication of the size and location of the proposed assessment district to be formed by SAFCA is given. No estimate of required repayment rates by property owners in the district nor an indication of their willingness to accept these costs is indicated. There is no analysis of the financing and repayment of the non-Federal share of project costs: no assurances that the State legislature will provide necessary funds in a timely manner; no delineation of the local benefit assessment district; no estimate of required repayment rates nor commitments to accept them. The treatment does not seem to constitute an appropriate feasibility-level financial analysis.

CVP Operations

Page 5, paragraph 3. The first sentence should also indicate that a permanent increase in the seasonal flood control space in Folsom Reservoir would reduce the potential to provide benefits to fish and wildlife, recreation, and water quality.

Page II-9, paragraph 4, sentence 4. Reservoir releases are also controlled by releases through the powerhouse.

Page V-28, table V-8; page V-30, table V-10; page V-34, table V-12. Under the item, "Reduced recreation at Folsom . . . ", the mitigation is shown as "loss to Recreation Resources". It is not clear how a loss to recreation resources will mitigate for reduced recreation.

Page DEIS 3-13, paragraph 2, sentence 1. While it may be true that the operators may not achieve perfection in the use of the flood storage space available in the reservoir, even operating exactly as indicated by the Flood Control Manual may not achieve a perfect use of the flood space. The operations described by the Flood Control Manual are based upon certain assumptions on runoff and hydrologic conditions. The actual flood control operations and releases may vary from the Flood Control Manual as actual hydrologic conditions dictate.

Page DEIS 3-14, top of page, sentence 2. This sentence appears to indicate that the structure could fail due to the head behind the dam. Is it the water that "builds" up behind the dam that causes the problem or the overtopping of the dam which would cause the failure? Does this correspond to studies performed for the Probable Maximum Flood?

Page DEIS 6-4, table 6-1. The numbers shown in the columns do not match up with the correct parameters.

Page DEIS 8-10, paragraph 4, sentence 1. In addition to the flood protection noted in this sentence, Folsom Reservoir, a multipurpose project, was constructed to provide benefits for water supply, water quality, fish and wildlife, hydroelectric power generation, and recreation.

Page DEIS 8-10, paragraph 4, sentence 6. The statement that Folsom Dam is currently operated at a level above D-1400 is not correct. The Bureau of Reclamation attempts to operate above the minimum D-1400 flows whenever possible, but will reduce releases to the minimum D-893 flows under adverse conditions. For example, for periods during this current drought the release to the American River was the minimum allowed by D-893 in order to conserve water.

Page DEIS 8-21, paragraph 3, sentence 3. It is stated that fishery impacts in the reservoir would result from an increase in reservoir fluctuations and drawdown in future years. What was the basis for this assumed Folsom operation? These assumed future fluctuations do not appear to correspond to the assumed future Folsom operations for other chapters in the DEIS. For example, the recreation and visual impact chapters appear to assume a future no-action alternative Folsom Reservoir operations similar to current conditions.

Page DEIS 8-21, paragraph 4, sentences 2 and 3. Similar to comment 12. Were future no-action Folsom Reservoir operations developed in adequate detail to predict a 10-percent decline in the hatchery production due to reduced flows and water quality?

Page DEIS 8-61, paragraph 6. In regards to indirect impacts due to reoperation of Folsom Reservoir for additional flood space, the report



indicates that this reoperation can affect Folsom Reservoir water supplies and power generation. Any effect on Folsom operation could have an effect on CVP operation including Shasta and Clair Engle Reservoirs. Therefore, Folsom Reservoir reoperation, theoretically, could have an indirect impact on species such as the winter-run salmon. The impact may not be significant, but it may not be correct to indicate that no impact would occur. As noted in appendix B, page B-68, higher temperatures on the Sacramento River due to CVP reoperation would likely be slight but measurable. This could have an adverse impact on the anadromous fish habitat.

Page DEIS 8-62, paragraph 5 and 6. Recommended mitigation for fishery impacts includes increased minimum American River flows and a block of water reserved for fishery use. Were these mitigation actions included in the future impacts on Folsom Reservoir operations and CVP operations?

Page 8-66, paragraph 6. If indirect impacts for the 150-year alternative include the potential impacts to the CVP, this paragraph should be revised to indicate that the 100-year alternative indirect impacts would be similar to the 150-year alternative, not the TSP.

Page DEIS 9-3, paragraph 5. As indicated in comment 14, any impact on the Folsom Reservoir operations can impact the operations of the CVP, including Shasta Reservoir. This could have an impact on the winter-run salmon.

Page DEIS 9-13, paragraph 8. Indirect impacts could include those to the winter run salmon. See above page DEIS 8-61 comment.

Page DEIS 14-20, table 14-5. The units for the contents of the table are not shown (attendance in visitor days?).

Page DEIS 15-30, paragraph 11. Indirect impacts due to the 150-year alternative could include an increased risk of a reduced water supply to water districts pumping water from the reservoir. The districts may not be physically able to pump adequate quantities of water from a low Folsom Reservoir. This would result from the increased flood storage and less reservoir storage in dry and critically dry years.

Flow Requirements

Pages 4, 5, 6, and DEIS 1-7. The discussion of the 100-Year (FEMA) Storage alternative, the 100-Year (FEMA) Levee/Storage and Spillway alternative, and the 150-year protection alternative (three alternatives which increase Folsom Reservoir flood control storage) does not address the impact on legally established flow requirements in the lower American River, the Sacramento River, and the Delta, and temperature requirements in the Sacramento River.

Existing Water Supply and Power Contracts

Page IV-2, paragraph 6, Acceptability. The discussion of the TSP and the other Alternatives did not address the acceptability or impacts with respect to existing water supply and power contracts.

Real Estate

Impacts upon management of lands under the jurisdiction of Reclamation and other agencies were not presented. For the TSP, the details regarding the disposition of Reclamation lands were unclear, and the possible impacts on a future multipurpose dam were not addressed. For example, what happens to the flowage easements if there is a multipurpose dam? Or what happens if land is needed back to construct the multipurpose dam?

Page VII-2, paragraph 4. It is indicated that the required lands include 2,060 acres in fee title and 20,550 acres in flowage easements, of which 75 percent is federally owned. A breakdown should be provided to show how many acres are under control of the U.S. Bureau of Reclamation (USBR), Bureau of Land Management (BLM), U.S. Forest Service, etc.

Page VII-2, paragraph 5. It is indicated that the non-Federal sponsor would acquire flowage and road easements from private landowners and the USBR, and that the Corps would act on behalf of the non-Federal sponsor to obtain jurisdiction over the lands currently held by USBR which are needed for the dam and embankment. This suggests that the sponsor will own the dam. Would the dam have to be purchased back from the sponsor in order to construct a multipurpose dam?

Page IX-5, paragraph 4, and page XI-3, paragraph 2. These paragraphs appear to be inconsistent. The first paragraph indicates maintenance by the United States. The second paragraph indicates maintenance by the non-Federal interests.

Page XI-2, paragraph 6, and page XI-3, paragraph 2. These paragraphs appear to be inconsistent. The first paragraph indicates transfer of lands to the non-Federal sponsor from Federal agency managers for easements in the reservoir area and fee title for lands at the damsite. The second paragraph indicates transfer to the United States of all lands, easements, and rights-of-way for construction and maintenance of flood control measures. If the dam and damsite require Federal maintenance, the damsite should remain under Federal control, not only for maintenance but also for possible expansion to a multipurpose project.

Appendix O, plate 2. USBR and the State of California Department of Parks and Recreation are working on an Interim Resource Management Plan for the Auburn State Recreation Area involving lands which are under USBR and BLM jurisdiction within the Project Boundary. The Report/DEIS/EIR does not address the impacts upon current or future management of these Federal lands.

Multipurpose Auburn Dam

Page DEIS 17-7, paragraph 4. It is stated that "the project design does not preclude subsequent expansion for water and power purposes." While expansion is not precluded, a major impact of the TSP on a future multipurpose project is overlooked. For a given size of a multipurpose dam, a two-stage development, in which a flood control dam is first constructed followed by expansion to a multipurpose dam, the construction cost will be higher than if a single-stage multipurpose dam were constructed.

In addition to mobilization, demobilization, and preparatory costs (over $2 million with contingencies for the flood control dam as indicated in appendix N, chapter 4), structural changes to the flood control dam will be required,



the outlet works will have to be replaced, and other changes will be necessary in order to meet design requirements for the multipurpose project.

What will be the estimated added construction cost for a future multipurpose dam as an impact resulting from construction of a flood control dam at the Auburn site? This could have an adverse effect on the construction cost and economic feasibility of a multipurpose project.

Page DEIS 17-7, paragraph 4. It is stated that "Nor would the TSP affect the status of the multipurpose project with respect to project lands in the Auburn area." This statement does not agree with the referenced paragraphs discussed above under Real Estate, Paragraphs 3 and 4.

Page DEIS 17-7, paragraph 5. This indicates inter-Federal-agency transfers of land required for the flood control project. This statement appears inconsistent with paragraphs discussed under Real Estate, Paragraphs 3 and 4.

CULTURAL RESOURCES

The National Park Service has the following comments:

Page DEIS 1-7, paragraph 2. The statement is made that the construction required for levees, channelization and bank protection, under the 150-year alternative and two of the 100-year (FEMA) alternatives, would have significant impacts on the river's recreation, visual resources, vegetation, and wildlife, and could "affect its designation as part of the State and Federal Wild and Scenic River systems." In the following paragraph, the DEIS indicates that the effect of greater flood control capacity in Folsom Reservoir, from the same three alternatives, would lead to long-term reduction of the anadromous fishery along with other biological impacts.

Use of the phrase "affect its designation", as in the above reference and elsewhere in the text of the DEIS, can lead to a misinterpretation that the wild and scenic river status is tentative or could be altered readily by some future action. The Lower American River is an existing component of both the State and Federal wild and scenic river systems and was designated primarily because of its outstanding recreation and anadromous fishery values. Both of these values would be heavily impacted by the 150-year and two 100-year alternatives as now constituted.

Under Section 7(a) of the Federal Wild and Scenic River Act (P.L. 90-542, as amended) no Federal department or agency shall recommend authorization of any water resources project that would have a direct and adverse effect on the values for which such river was established without advising the Secretary charged with its administration (Secretary of the Interior in this case because of the Act's Section 2(a)(ii) designation provision) of the intention to do so, and without specifically reporting to Congress the respect to which construction on such a project would conflict with the purposes of the Act and would affect the component and the values protected under the Act.

Based on the above-stated wild and scenic river requirements, the impact analysis of the three alternatives in question should be revised to include this information. Also, the features of the 150-year and two 100-year alternatives should be reexamined to ascertain whether or not more adequate

mitigation could be developed to minimize impacts to wild and scenic river values. Otherwise, these are not reasonable alternatives.

FISH AND WILDLIFE RESOURCES

The Fish and Wildlife Service (Service) has the following comments:

General Comments

This investigation encompasses the 2,100 square mile American River drainage basin plus flood prone areas immediately downstream. Lands under study range from the Central Valley floor at elevations near 70 feet to the headwaters of the American River near 10,400 feet. Existing Federal projects that are part of the study include the Corps' Sacramento River Flood Control Project and American River Flood Control Project, and the Reclamation's Central Valley Project. Drainage from both the Sacramento Basin and American Basin is considered.

To accomplish 400-year level flood protection (NED), the TSP includes construction of a 500-foot-high dam on the North Fork American River near Auburn, California. The dam would be designed to store up to 894,000 acre-feet of peak flow temporarily. About 6,000 acres of canyon lands would be inundated. Major relocation of State Highway 49 and the Ponderosa Road Bridge would be necessary. About 6,000,000 cubic yards of gravel for dam construction would be extracted from the American River or obtained from some other source. The plan also includes downstream levee modification, new/extended levees, channel modification, bridge replacements, pump stations and pumps for the Natomas Area.

As a result of the February 1986 storms in the American Basin, the local, State and Federal interests focused their attention on Sacramento Area flooding problems and the status of flood protection. Anticipating the need for general information about additional flood control, the Service prepared a special report describing potential impacts to fish and wildlife from various flood control measures. Several of the measures were evaluated by the Corps in subsequent studies.

The Service provided three drafts of the Coordination Act Report (CAR) on the American River Watershed Investigation. The June 1990 Draft CAR (DCAR) evaluated several preliminary engineering alternatives and recommended a 100-year plan (Folsom Reservoir 470,000 acre-feet flood storage; lower American River 130,000 cfs release; Natomas one-third protection) as the least environmentally damaging alternative.

The December 21, 1990 DCAR evaluated four engineering alternatives including a 100-year, 150-year, 200-year and 400-year plan. This DCAR was preliminary in that the evaluation of inundation impacts in the Auburn Area was only partially complete. A 100-year plan was recommended as the least environmentally damaging plan.

The third DCAR was submitted to the Corps in February 1991. At the Corps' request, this DCAR evaluated only three engineering alternatives (400-year, 200-year and 150-year). Complete analysis of the inundation impacts in the Auburn Area was included in this DCAR.



In their DCARs, the Service focused on significant habitat and species at risk with the project. For the TSP, the Service identified important fish habitat in two major areas that would be affected. These are the Natomas Area and the Auburn Area. Federally listed winter-run salmon occur in the Sacramento River and Yolo Bypass and fall-run chinook salmon and steelhead occur in the Natomas Cross Canal and Natomas East Main Drain. Restoration efforts for these runs are in progress or being considered. Rainbow and brown trout, and smallmouth bass in the North Fork and Middle Fork American River are also important resident species.

The Service also identified abundant and significant wildlife resources that could be affected. In Natomas, thousands of migratory waterfowl and shorebirds rely on seasonally flooded farmland, agricultural waterways and wetlands for breeding and foraging habitat. These same farmlands and waterways provide the most important habitat remaining in California for the State-listed giant gartter snake (currently being reviewed by the Service for possible Federal Listing). In addition, the riparian forest and adjacent croplands along the Sacramento River adjacent to Natomas provide some of the most important nesting and foraging habitat remaining in California for the State-listed Swainson's hawk.

The riverine and oak woodland habitat of the North Fork and Middle Fork American River Canyons supports significant wildlife populations that would be affected by the TSP. The abundance and diversity of canyon wildlife is due largely to the continuous, dense, undisturbed nature of the riparian corridors along the small canyon tributary streams and main river channels. The undisturbed, widespread dense canopy of the oak woodland also contributes to the abundant wildlife species. Degradation of the canyon habitat would greatly diminish and probably eliminate bear, mountain lion, deer and other large game populations. Similarly, small game species such as wild turkey and squirrel would be lost.

The Service has several concerns about the DEIS meeting the full intent of the National Environmental Policy Act (NEPA). Because there are important fish and wildlife resources at risk throughout the affected area, it is essential that a full array of reasonable alternatives with full and fair discussion of significant environmental impacts be presented (NEPA 1502.1). As it stands, the document offers little substantive support for the various alternatives dismissed. It appears that several of the environmentally suitable alternatives, such as the upstream storage options, were dropped without full consideration.

There needs to be a clear description of effort spent on alternative evaluations and an explanation for those dropped from consideration. As presented, it appears that substantially greater effort was focused on upstream alternatives as compared to downstream alternatives, thereby prejudicing selection of alternatives.

This negates the opportunity for decisionmakers to make an objective informed choice (NEPA 1502.2(f)). The document fails to clearly disclose the apparent lack of information available for the analyses performed on dry dam inundation impacts in the Auburn Canyons. The disparity between the Corps and Service impact assessments supports this belief. Since this information is essential to a reasoned choice among alternatives, additional studies should be done and results made available (NEPA 1502.22).

The DEIS fails to fully disclose the distinction between irretrievable losses associated with upstream alternatives versus retrievable losses with downstream alternatives. This needs to be made clear in the discussion of environmental consequences section (NEPA 1502.16).

The Service has additional concerns about inadequacy of the mitigation proposed with the TSP. Mitigation recommended in the Service's February 1991 DCAR for the Natomas Area and Auburn Area is largely dismissed without clear explanation. Mitigation included in the DEIS for the Natomas Area is inadequate and highly speculative in terms of assured implementation.

Legal assurances and a reasonably detailed plan need to be included for assuring mitigation plans implementation in the Natomas Area. In view of the Service's impact assessment and recommendations, mitigation proposed in the DEIS for the Auburn Area is insufficient in quantity and in some cases infeasible due to site location. Resolution of mitigation disparities between the Corps and Service needs to be addressed for the Auburn Area.

Specific Comments

Page DEIS 1-2, paragraph 2, Background. The description of people and public property at risk needs to be more clearly defined. Since risk assessment and protection level are partly based on low-depth flooding versus high-depth flooding, descriptions should be based on people and property subject to low-depth versus high depth flooding.

Page DEIS 1-3, paragraph 4, Alternatives. Clear explanation of the differences between the 100-year FEMA level of protection and the Corps 100-year level is needed. The explanation should include discussion with specific example of how each is calculated and a table comparing the various flood control levels using FEMA versus Corps calculation methods.

Page DEIS 1-5, paragraph 2, Environmental Conclusions and Findings. The last sentence needs correction. Project sponsors, including the Corps, are responsible for addressing impacts to endangered species pursuant to the Endangered Species Act 1973, as amended.

Page DEIS 1-5, paragraph 3, Environmental Conclusions and Findings. The last sentence should be corrected to read, "It would avoid adverse effects on aquatic resources resulting from incremental increases in high flows, e.g., 115,000 cfs to 130,000 cfs or greater and high water temperatures in the lower American River channel and/or increased flood control capacity in Folsom Reservoir."

Page DEIS 1-7, paragraph 5, Upper American River. As stated, the likely inundation impacts to wetlands and uplands are greatly underestimated. Based on the Corps' inundation-duration submittal of August 1990, the 400-year plan would inundate vegetation over 600 times for 1 or more days during the 100-year project life. The Service estimates that significant losses of upland vegetation and wildlife habitat would be lost.

Page DEIS 1-8, paragraph 5, Environmental Commitments. Deferring responsibility for indirect impacts to the local sponsors who in this case have no specific plans is not acceptable. A specific mitigation plan that fully offsets habitat losses should be included. The plan should include



legal assurances that it will be implemented. Providing the plan is the same, the Service's recommendations should be followed or justification provided for not following them.

Page DEIS 2-4, paragraph 2, Flood Control Dam on the American River. Existing riverbed conditions above the Auburn Cofferdam site demonstrate that substantial accumulation of sediment is likely. It is not appropriate to dismiss the problem without additional study. Further information on probability of sediment accumulation is needed especially since it affects quality of instream habitat.

Page DEIS 3-2, paragraphs 4 and 5, No-Action Alternative. There is an apparent conflict between the description of the No-Action Alternative here and the discussion on dismissal of the Natomas Cross Levee Alternatives on page 3-14, paragraph 6. Further explanation is needed to explain the differences in these futures.

The No-Action Alternative states that "high base flood elevations in Natomas would make FEMA compliance on floodproofing infeasible and severely constrain new development". In contrast, the Natomas Cross Levee discussion states that "in addition, even if these costs could be substantially avoided, the proposed cross levee would not act as a barrier to urbanization. On completion of either of the cross levee alignments, the unprotected lands could be cheaply and effectively removed from the 100-year floodplain through the repair of several low spots along the Pleasant Grove Creek Canal and NCC."

NCC refers to the Natomas Cross Canal. This implies that without the Federal project, State or local entities would likely complete the necessary levee work and accomplish 100-year protection in the near future. Thus, the future without-Federal project would be 100-year protection by state or locals therein changing the entire project analysis.

Page DEIS 3-11, paragraph 5, Upstream Storage. Further study of this option is warranted. Retrofitting to accomplish flood control objectives along with increasing storage capacity could benefit water supply, hydropower and flood control purposes. Multipurpose benefits would likely outweigh costs. Making better use of existing facilities is an environmentally prudent option.

Page DEIS 3-11, paragraph 6, Upstream Storage. Further explanation is needed here before dismissing this option. Standard probable flood projections generally assume rainfall is equally distributed across the drainage basin. Thus, total inflow reduction of 14 percent would reduce the potential inflow by 14 percent in a hypothetical flood. This would represent an important segment of flood protection.

Page DEIS 3-12, paragraph 4, Channel Capacity. Further explanation is needed to validate this statement. There is no supportive information to demonstrate that an additional increment of erosion occurred at flows above 115,000 cfs. If no evidence is available to support the statement then it should be dropped.

Page DEIS 3-12, paragraph 6, Channel Capacity. Additional discussion of channel capacity increase is warranted here. Constructing new channels or widening existing channels could increase downstream capacity without compromising levee protection and flooding risk.

Page DEIS 3-13, paragraph 2, Folsom Operation. Minor mechanical difficulties should be corrected so outlet works are fully functional. Recreational facilities subject to inundation damage that hamper or compromise the flood control operations should be removed from the floodway. Flood control release decisions versus saving water supply should not be a burden placed on dam operators. Instructional guidance should be provided to minimize personal operator decisions.

Page DEIS 3-14, paragraph 6, Natomas Cross Levee Alternatives. More detailed explanation is needed to justify dismissing the cross levee alternatives. Cost and environmental impacts are claimed as criteria for dismissal, yet costs and environmental impacts are not compared in the supportive tables 3-2 and 3-3, or in the discussion.

In addition, if the cross levee alternative were selected and a natural overflow retention basin created then it is logical that local sponsors would take necessary actions to establish the overflow basin and they would accept responsibility for lands, easements and rights of way acquisition, not the Federal Government.

The flood retention/overflow basin could greatly reduce need for levee work along Arcade Creek and Dry Creek. In fact, a 40,000 acre basin with depths to 20 feet would temporarily store up to 800,000 acre-feet. Additional benefits derived from this alternative could include waterfowl/wetland restoration, fishing lakes, riparian habitat restoration, reduced air and water pollution, increased recreational activities.

Also this could greatly reduce the need for expensive pumping systems to resolve internal drainage problems in the Natomas Area. It could also help resolve flooding problems in Pleasant Grove and Sutter County to the north of the Natomas Cross Canal.

Prior to dismissing the cross levee alternatives a thorough economic evaluation should be done comparing the overflow/flood retention basin concept and its potential beneficial values with the full Natomas Protection Plan. The evaluation should be a with- and without-project comparison over a 100-year project life. Both the 1/3 and 2/3 cross levee alternatives should be evaluated in this manner.

Page DEIS 3-19, paragraph 3, Comparison of Impacts. Additional discussion is warranted here. As stated, the discussion implies that existing landowners of property in Natomas are the original ones who reclaimed the land in the 1900's. This is surely not the case. In fact, it is well known that much of the land is owned by investors preparing to develop it into urban or industrial use. Recognizing that there is widespread public concern about the shortsighted national policy of reclaiming, i.e., drying up floodplains and wetlands, it seems appropriate to include discussion about the opportunity in Natomas to restore those reclaimed lands to their original state as floodplains and wetlands.

Page DEIS 4-5, paragraph 2, Regulatory Background. Additional discussion is needed here. A counter statement that describes a scenario wherein the proposed project is not authorized should be included. Alternatives other than those proposed may be selected for further study.



Page DEIS 4-14, paragraph 2, Upper American River. Further explanation is needed here. It is difficult to understand how 6,000,000 cubic yards of gravel can be extracted from about 12 miles of riverbed without some impacts.

*Page DEIS 4-21, paragraph 1, 100-Year (FEMA) Levees/Storage Alternative.* This is correct as stated. The direct impacts with this alternative would be much less than the 150-year alternative. There would be fewer temperature and flow impacts on the lower American River fisheries. There would be less erosion impact from the 130,000 cfs channel release as compared to 180,000 cfs release. There would be less impact on Folsom Reservoir with an added 70,000 acre feet of flood storage space versus 250,000 acre feet of added space.

Page DEIS 6-3, paragraph 1, Natomas Area. The last sentence refers to a C-1 canal which is not displayed in figure 6-1.

*Page DEIS 6-15, paragraph 3, Upper American River. Additional information* and further discussion is warranted here. It is stated that as a result of storms and dry dam inundation events suspended materials would be transported into Folsom Reservoir. There needs to be some assessment of the impact that increased sedimentation would have on Folsom Reservoir authorized purposes. Impacts on instream aquatic habitat below the dam site should be part of the assessment.

Page DEIS 6-21, paragraph 2, Direct Impacts. Additional discussion is warranted here. Diversion of the stream into alternate channels could cause additional impacts on aquatic or terrestrial habitat. Construction methods, timing, site locations and restoration efforts would influence impacts. A stream alteration agreement from the California Department of Fish and Game is likely necessary.

Page DEIS 8-1, paragraph 2, Fish, Vegetation and Wildlife. This paragraph needs revision to clarify the sources and methods used to assess impacts to fish, vegetation and wildlife. It should be made clear that the Service employed the Habitat Evaluation Procedure (HEP) methodology taking into account slope instability, erosion, top soil, and litter loss. In contrast to the Corps' analysis which only looked at vegetation loss, the Service evaluated a variety of physical features (including vegetation) that affect the amount and quality of wildlife habitat. The Service also considered the direct losses of wildlife populations that would result from flooding. As supported by our HEP results we are of the opinion that wildlife habitat and wildlife population losses will be much greater than predicted by the Corps.

*Page DEIS 8-9, paragraph 4, Natomas Basin. Clarification is needed here.* It needs to be stated that the Fremont Weir/Yolo Bypass area only supports fish populations during high flow periods during the fall-winter period. At other times it is dry.

Page DEIS 8-10, paragraph 5, Lower American River. As stated, the last sentence is not entirely correct. The Reclamation operates according to a modified D-893 flow release schedule and does not consistently meet D-1400 flow levels. The frequency of falling below D-1400 recommended flows is greater in below normal, dry and critical water years.

Page DEIS 8-13, paragraph 3, Natomas Basin. Further explanation is needed here. The Corps needs to arrange for entry as necessary onto private

properties to complete their evaluation. Without this, the correct acreage of jurisdictional wetlands in Natomas is unknown. This information would be useful for the Service's Final CAR (FCAR). The results should be included in the Final EIS (FEIS).

Page DEIS 8-15, paragraph 2, Natomas Basin. Further discussion is needed here. The Corps needs to complete their jurisdictional wetland survey, make results available to the Service, and include the results in the FEIS.

Page DEIS 8-15, paragraph 5, Lower American River. Further discussion is needed here. Once again the Corps needs to complete their jurisdictional survey for the entire 23-mile reach of the river. Proposed changes in hydrology with the alternatives could affect jurisdictional wetlands. The information is needed for impact assessment.

Page DEIS 8-16, paragraph 2, Upper American River. Further discussion and correction is needed here. The last few sentences discuss the Service's method of estimating inundated lands. The Service is aware of the methods used to calculate reservoir surface area. Calculation of existing habitat for wildlife was based on land surface area that supports wildlife. Average slopes in the canyons varied from 30-60 percent thus providing a great deal more land surface area than reservoir surface area. The Service used the same methods for calculating mitigation area to ensure consistency in acreage determination.

Page DEIS 8-17, paragraph 2, Upper American River. Further discussion is needed here. There are likely many additional sites above the high water lines along both canyons that meet jurisdictional wetland criteria. The Corps needs to complete their jurisdictional determination above the high water lines and include the results in the FEIS.

Page DEIS 8-17, paragraph 5, Lower American River. There appears to be some text missing here as the statement is confusing.

Page DEIS 8-18, paragraph 2, Impacts and Mitigation. The second sentence needs clarification. The 100-year levee and 100-year levee/storage alternatives would be similar in terms of the same types of impacts but different in amount of impacts. There will be direct levee construction impacts in both alternatives but no storage-caused impacts would occur with the levee only alternative.

Page DEIS 8-23, paragraph 1, Lower American River. Additional discussion is needed here. The last sentence describes the Service's without-project scenario as speculative and therefore not accepted by the Corps as an accurate representation. It should be explained that as part of this investigation, the Service requested funding and approval to conduct additional studies on pre- and post-Folsom Reservoir historical changes in the lower American River to determine ongoing changes in the lower American River system.

The Corps chose not to fund these studies. Since there was little information developed on historical changes of the lower River and analyses of Folsom reservoir impacts, the Service developed a without-project scenario based on limited field observations and readily available data.



Page DEIS 8-27, paragraph 3, Upper American River. The first sentence is incorrect as stated. There would be direct impacts on fisheries habitat from the instream gravel mining and from increased sedimentation due to inundation events. The degree of impacts has not been assessed to date but should be included in the FEIS.

Page DEIS 8-27, paragraph 6, Upper American River. The second sentence is incorrect. The proposed dam will be about 400 yards downstream of the existing Auburn dam site where intact vegetation occurs. It is likely there will be some habitat losses. The Service will assess these habitat losses and include results in a FCAR to the Corps.

Page DEIS 8-37, paragraph 3, Upper American River. The first sentence is incorrect. The proposed damsite is 400-yards downstream from the existing Auburn Dam site and there will be some wildlife habitat losses.

Page DEIS 8-37, paragraph 4, Upper American River. As stated, the second sentence is misleading. Displaced wildlife are typically unable to survive in new territories because the territories are already occupied. Mass movement of ground dwellers and underground dwellers to higher elevations as flood waters rise, and subsequent return as the waters recede, is an errant view of a flooding event. A more correct view is that most underground dwellers, and cold-blooded and relatively immobile species, will be drowned and many of the species forced into new territories will be harassed or killed by the animals whose territories they have invaded.

Page DEIS 8-43, paragraph 1, Direct Impact Mitigation. It is likely that this mitigation site will not be adequate to compensate for all direct impacts. It will be difficult to optimize habitat values within the Yolo Bypass because of uncontrolled flood events that would periodically destroy vegetation and thereby reduce habitat values. In addition, monitoring for plant survival and habitat optimization will require many years, not 3 years.

Page DEIS 8-43, paragraph 4, Indirect Impact Mitigation. This paragraph needs correction. Prior environmental documents have evaluated the North and South Natomas area but not the North Sacramento County and South Sutter County portions of the Natomas Area.

Page DEIS 8-45, paragraph 8, Inundation Analysis Mitigation Recommendations/Auburn. Further discussion and support for this mitigation program is needed. There should be a description of the existing scientific evidence (references).

Page DEIS 8-46, paragraph 3, Inundation Analysis Mitigation Recommendations/Auburn. The adaptive management program as proposed is experimental in nature, unproven and, in the Service's view, unlikely to succeed. Acceptance of the plan places thousands of acres of wildlife habitat at risk with little assurance that alternate mitigation would be carried out if the plan fails. The Service remains convinced that offsite acquisition in a nearby river canyon is the only feasible means to fully mitigate these inundation impacts. Also, dependence on uncertain annual Corps operations and maintenance budgets to deal with major mitigation cost demands is not a reasonable risk.

Page DEIS 8-51, paragraph 4, Direct Impacts. Additional discussion is needed in the last sentence. You should add "fall flows would be increased in many years to evacuate the reservoir in preparation for the flood season".

Page DEIS 8-63, paragraph 2, Project Mitigation Plan. Further discussion is warranted here. The Service evaluated the 150-year plan that was developed by the Corps. The alternative includes reoperation of Folsom Reservoir which will alter flow releases, water temperatures and Folsom storage levels among other things. This alternative would require Congressional reauthorization. In addition, full assessment of reoperation requires full analysis of CVP and Bay-Delta impacts.

Based on the need to conduct the above analyses, it seems very reasonable to look for opportunities to mitigate flood control impacts by altering water supply releases. Reoperation of Folsom Reservoir in a manner that avoids flow and temperature impacts on fish and wildlife resources, provides 150-year flood control for Sacramento and reallocates water supply may be an environmentally suitable alternative that should be considered. This alternative approach would be consistent with NEPA 1502.14(c).

Page DEIS 9-3, paragraph 5, Impacts to Winter Run Chinook Salmon. This paragraph needs clarification. As written, it reads as if adult winter-run salmon migrate into Dry Creek, Pleasant Grove Canal, and Auburn Ravine. The adult chinook salmon migrating into these creeks are fall-run chinook not winter-run. We recommend deleting the last two sentences.

Page DEIS 9-5, paragraph 1, Impacts to Valley Elderberry Longhorn Beetle (VELB). Some additional discussion is warranted here. You should modify the text as follows: "The valley elderberry longhorn beetle (Desmocerus californicus dimorphus) (VELB) is a threatened species. It is fully protected under the Endangered Species Act of 1973, as amended (Act). The Service has found that significant amounts of habitat for the beetle exist in the project area (Letter to Colonel Laurence Sadoff from Wayne White, dated April 2, 1991, titled CE-American River Watershed Investigation, Draft Report on the Distribution and Habitat for the Valley Elderberry Longhorn Beetle in the Study Area)."

The selected plan would likely have an indirect adverse impact on the VELB. The 100 (FEMA) and 150 year alternatives would likely have a direct adverse impact on the species. The 100 (FEMA), 150 year alternative, 200 year alternative, and the 400 year alternative would all likely have an adverse effect on the VELB. The Corps of Engineers requested formal consultation with the Service under Section 7 of the Act on May 6, 1991.

Page DEIS 9-7, paragraph 5, Natomas. This paragraph is not entirely correct as written. Soil type affects the success or failure of agricultural crops. Much of the interior land in Natomas is underlain with clay-type soils. Rice and some grains are compatible crops for these soils. Similarly, many of the row and truck and berry crops favor more well drained soils found along the perimeter of Natomas. These truck and row crops would not grow well on clay soils. Thus, there are site limitations on acreage of crop types than could be grown in Natomas.

Page DEIS 9-9, paragraph 4, Natomas. The specific practices for levee maintenance used by the managing district should be discussed. For example,



some of the Reclamation Districts use burning, mowing and herbicidal spraying to manage vegetation on the levees. Each of these practices would impact the prey species for the Swainson's hawk in a different manner. Maintenance timing and methods used by the Districts offer mitigative opportunities that should be explored.

Page DEIS 9-18, paragraph 2, Natomas. There are small agricultural ditches in the Sacramento Weir area that may be affected by proposed construction. In addition, there may be some ditches in the Fremont Weir area that may be affected.

Page DEIS 9-19, paragraph 5, Natomas. Additional impacts that could result from urbanization include unlawful taking, general disturbance, habitat degradation and introduction of harmful predatory fish.

Page DEIS 9-22, paragraph 3, Lower American River. Specific acreage historically inhabited by the giant garter snake should be mentioned.

Page DEIS 11-9, paragraph 1, Mitigation - Prime and Unique Farmlands. Combining the need for open space around the Sacramento Metropolitan Airport with the need for maintaining wildlife cover values could be a useful mitigation measure. Managing lands with suitable agricultural crops that serve as forage, cover or breeding habitat would be a prudent multi-use concept.

Page DEIS 14-9, paragraph 1, Natomas Recreation Facilities. Integration of recreation and wildlife habitat at the Druttia property would need to be carefully planned. Improper design could diminish adjacent wildlife values in that area and conflict with National Wild and Scenic Rivers criteria. Also, consideration should be given to developing the site as partial mitigation for project impacts.

Page DEIS 17-7, paragraph 4, Multipurpose Auburn Dam. The last sentence should be corrected. The Knickerbocker Area near Cool that is proposed as a mitigation area for the selected plan was also the proposed mitigation area for the multipurpose Auburn Dam project. Since mitigation areas within project lands are scarce, there would be an effect.

Page DEIS 21-4, paragraph 3, Upper American River. The Service disagrees with this assessment. Based on the Service's studies, there will be significant erosion, soil loss and slope failure caused by inundation events. Over the 100-year project life irreversible wildlife habitat damages will occur. Because of the steep slopes, restoration would be infeasible.

Page DEIS 22-5, paragraph 3, Memorandum of Understanding Regarding Local Assurances. Clarification is needed here. Results of the Service's HEP evaluation for the Natomas Area were based on a much larger area than the City's local development plans. Therefore, the Service's recommended mitigation plans may differ conceptually from those proposed by the local agencies. Any issues should be resolved and agreements included in the Final EIS.

Page DEIS 22-5, paragraph 4, Memorandum of Understanding Regarding Local Assurances. The Service disagrees with the reasonable assurances approach recommended to address future growth impacts. Within the 100-year period of

analysis it is reasonably foreseeable that all of the Natomas Area will be urbanized. Unless adequate lands are set aside with ironclad guarantees that they will be managed for wildlife purposes a piecemeal degradation will occur over time. The manner in which South Natomas has been developed is a good example.

Page DEIS 22-6, paragraph 3, Fish and Wildlife Resources. The Service disagrees with the project-by-project approach to impact assessment and mitigation planning. Planning future development along with protecting existing fish and wildlife habitat cannot be effectively done on a project-by-project basis. Adequate cumulative impact assessment cannot be done on a project-by-project basis.

The only way to ensure that all fish and wildlife values are preserved is to develop a comprehensive plan for all of the Natomas area that strategically locates fish and wildlife areas and integrates development so that existing fish and wildlife values are not diminished. This is the only way that full mitigation for growth induced impacts can be accomplished.

Summary Comments

Because there are abundant and highly significant fish and wildlife resources at risk in the Natomas, Lower American River and Upper American River areas the Department is concerned that no environmentally acceptable alternatives are presented in the DEIS. We are also concerned that alternatives that appear less environmentally damaging, such as the upstream reservoir option, were dismissed with little supportive documentation. Considering the high resource values and the lack of environmentally suitable choices, we are concerned that equal consideration of environmental values is not included in alternatives development. This leads us to believe there may be other alternatives not presented in the DEIS that would accomplish flood control goals with minimal fish and wildlife losses.

Because there are no clearly defined mitigation plans with legal assurances that guarantee implementation for impacts identified in the Service's DCAR for Natomas, we cannot concur that mitigation is adequate. We are also concerned that the direct impact assessment for the Upper American River grossly underestimates the impacts and needed mitigation for the upstream dam, thus leading to a false conclusion that the selected plan is the least environmentally damaging alternative. Again, we cannot concur that mitigation needs will be fully met until the discrepancies between the Service's recommendation and the DEIS are resolved.



Thank you for the opportunity to review and comment on this Report.

Sincerely,

Patricia Sanderson Port
Regional Environmental Officer

SAFCA

Sacramento
Area Flood
Control
Agency

June 24, 1991

We have attached copies of two executed resolutions stating SAFCA's approved recommendations regarding the components which should be included in the overall plan for flood protection along the American River.

These resolutions were adopted unanimously by the SAFCA Board of Directors at their meeting of June 20, 1991.

Please call if you have any questions about this matter.

Sincerely,

William H. Edgar

WILLIAM H. EDGAR
Executive Director

A-200

RESOLUTION NO. 91-008
Adopted by the Sacramento Area Flood Control Agency

WHEREAS, on April 5, 1991, the Army Corps of Engineers (Corps) submitted for public review and comment the draft American River Watershed Investigation Feasibility Report and Draft Environmental Impact Statement/Environmental Impact Report (Draft Report); and

WHEREAS, until all comments on the Draft Report have been received, responses prepared, and a Final EIS/EIR issued by the Corps, the Draft EIS/EIR cannot be certified by the Corps or by the State Department of Water Resources/Reclamation Board, the state lead agency under CEQA, and SAFCA cannot take any final action or make any legally binding decisions regarding the proposed flood control project; and

WHEREAS, the planning requirements of the project, including sequential approval at the federal, state, and local levels, make it essential that the sponsoring agencies communicate their mutual views regarding the project at significant junctures in the feasibility and environment review process; and

WHEREAS, publication of the Draft Report represents such a juncture;

NOW, THEREFORE, it is appropriate for SAFCA, utilizing the information available to date, to offer the following recommendations regarding the components which should be included in the overall plan for flood protection along the American River, with the understanding that this action will permit the final feasibility study and Final EIS/EIR to thoroughly evaluate the identified components, and will assist the Sacramento area's congressional representatives in developing appropriate language for the 1992 omnibus water bill:

1. The Corps should pursue authorization of a flood control project along the American River consisting of a 200-year flood control dam at River Mile 20.1 near Auburn capable of detaining 545,000 acre feet (AF) of water during flood events, and levee improvements around the perimeter of the Natomas basin designed to provide existing residents of Natomas with the same level of flood protection as is afforded to the rest of the American River floodplain. This project should include the following subsidiary elements:

    a. The flood control dam should not preclude future expansion for water, power, and recreational purposes, and should therefore create no significantly greater impediments to expansion than construction of a multipurpose dam would encounter on its own.

    b. The flood control dam should be designed as an ungated facility, unless the Corps and the State determine that gates are essential to maintain the integrity of the dam and/or the safety of the flood control system below Auburn.

RESOLUTION NO. 91-008
Adopted by the Sacramento Area Flood Control Agency

WHEREAS, on April 5, 1991, the Army Corps of Engineers (Corps) submitted for public review and comment the draft American River Watershed Investigation Feasibility Report and Draft Environmental Impact Statement/Environmental Impact Report (Draft Report); and

WHEREAS, until all comments on the Draft Report have been received, responses prepared, and a Final EIS/EIR issued by the Corps, the Draft EIS/EIR cannot be certified by the Corps or by the State Department of Water Resources/Reclamation Board, the state lead agency under CEQA, and SAFCA cannot take any final action or make any legally binding decisions regarding the proposed flood control project; and

WHEREAS, the planning requirements of the project, including sequential approval at the federal, state, and local levels, make it essential that the sponsoring agencies communicate their mutual views regarding the project at significant junctures in the feasibility and environment review process; and

WHEREAS, publication of the Draft Report represents such a juncture;

NOW, THEREFORE, it is appropriate for SAFCA, utilizing the information available to date, to offer the following recommendations regarding the components which should be included in the overall plan for flood protection along the American River, with the understanding that this action will permit the final feasibility study and Final EIS/EIR to thoroughly evaluate the identified components, and will assist the Sacramento area's congressional representatives in developing appropriate language for the 1992 omnibus water bill:

1. The Corps should pursue authorization of a flood control project along the American River consisting of a 200-year flood control dam at River Mile 20.1 near Auburn capable of detaining 545,000 acre feet (AF) of water during flood events, and levee improvements around the perimeter of the Natomas basin designed to provide existing residents of Natomas with the same level of flood protection as is afforded to the rest of the American River floodplain. This project should include the following subsidiary elements:

    a. The flood control dam should not preclude future expansion for water, power, and recreational purposes, and should therefore create no significantly greater impediments to expansion than construction of a multipurpose dam would encounter on its own.

    b. The flood control dam should be designed as an ungated facility, unless the Corps and the State determine that gates are essential to maintain the integrity of the dam and/or the safety of the flood control system below Auburn.



    c. The lands in the canyons of the North and Middle Forks of the American River near Auburn which are now owned by the federal government, and any private lands in these canyons which are acquired to operate the flood control dam, should be maintained in some form of public ownership in order to provide needed actively managed public recreation and to preserve future options with respect to developing the resources available in the canyons.

    d. SAFCA should be authorized to finance and construct the proposed Natomas levee improvements as a local project on a credited basis.

2. Until such time as the flood control dam at Auburn is constructed, Folsom Reservoir should be reoperated to provide enough additional flood storage to protect residents of the floodplain from storms up to a 100-year (FEMA) level.

3. The above actions should not preclude any other measures that would add to the protection afforded by the proposed dam, levee improvements, and reoperation, provided such additional measures are determined to be cost effective or are justified on grounds other than flood control.

4. To the extent that the proposed flood control project would facilitate urban growth in Natomas and elsewhere in the floodplain, the local agencies controlling land use in the affected areas should take responsibility for addressing the impacts associated with this growth. In particular, the local agencies should respond to the preliminary conclusion of the State Department of Fish and Game that continued urbanization of the Natomas basin could jeopardize the two state-listed species, Swainson's hawk and California giant garter snake, which currently inhabit or forage in the basin.

5. Finally, the Bureau of Reclamation should continue to pursue, in concert with all interested non-federal parties, a study designed to identify future water and power needs in the region and to evaluate feasible alternatives to meet those needs, including the alternative of expanding the flood control dam for water and power purposes. This study should fully comply with the principles and guidelines applicable to all federal water resource development projects, and should in no way hinder or delay construction of the flood control dam.

ON A MOTION by Director Robie, seconded by Director Barandas, the foregoing resolution was passed and adopted by the Board of Directors of the Sacramento Area Flood Control Agency this 20th day of June, 1991, by the following vote, to wit:

| | | |
|---|---|---|
| AYES: | Directors | Johnson, G., Collin, Smoley, Filipelli, Notolli, Rudin, Robie, Fargo, Barandas, Nickless, Hawkins, LeVake, Christophel |
| NOES: | Directors | None |
| ABSTAIN: | Directors | None |
| ABSENT: | Directors | None |

Chairman of the Board of Directors of the
Sacramento Area Flood Control Agency

(SEAL)

ATTEST: Diana J. Connelly
Clerk of the Board of Directors

Attachments

RESOLUTION NO. 91-011
Adopted by the Sacramento Area Flood Control Agency

WHEREAS, the Board of Directors of the Sacramento Area Flood Control Agency adopted Resolution No. 91-008 recommending components which should be included for further study as part of the overall plan for flood protection along the American River; and

WHEREAS, the recommended components include construction of a 200-year flood control dam at Auburn and reoperation of Folsom Dam and Reservoir until such time as the proposed dam is completed; and

WHEREAS, interim reoperation of Folsom Dam would alter existing instream flows in the lower American River and could therefore adversely affect the environmental quality of the American River Parkway; and

WHEREAS, construction of the 200-year flood control dam alternative would require significant volumes of concrete, most of which would be sand and aggregate obtained from sources near the proposed dam site; and

WHEREAS, obtaining the needed sand and aggregate from existing aggregate bars along the channel of the Middle Fork of the American River, as currently proposed by the Corps, could result in severe harm to the environment;

NOW, THEREFORE the Board calls upon the Corps to make certain that in evaluating the above components and making recommendations to Congress with respect to the flood control program to be implemented along the American River:

1. Every effort is made to minimize the adverse impacts to the environment of the American River Parkway that could result from interim reoperation of Folsom Dam and operation of the proposed flood control dam at Auburn.

2. Every effort is made to obtain the aggregate and sand needed for the proposed flood control dam from sources other than the aggregate bars along the Middle and North Forks of the American River. Such alternative sources could include:

   a. the failed cofferdam

   b. the area below the dam to areas within Folsom Reservoir

   c. the almost filled-in Lake Clementine, and

   d. rock quarries

3. In the event that the aggregate bars must be used as a source of material for the dam, a complete mitigation program to restore the river environment must be included as a project feature.

4. Every effort is made to mininize adverse impacts to the environment of the American River canyons from construction and operation of the proposed flood control dam at Auburn.



ON A MOTION BY Director Robie, seconded by Director Fargo, the foregoing resolution was passed and adopted by the Board of Directors of the Sacramento Area Flood Control Agency this 20th day of June, 1991, by the following vote, to wit:

| | | |
|---|---|---|
| AYES: | Directors | Johnson, G., Collin, Smoley, Filipelli, Notolli, Rudin, Robie, Fargo, Barandas, Nickless, Hawkins, LeVake, Christophel |
| NOES: | Directors | None |
| ABSTAIN: | Directors | None |
| ABSENT: | Directors | None |

(Chairman of the Board of Directors of the Sacramento Area Flood Control Agency

(SEAL)

ATTEST:

Diana G. Connelly
Clerk of the Board of Directors

Attachments

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, Governor

THE RECLAMATION BOARD
1416 Ninth Street, Room 455-6
Sacramento, CA 95814
(916) 445-9454

JUN 28 1991

Colonel Laurence R. Sadoff
District Engineer
Sacramento District
U. S. Army Corps of Engineers
650 Capitol Mall
Sacramento, California 95814-4794

Dear Colonel Sadoff:

The Reclamation Board is pleased to transmit to you Resolution No. 91-10 which was unanimously adopted by The Reclamation Board at its meeting on June 28, 1991. This Resolution reaffirms the Board's support for high levels of flood protection in the greater Sacramento area and also recommends that the Corps of Engineers consider a locally preferred plan in the American River Watershed Investigation Feasibility Report. The locally preferred plan should provide reliable protection from floods with an annual probability of occurrence of 1-in-200. It is recommended that the Corps, in completing the draft feasibility report, develop necessary engineering, economic, and environmental information for a locally preferred project which includes a peak flow detention dam in the vicinity of River Mile 20.1 near Auburn capable of detaining about 545,000 acre-feet of floodwater and levee improvements around the perimeter of the Natomas Basin.

This locally preferred plan is being recommended in lieu of the National Economic Development Plan for three reasons: (1) based upon the public input, the locally preferred plan is more widely supported than the NED, (2) the locally preferred plan would require less material (gravel) to construct and would likely result in fewer construction-related impacts in the upper American River canyons, and (3) the locally preferred plan is less costly for all project participants.

The Board looks forward to your completion of the planning process to provide much needed flood protection for the greater Sacramento area.

If you have any questions regarding the Resolution, please contact Raymond Barsch, General Manager, at (916) 445-9454.

Sincerely,

Wallace McCormack

Wallace McCormack
President

Ms. Collette Johnson-Schulke
Office of Congressman Robert T. Matsui
650 Capitol Mall, Room 8050
Sacramento, California 95814

Mr. Richard Harris
Office of Congressman Vic Fazio
2525 Natomas Park Drive
Room 330
Sacramento, California 95833

Mr. Lance Hastings
Office of John T. Doolittle
1624 Santa Clara Drive, Room 260
Roseville, California 95661

Mr. David N. Kennedy, Director
Department of Water Resources
1416 Ninth Street
Sacramento, California 95814

Mr. Douglas P. Wheeler
Secretary for Resources
The Resources Agency
1416 Ninth Street, 13th Floor
Sacramento, California 95814

Honorable Anne Rudin
Mayor of the City of Sacramento
915 I Street
Sacramento, California 95814

Mr. William H. Edgar
Executive Director
Sacramento Area Flood Control Agency
926 J Street, Suite 424
Sacramento, California 95814

Mr. James T. Sopwith, Jr.
President
Reclamation District 1000
1633 Garden Highway
Sacramento, California 95833

Mr. Alex Ferreira, Chairperson
Board of Supervisors
County of Placer
175 Fulweiler Avenue
Auburn, California 95603

Mr. Larry Hancock
Regional Director
Mid-Pacific Region
U. S. Bureau of Reclamation
2800 Cottage Way, Room W1105
Sacramento, California 95825

Mr. Jim Streng, Chairperson
Board of Supervisors
County of Sacramento
700 H Street
Sacramento, California 95814

Ms. Barbara LeVake
Board of Supervisors
County of Sutter
463 Second Street
Yuba City, California 95991

Mr. George Campini
American River Flood Control District
2590 Venture Oaks Way
Sacramento, California 95833

Mr. Stephen K. Hall
Vice-President
The Reclamation Board
770 East Shaw Avenue, Suite 216
Fresno, California 93710

Mrs. Jane Carter, Secretary
The Reclamation Board
909 Oak Street
Colusa, California 95932

Mr. Charles E. Greene, Member
The Reclamation Board
600 - 46th Street
Sacramento, California 95819

Mr. Michael Stearns, Member
The Reclamation Board
8021 West Hutchins Road
Dos Palos, California 93620

Mr. Wood A. Yerxa, Member
The Reclamation Board
Post Office Box 209
Colusa, California 95932

Mr. George E. Ribble, Member
The Reclamation Board
Post Office Box 58
Bakersfield, California 93302

STATE OF CALIFORNIA
THE RESOURCES AGENCY
THE RECLAMATION BOARD

RESOLUTION NO. 91-10

WHEREAS, The Reclamation Board passed Resolution No. 89-14 on September 15, 1989, and Resolution No. 90-3 on February 16, 1990, stating the Board's position on the minimum 200-year level of protection; and

WHEREAS, on April 5, 1991, the draft Feasibility Report and Joint Environmental Impact Statement/Environmental Impact Report for the American River Watershed Investigation, California, was provided to the public for review and comment; and

WHEREAS, the Board cosponsored 14 workshops to respond to questions about the draft documents, and then cosponsored 3 public hearings to receive public input on the contents of the reports; and

WHEREAS, the Corps of Engineers is seeking direction from the Board, as potential local sponsor, on a preferred plan for which the Corps should focus its study efforts in completing the feasibility report and related environmental documentation; and

WHEREAS, the Board acknowledges the multitude of comments on the draft report and EIS/EIR submitted by public agencies, private interest groups, and concerned citizens; and

WHEREAS, the Board recognizes the controversy surrounding a number of issues which will be addressed as the Corps completes the feasibility study. It is not practical to cite all these issues individually in this resolution, but some technical issues that have been mentioned repeatedly during the public review period are emergency gates, assurance that the dam design would neither advance nor preclude future expansion, and land disposition.

NOW, THEREFORE BE IT RESOLVED that this Board reaffirms its position as contained in Resolution No. 89-14 and Resolution No. 90-3; and

BE IT FURTHER RESOLVED that this Board's recommendation is for an affordable plan that is a federally-authorized flood control project for the American River which will provide reliable protection from floods with an annual probability of occurrence of 1-in-200; the Board further recommends that the Corps of Engineers, in completing its feasibility report and environmental documentation, develop necessary engineering, economic, and environmental information for a project which includes a peak flow detention dam in the vicinity of River Mile 20.1 near Auburn capable of detaining about 545,000 acre-feet of floodwater, and levee improvements around the perimeter of the Natomas basin; and

BE IT FURTHER RESOLVED that this Board directs staff to assist the Corps in developing information necessary to address public comments and to complete the draft documents; and

BE IT FURTHER RESOLVED that this Board directs staff to work closely with the Corps to analyze a variety of temporary emergency closure configurations which will achieve system safety goals ("time window" for emergency repairs or warnings) while providing assurance that those closure configurations would not be used to impound water permanently; and further directs staff to assist the Corps in examining the rationale for including emergency gates in the design, proposed criteria for closing and reopening the gates, and various scenarios illustrating the public safety benefits of this feature; and

BE IT FURTHER RESOLVED that this Board recommends that an independent consulting board composed of eminent experts be established to guide the detailed design and construction effort. A separate charge for this consulting board will be to monitor the design process and prepare a report for the State which provides technical confirmation that future expansion of the flood detention dam, for other beneficial purposes, including but not limited to water supply, power production, fish and wildlife, and recreation, which may someday be authorized, is not precluded; and

BE IT FURTHER RESOLVED that this Board acknowledges the Sacramento Area Flood Control Agency's Resolutions No. 91-008 and No. 91-011, both adopted June 20, 1991, and recognizes the importance of SAFCA taking the lead in activities necessary to provide temporary flood protection, including Folsom Reoperation, until completion of a project to achieve the needed high level of protection, and to ensure compliance with environmental laws regarding mitigation for future urban growth. This Board's primary focus is in achieving a high level of long-term flood protection for the Sacramento area, and SAFCA's efforts as cited above are an important component of the regional flood control planning strategy; and

BE IT FURTHER RESOLVED that this Board concurs specifically with Items 1(c.) and 5 in SAFCA's Resolution No. 91-008, quoted as follows:

"1(c.) The lands in the canyons of the North and Middle Forks of the American River near Auburn which are now owned by the federal government, and any private lands in these canyons which are acquired to operate the flood control dam, should be maintained in some form of public ownership in order to provide needed actively managed public recreation and to preserve future options with respect to developing the resources available in the canyons.

"5. The Bureau of Reclamation should continue to pursue, in concert with all interested non-federal parties, a study designed to identify future water and power needs in the region and to evaluate feasible alternatives to meet those needs, including the alternative of expanding the flood control dam for water and power purposes. This study should fully comply with the principles and guidelines applicable to all federal water resource development projects, and should in no way hinder or delay construction of the flood control dam."

Dated: June 28, 1991

THE RECLAMATION BOARD of the
State of California

By _____
President

By _____
Secretary

Congress of the United States
House of Representatives
Washington, DC 20515

July 12, 1991

Dr. G. Edward Dickey
Acting Principal Deputy Assistant Secretary
Department of the Army, Civil Works
The Pentagon, 2E570
Washington, D.C. 20310

Dear Dr. Dickey:

As you know, the Corps' draft feasibility study and environmental impact statement for the American River Flood Control Project in Sacramento have been circulating for public review. They have drawn a considerable amount of comment. We confess to being concerned about the Corps' ability to maintain a schedule that would get a report to the Hill in time for 1992 authorization even if the comments are dismissed without making authorization extremely difficult, if possible at all.

We became concerned first when the Environmental Protection Agency (EPA) provided us with a copy of its comments. Since then we have reviewed those of other agencies, and have been asked to meet with environmental groups and others. Somewhat prematurely, we believe, these environmental groups are already attacking the project in Congress. But that indicates the debate that will occur when the project officially arrives.

We believe it vital to focus on the criticisms from federal agencies and from the State of California. First, they reflect the problems expressed by environmentalists and others. Second, these agencies have the procedural power to hold back the project unless their concerns are addressed substantially to their satisfaction.

In summary, the concerns of state and federal agencies are as follows:

The Environmental Protection Agency

-- The discussion of the 200 year alternative does not appear to consider or even explain rejection of several measures which might reduce the size of a flood control dam at Auburn. The measures are: use of up-stream power reservoirs for greater flood control, the permanent reoperation of Folsom at a slightly lower level, the lowering of the Folsom Dam spillway, and



increasing the capacity of the Lower American levees to 130,000 cfs.

Even if these alternatives are not viable, or are less cost effective than a slightly larger flood control dam, it is essential that the Corps establish those points. It appears that the Corps has not. The EPA's concern about alternatives is cited over and over again, by additional agencies, environmental groups, and others who simply worry about flaws in the report.

-- The draft report does not provide enough information for the EPA to determine whether the project can qualify for a Section 404 (r) Clean Water Act exemption.

-- The draft does not show whether or how the project complies with the Clean Air Act.

-- The draft does not explain where 6 million cubic feet of aggregate for the dam can be obtained, and does not evaluate the environmental impacts of obtaining it. Since the aggregate will presumably come from the Auburn Canyon and the canyon is not to be inundated by this project, these impacts become significant.

-- Interim reoperation of Folsom is part of the plan and is not analyzed, nor are the "combined" or "synergistic" effects of interim reoperation followed by the flood control dam.

We understand that reoperation of Folsom is not part of the American River project as far as the Corps is concerned and could, in a fair minded and reasonable world, be considered separately. But, the EPA's complaint is aggravated by the fact that the actual Folsom reoperation plan and EIS are not yet public.

-- The report and EIS need to explicitly state that they are an insufficient basis for expansion of the flood control dam, and that expansion would require a whole new feasibility study, environmental impact report, and Congressional authorization.

-- The EPA notes that answers to these questions, all NEPA requirements, will of necessity entail new information and that NEPA requires re-circulation of new information in a revised draft.

-- Lastly, the EPA warns that failure to comply with NEPA in the above respects could require invocation of CEQ dispute mechanisms. We note that even if the CEQ decides in the Corps' favor in every respect, the 1992 Congressional authorization will

be missed by several months if not more. Plus, the political problems are compounded further.

The U.S. Fish and Wildlife Service

-- The report and EIS fail to analyze the potential of and explain the evident rejection of the measures that could reduce the size of the flood control dam, i.e.: the upstream power reservoirs, permanent reoperation of Lake Folsom, lowering the Folsom Dam spillway, and upgrading the Lower American levees to 130,000 cfs.

-- The report and EIS fail to describe and explain as required by NEPA the wide discrepancy between the Corps and FWS's analysis of the impacts of periodic inundation of canyon vegetation.

-- The mitigation described in the report and EIS fails entirely to compensate for inundation's effect on soil stability on the steep canyon walls, for the means and impacts of aggregate extraction, for the drowning of immobile or underground animal life, and for the probable deaths of mobile animals forced into territory already occupied by others.

-- Mitigation for direct and indirect impacts in Natomas is not discussed, nor is who will implement it and how we can be assured of its implementation.

The California Resources Agency

The letter from the Resources Agency notes that the State cannot support a project that is not completely and adequately studied. The Agency clearly implies that the State might withdraw as a local sponsor. This warning was probably not widely reviewed in the State, and before the State would withdraw, some considerations would be entertained that are well beyond the role of the agencies now reviewing the document for technical adequacy. However, there also clearly exists a set of program mechanisms, including the Fish and Game Department's endangered species warning, which might force the hands of the policy people.

-- The State Lands Commission reiterated the concern that alternative measures to reduce the size of the 200 year dam are not evaluated.

-- The State Fish and Game Department declares that discussion of 17 topics is incomplete, including failure to



identify specific mitigation measures and assurances that they will be implemented, notable mitigation for insufficiently described damage in the canyon and for endangered species in Natomas.

Fish and Game warns that corrections of these deficiencies will require re-circulation of the documents.

Fish and Game also says that the lack of mitigation planning and the lack of description on how mitigation is to be assured will trigger its endangered species jeopardy opinion. We believe that the Corps maintains -- no doubt correctly -- that it is not responsible for secondary mitigation, i.e. for the growth impacts in Natomas or perhaps for growth impacts of relocating the Highway 49 bridge. Our understanding of the complaints, however, is that mitigation needs to be described and its implementation demonstrated in the documents even if the Corps itself is not responsible for implementing it.

-- The State Parks Department cites many mitigation requirements unaddressed.

We think few if any of these complaints can be dismissed, even if in the judgement of Corps' personnel they are unfounded. This is a difficult project and the Corps has devoted enormous energy to completing it as rapidly as possible. It would be highly unfortunate at this late and critical juncture if we miss remaining opportunities to correct defects which would bring all this effort to naught. Therefore, we urgently request your attention to making this document fully responsive to the agency requests. Further, we anticipate requesting in the near future some changes in the review process which would enable not only a solid document to be provided Congress but for its provision in time for 1992 authorization. Thank you.

Sincerely,

Bob Matsui
ROBERT T. MATSUI
Member of Congress

Vic
VIC FAZIO
Member of Congress

July 30, 1991

Environmental Resources Branch

Ms. Claudia Nissley
Director, Western Office of Project Review
Advisory Council on Historic Preservation
730 Simas Street, Suite 401
Golden, Colorado 80401

Dear Ms. Nissley:

Enclosed for your review is the draft Programmatic Agreement (PA) for the American River Watershed Investigation, as requested in your letter of July 12, 1991. We have received substantial assistance from the California State Historic Preservation Office in the development of this document.

Your comments may be submitted to Ms. Sannie K. Osborn, Archeologist, Environmental Resources Branch at the address above. Ms. Osborn may also be reached by telephone at commercial (916) 557-6714/ FTS 465-6714. Please note our new mailing address which became effective July 22, 1991.

Sincerely,

Walter Yep
Chief, Planning Division

Enclosure

A-209

RECREATION & PARK AND FISH & GAME COMMISSION

ANN KOHL
Chairperson
JOHN W. ANDERSON
ROBERT J. BASTIAN
GEORGE DUPRAY
DR. A.C. UBALDE, JR.

COUNTY SERVICE AREAS

#4B Wilton/Cosumnes
#4C Delta
#4D Herald

# COUNTY OF SACRAMENTO
## DEPARTMENT OF PARKS AND RECREATION

GENE W. ANDAL
Director
RICK CARUNCHIO
Assistant Director
RON SUTER
Chief, Administration and Leisure Services
ROY IMAI
Chief, Planning & Development

August 20, 1991

Dave Gore, Civil Engineer
Project Manager
Corps of Engineers: Sacramento Division
CESPK-PD
1325 J Street
Sacramento, CA 95814

Dear Mr. Gore:

By this letter, the Sacramento County Department of Parks and Recreation expresses its intent to act as the non-federal sponsor for the recreation facility development portion of the Natomas East Main Drain flood control project. By acting as the non-federal sponsor, we are agreeing to pay 50% of the development and construction costs for that portion of this project which falls within our jurisdiction.

I understand that, should funding be unavailable at the time of construction, and if another method of payment cannot be agreed upon, then we are not obligated to adhere to this agreement.

Please be advised that this proposal must be presented to the Recreation and Park Commission for approval (in September) and to the County Board of Supervisors for approval (in October) for their approval. When this process has been successfully completed, I will submit another letter so stating.

Sincerely,

Gene W. Andal
Director

cc: Donna Stanek - Corps of Engineers
Roy Imai, County Parks
Sharon Williams, County Parks

GA:SW:eg:82091

3711 Branch Center Road • Sacramento, California 95827 • (916) 366-2061

CESPD-PD-P (CESPK-PD-A/9 July 91) (1105) 1st End Mr. Frentzen
tjm/415-705-1637
SUBJECT: American River Watershed Investigation, California - Deviation from NED Plan

DA, South Pacific Division, Corps of Engineers, 630 Sansome St., Room 720, San Francisco, CA 94111-2206 08 AUG 1991

FOR DIRECTOR OF CIVIL WORKS, 20 MASS. AVE., NW., WASH DC 20314-1000

1. Reference: ER 1105-2-100, paragraph 5-16c.

2. I concur with the District Engineer's request that an exception be granted in accordance with reference for deviating from the National Economic Development plan. Accordingly, it would be appropriate to use the MCACES cost estimate developed for the locally preferred plan as the basis for Federal participation in the project.

ROGER F. FANKOUPE
Brigadier General, U.S. Army
Commanding

Encl
nc

A-210



DEPARTMENT OF PARKS AND COMMUNITY SERVICES

ROBERT P. THOMAS
DIRECTOR

G. ERLING LINGGI
ASSISTANT DIRECTOR

WALTER S. UEDA
DEPUTY DIRECTOR

CITY OF SACRAMENTO
CALIFORNIA

1231 I STREET
SUITE 400
SACRAMENTO, CA
95814-2977

916-449-5200
FAX 916-449-8584

DIVISIONS:
GOLF
CROCKER ART MUSEUM
HISTORY AND SCIENCE
METROPOLITAN ARTS
SACRAMENTO ZOO
PARKS AND RECREATION
• NORTH
• SOUTH
• CITY-WIDE

September 23, 1991

Mr. David Gore, Civil Engineer
Project Manager
Corps of Engineers: Sacramento Division
CESPK-PD
1325 J Street
Sacramento, California 95814

Dear Mr. Gore:

The City of Sacramento, Department of Parks and Community Services, hereby expresses our intent to act as a non-federal sponsor for the development of the recreation portion of the Natomas East Main Drain Flood Control Project.

The City agrees to pay 50 percent of the development and construction costs for that portion of the project which falls within our jurisdiction. However, should funding be unavailable at the time of construction, and if no other method of payment can be agreed upon, the City will not be obligated to adhere to this agreement.

This proposal must be approved by the Sacramento City Council and will be presented to them at a meeting in October. When the Council approves the proposal, I will send a confirmation letter.

Sincerely,

ROBERT P. THOMAS, Director
Parks and Community Services

cc: Walt Ueda, Deputy Director

26 Sep 91 1

CECW-PW (CESPK-PD-A/9 Jul 91) (335-2-5c) 2nd End Lucyshyn/bw/202-272-0158
SUBJECT: American River Watershed Investigation, California - Deviation from NED Plan

HQ, US Army Corps of Engineers, Washington, DC 20314-1000

FOR Commander, South Pacific Division

1. Your request that an exception be granted to deviate from the National Economic Development (NED) plan as the recommended plan for the subject investigation has been reviewed and considered by this office. In view of the fact that the locally preferred plan supported by the non-Federal sponsor is similar to the NED plan but smaller in scope, an exception to deviate from the NED requirement will generally be considered favorably. However, only the Assistant Secretary of the Army for Civil Works (ASA(CW)) can grant an exception to deviate from the NED plan. The ASA(CW) decision to grant an exception will be based upon information contained in the feasibility report along with recommendations of the Board of Engineers for Rivers and Harbors and the Chief of Engineers. Therefore, in accordance with guidance contained in ER 1105-2-100, paragraph 5-16c, you should proceed tc complete your final feasibility report and provide clear and complete rationale in support of your recommendation so that decision makers can fully evaluate the appropriateness of such a deviation.

2. The M-CACES estimate in the final report should be accomplished for the project recommended for implementation.

FOR THE COMMANDER:

/s/
ARTHUR E. WILLIAMS
Major General, USA
Director of Civil Works

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A-211



RECREATION & PARK AND FISH & GAME COMMISSION

ANN KOHL
Chairperson
JOHN W. ANDERSON
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COUNTY SERVICE AREAS

#4B Wilton/Cosumnes
#4C Delta
#4D Herald

# COUNTY OF SACRAMENTO
## DEPARTMENT OF PARKS AND RECREATION

GENE W. ANDAL
Director
RICK CARUNCHIO
Assistant Director
RON SUTER
Chief, Administration and Leisure Services
ROY IMAI
Chief, Planning & Development

September 27, 1991

Dave Gore, Civil Engineer
Project Manager
Corps of Engineers, Sacramento Division
CESPK - PD
1325 J Street
Sacramento, CA 95814

Dear Mr. Gore:

On August 26, 1991 the Sacramento County Recreation and Parks Commission voted 5-0 to endorse the participation of the Department of Parks and Recreation as a non-federal sponsor for the Natomas East Main Drain Flood Control Project (recreation element).

We realize that, should funding be unavailable at the time of construction, and if another method of payment cannot be agreed upon the Department is not obligated to participate in the project.

Please keep this Commission informed on the status of this project.

Sincerely,

Ann Kohl

Ann Kohl, Chairperson
Sacramento County Recreation and Park Commission

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, *Governor*

**THE RECLAMATION BOARD**
1416 Ninth Street, Room 455-6
Sacramento, CA 95814
(916) 445-9454

OCT 4 1991

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

Dear Colonel Sadoff:

In response to the August 22, 1991 letter from John Saia, The Reclamation Board of the State of California and the Sacramento Area Flood Control Agency hereby convey their intent to be joint sponsors for the American River Watershed Project. This letter supplements the Board's letter to you dated June 18, 1991.

SAFCA will assume primary responsibility for the nonfederal requirements (lands, easements, rights of way, and relocations) of the Natomas portion of the Project. The Reclamation Board will assume primary responsibility for the nonfederal requirements of the proposed flood control detention dam near Auburn.

This arrangement will not affect the statutory cost-sharing formula between the Board and SAFCA for the nonfederal costs of the overall project.

It is our understanding that this letter satisfies the joint sponsorship requirement in your August 22 letter and will thus allow SAFCA to proceed with submitting an application under Section 104 of the 1986 Water Resources Act to receive credit for constructing the Natomas improvements on an expedited basis.

If you have any questions, please call Raymond Barsch at (916) 445-9454 or William Edgar at (916) 440-7606, or have your staff contact either Steve Yaeger at (916) 322-6230 or Tim Washburn at (916) 440-7606.

Sincerely,

Wallace McCormack
President
The Reclamation Board

Bill Christophel
Chairman
Sacramento Area Flood
Control Agency

November 22, 1991

Environmental Resources Branch

Mr. Wayne S. White, Field Supervisor
Fish and Wildlife Service
Fish and Wildlife Enhancement
2800 Cottage Way, Room E-1823
Sacramento, California 95825-1846

Dear Mr. White:

I am providing the information you requested in your letters of September 27 and October 4 concerning the American River Watershed Investigation (ARWI). I am also supplementing our previous biological assessment on the threatened valley elderberry longhorn beetle (VELB), as explained below.

The revised selected plan is the 200-Year flood control dam alternative which was described in the Draft EIS/EIR (DEIS/EIR) dated April 5, 1991. This alternative has the same basic impacts as the 400-Year alternative described in detail in the DEIS/EIR, except that there would be slightly less fill placed on the levees in the Natomas area and the detention dam would be 425 feet tall instead of 495 feet. This reduction in dam height has reduced the temporary storage capability from 894,000 acre-feet to 545,000 acre-feet covering a maximum of 4,000 acres for no more than 20-days during a 200-year event. The aggregate required to construct the dam will be obtained from an existing quarry located near Cool in El Dorado County, and transported to the dam site on a conveyor system.

Recent information provided informally by Chris Nagano of your staff reveals that although the elderberry shrub has been known to occur in the detention dam area, you now believe that the VELB inhabits shrubs at these elevations. It is requested that you officially advise us in writing whether or not the VELB is known to occur in the vicinity of the proposed dam and inundation area. Assuming that the VELB does occur in the detention dam area, it is our biological assessment that there is the likelihood of adverse impacts on the VELB and formal consultation is requested supplementing our previous request.

Our schedule calls for completing the EIS/EIR on the ARWI next month. In order to maintain our schedule in light of this recent information and assuming you confirm the elderberry shrubs in the detention dam area provide habitat for the VELB, we will include an estimate of impacts and mitigation in the EIS/EIR. Following project authorization, we will confirm the mitigation requirement after conducting detailed field investigations.





During the process of mapping habitat in the earlier evaluation process, the densities of elderberry shrubs in the upper canyon area were determined. On the basis of this mapping, in the lowest inundation zone (adjacent to the river) there are 601 acres which have at least 5 shrubs per acre. In the second zone there are 1,739 acres which have between 1 and 5 shrubs per acre. In the upper zone, there are 1660 acres which have less than 1 shrub per acre. Because we need to proceed vigorously with this very important project, for purposes of this analysis only, we have made the following assumptions:

The area behind the dam will be inundated during the first few years of the project life.

When a shrub becomes inundated, it no longer provides habitat for the VELB over the 100-year project life.

All of the shrubs in the lowest elevations provide highly effective VELB habitat, and that in the higher elevations (as the shrubs become more isolated) they provide less valuable habitat.

On the basis of the above, we suggest that the following mitigation will avoid jeopardy, and request your advice be provided on this in your biological opinion. This analysis has been accomplished generally in conformity with your 1988 General Compensation Guidelines for the VELB. Because the 601 acres contains the greatest densities of shrubs, we have assumed that mitigation for these shrubs will be provided at a ratio of 5 to 1, or 15,025 shrubs replanted. Because the shrubs in the middle zone are less dense, mitigation for these shrubs will be provided at a ratio of 3 to 1, or 15,651 shrubs replanted. For the upper zone containing 1 or less shrubs per acre, we have assumed there is 1 shrub occurring on each acre, and mitigation will be provided on a 1 to 1 ratio for a total of 1,660 shrubs replanted.

The resulting total mitigation requirement of 32,336 shrubs will be incorporated into the plantings being accomplished on the 2,700 acres of land to be acquired along the South Fork American River. This mitigation effort will be started prior to construction being started and will be completed before the project is finished. There will be a three year maintenance and monitoring period incorporated into the planting contract, and at the end of that period, the non-Federal sponsor will be responsible for assuring the success of all mitigation areas for the life of the project.

Valley Elderberry Longhorn Beetle
Distribution and Habitat Survey
for the Interior Natomas Area

## Introduction

The survey was conducted to determine the location elderberry shrubs within the interior of the Natomas basin. This survey involved mapping the occurrence and distribution of elderberry shrubs throughout the basin. The information obtained from this field survey will assist in determining the possible effects of future development (which will result from the proposed flood protection project) on the threatened valley elderberry longhorn beetle.

## Survey Discussion

With the size of the study area being roughly 55,000 acres, the abundance of streets and dirt roads made it possible to do a thorough search to locate and map the location of existing shrubs. Aerial photographs with a scale of 1" to 400' were used to map the location of elderberry shrubs found during the survey.

The method of search employed was to simply drive the entire study area and look for elderberry shrubs. In some places the survey team walked the levees in the southeast portion of Natomas as well as a portion of the East Main Drain and Cross Canal. In some of these areas and some internal areas, binoculars were used to determine if elderberry shrubs existed in inaccessible locations. Not only was the location of the shrubs determined, but the type of other vegetation associated with the shrubs was also noted.

## Results

A map of the Natomas basin showing where elderberry shrubs were found is attached. It is a very small scale in order to reveal the information obtained from the study.

The study revealed that elderberry shrubs were not found to occur within the interior of the Natomas area. This included the Natomas Cross Canal and the Natomas East Main Drain. However, the elderberry shrubs that were found occurred mostly on the landside of the Sacramento River levee. The shrubs occurred in this way:

1. A multi-stem elderberry shrub growing within a heavily vegetated area. Bush approximately 400 feet from Highway 80.

2. Elderberry habitat occurs at 2 miles North of San Juan on Garden Highway. Bush was a multi-stem shrub and was found growing with other vegetation. Area was heavily vegetated.

3. A small multi-stem shrub found at about one-third of a mile from Powerline on Garden Highway(G.H). Shrub is off to the right hand side of the road-can be seen from G.H. Area is heavily vegetated.

4. Another very small single-stem elderberry was found about 0.1 mile from the shrub described in 3 above.

5. A small multi-stem was found growing with other small shrubs at about 0.2 miles north of the shrub described in 4 above.

6. A single stem elderberry shrub was found about 1.5 miles north of Powerline Road. The shrub was growing by itself.

7. A small multi-stem shrub was found at about 3.0 miles north of Powerline Road. The shrub was located about 100 feet from Garden Highway on the south side of the irrigation canal. This area was heavily vegetated.

8. A small multi-stem elderberry was located 0.2 miles north of I-5. The shrub occurred 50 yards east of Garden Highway near a house. The shrub was growing in its backyard, along with ornamental shrubs.

9. A large multi-stem shrub occurred about 1.8 miles north of Elkhorn Road adjacent to a dirt road about 100 feet east of Garden Highway. The area was heavily vegetated and heavily traveled by large trucks.

10. Another multi-stem shrub was found growing in a field alone with a large oak tree at about 0.5 miles north of Elverta Road.

11. A multi-stem shrub was found growing in a field about 2.7 miles north of Elkhorn Road. It had heavy vegetation growing near it.

12. A multi-stem shrub was found about 1.5 miles north of Riego Road on Garden Highway growing in a stand of trees and shrubs.

13. A large multi-stem shrub was found about 100 feet north of Sankey Road. There was not much vegetation nearby except for small shrubs.

14. A small field to the southwest of the intersection of Northgate Boulevard and Garden Highway contains

approximately 15-20 multi-stem shrubs. The only other vegetation that inhabited this field was some trees and other small shrubs.

15. A small multi-stem shrub was found near East Levee Road about 100-yards from Northgate Boulevard. Vegetation in the area was quite abundant.

16. A small multi-stem shrub was found on East Levee Road about 150-200 yards east of Northgate Boulevard with abundant vegetation surrounding it.

## Discussion

The survey located 16 shrubs or groups of shrubs that can possibly be areas in which the Valley Elderberry Longhorn Beetle may live. The areas can be seen on the small map attached. If a larger scale is needed, 1" to 400' scale maps are available in the Environmental REsources Branch.



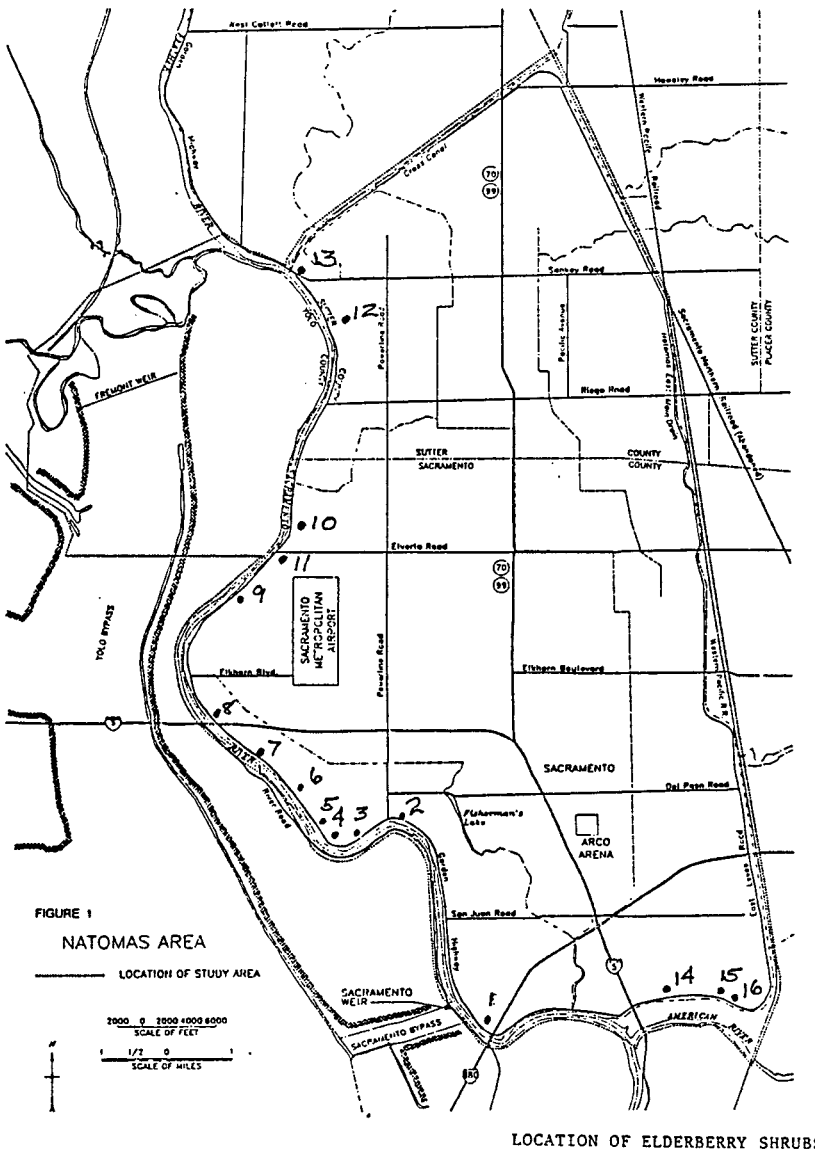


FIGURE 1
NATOMAS AREA
LOCATION OF STUDY AREA
SCALE OF FEET
SCALE OF MILES

LOCATION OF ELDERBERRY SHRUBS
IN NATOMAS BASIN

Construction and operation of the project in the Natomas area will not affect elderberry shrubs. There is no mitigation requirement for direct impacts to VELB in the Natomas area. However, there will be elderberry shrubs mixed into the planting mix used to compensate for impacts to riparian vegetation resulting from construction activities in the Natomas area. The 255-acre mitigation area will consist of a combination of wetland and upland riparian habitats. Elderberry shrubs will also be incorporated into the planting mix of native plants which will be used to revegetate the conveyor system alignment, the concrete processing and mixing plant sites, access roads, and disposal areas after construction is completed. As part of the operation and maintenance of the project, areas which are affected by slides or sloughing after flood events will be planted with suitable native species (including elderberry shrubs as appropriate).

The Natomas basin was surveyed to determine the location of elderberry shrubs which may be affected by development in the future. As described in the survey results attached, the elderberry shrubs that do occur in the Natomas area are generally found near the landside of the levee along the Sacramento River. The sixteen locations of elderberry shrubs identified generally occur as single shrubs except for those which are growing in a small field located at the intersection of Northgate Boulevard and the Garden Highway. This area contain as many as 20 small shrubs scattered in clumps. Many of these shrubs are located in areas which are not proposed for development under the adopted local plans. Incorporating elderberry shrubs into the planting mix for the mitigation area should provide sufficient compensation for future impacts to elderberry shrubs in the project area.

If you have any questions in this matter, please con
Michael Welsh at (916) 557-6718.

Sincerely,

Walter Yep
Chief, Planning Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1823
Sacramento, California 95825-1846

In Reply Refer To:
1-1-91-F-20

November 27, 1991

Colonel Laurence R. Sadoff
Environmental Resources Branch
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814

Subject: Biological Opinion on the Formal Section 7 Consultation for the American River Watershed Investigation, California

Dear Sir:

This responds to your May 6, 1991, request for formal consultation pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act). At issue are the effects of the American River Watershed Investigation on the federally listed threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle) and its elderberry (*Sambucus* species) habitat.

Your request for consultation was received on May 13, 1991. This office requested additional required information on September 24 and 27, 1991, and October 4, 1991. The requested information from your office, dated October 15, 1991, was received on October 18, 1991. Additional information on the mitigation for the proposed project was provided in your letter dated November 22, 1991. This formal consultation is based on the letters and associated material from your office, a meeting between Mike Welsh of your office and Chris Nagano of my staff on July 16, 1991, and November 4, 1991, a meeting between Mike Welsh and Peggie Kohl and Chris Nagano of my staff on September 11, 1991, a telephone conversation between Charles Baad of your office and Chris Nagano on September 25, 1991, and telephone conversations between Chris Nagano and Mike Welsh of your office on November 8, 1991 and November 20, 1991.

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Biological Opinion

It is our biological opinion that construction and operation of the proposed 200-year American River Watershed Investigation project alternative, including the mitigation for the beetle, as described in this biological opinion, is not likely to jeopardize the valley elderberry longhorn beetle and is not likely to result in destruction or adverse modification of its critical habitat. Although critical habitat has been designated for the beetle, none will be adversely affected by the proposed project.



Description of the Proposed Action

Please refer to the following documents for a detailed description of the proposed project: 1) *Draft American River Watershed Investigation, California Feasibility Report, Part I Main Report, Part II Draft Environmental Impact Statement/Environmental Impact Report;* and the accompanying *Documentation Report, volume 3-Appendixes N-Q* (DEIS) prepared by the Sacramento District of the U.S. Army Corps of Engineers and dated April 1991; 2) *CE-American River Watershed Investigation, Draft Report on the Distribution and Habitat for the Valley Elderberry Longhorn Beetle in the Study Area* (Study) prepared by the Sacramento Field Office of the U.S. Fish and Wildlife Service and dated April 2, 1991; 3) *Draft American River Watershed Investigation, Lower American River, substantiating report; Auburn Area, substantiating report and appendices* (Investigation) prepared by the Sacramento Field Office of the U.S. Fish and Wildlife Service and dated February 1991; and 4) *Existing and Proposed Land Uses of Alternative Mitigation Lands* (Report) by the Realty Division of the Sacramento District of the U.S. Army Corps of Engineers, dated November 9, 1991.

In brief, the proposed project was developed based on studies on flooding problems along the American and Sacramento Rivers in the greater Sacramento Area by the U.S. Army Corps of Engineers (Corps). A number of alternatives for flood protection to lands within the American River watershed at 400, 200, 150 and 100 year intervals were presented in the DEIS. The alternatives would involve various combinations of flood controls. The material supplied by the Corps in letter dated October 15, 1991, requested formal consultation on the 200-year project alternative (project). According to the DEIS, this would include setting the Folsom Dam release and American River capacity to 115,000 cubic feet per second, raising/replacing the bridge at Ponderosa Way and Main Avenue, raising the Yolo Bypass levees, raising/constructing new levees in Natomas, lengthening Fremont Weir for 1000 feet, building a dam at Auburn (Dry Dam) with a height of 415 feet and a storage capacity of 545,000 acre feet, relocating Highway 49 in the Dry Dam area, and constructing recreation trails in Natomas.

The beetle habitat on the North Fork American River and Middle Fork American River behind the Dry Dam would be inundated during a 200-year event, based on the Study and discussion of other fish and wildlife issues between the Corps and the Service. The letter from your office dated November 22, 1991, indicated that this area could be covered for a short period or a time period of not more than 20-days.

To offset adverse impacts to the beetle and its habitat, the Corps has developed a mitigation plan. This plan includes the following mitigations:

1. Acquisition of fee-title to 2,700 acres of the South Fork American River above referenced in the November 9, 1991, report.

2. Planting of 37,336 elderberry shrubs in the 2,700 acres on the South Fork American River.

3. Maintaining and monitoring the 2,700 acres for three years and at the end of that period, the non-Federal sponsor will be responsible for assuring the success of all mitigation areas for the life of the project.

4. Revegetating of areas behind the Dry Dam eliminated by landslides during 200-year flood events.

Species Account/Environmental Baseline

The valley elderberry longhorn beetle is dependent on its host plant, the elderberry shrub (*Sambucus* sp.). The beetle ranges from Redding to the Bakersfield area and from the west slope of the Sierra Nevada to the east slope of the Coast Range in California. Adult specimens have been found from the valley floor to an altitude of 2,700 feet in the western foothills of the Sierra Nevada. Exit holes made by the beetle have been found in the Auburn area of Placer County. Use of elderberry plants by the animal, a wood borer, is rarely apparent. Frequently, the only exterior evidence of the shrub's use by the beetle is an exit hole created by the larvae prior to the pupal stage. Our June 28, 1984, Valley Elderberry Longhorn Beetle Recovery Plan contains further details on the beetle's life history.

The study documents the occurrence of 16,945 acres of beetle habitat in the project area. Many of the elderberry shrubs in the project area show evidence of use by the beetle, i.e, emergence holes. In addition, adult beetles have been observed on numerous instances on the American and Sacramento Rivers in Sacramento County. Thus, all elderberry shrubs with a stem diameter of one inch or greater in the project area are considered to be habitat for the animal. Suitable habitat was classified as follows: Category 1-elderberry shrubs common to abundant, clumps of shrubs commonly present, typically ranging in abundance from >5 to many shrubs per acre; Category 2-elderberry shrubs common to infrequent, ranging from >1 shrub per acre to 5 or more per acre; and Category 3-elderberry shrubs infrequent to rare, frequently sparse, isolated or widely scattered often single shrubs typically <1 shrub per acre. There are 1108 acres of category 1 habitat, 3,872 acres of category 2 habitat, and 11,965 acres of category 3 habitat in the project area. Exit holes made by the threatened valley elderberry longhorn beetle are located in a number of these plants.

Effects of the Action

According to the DEIS, the Study, and the Investigation, 3,900 acres of habitat for the threatened valley elderberry longhorn beetle above the Dry Dam would be lost over the life of the project as a result of flooding, inundation, landslides, and other associated impacts.

Our analysis indicates that the Natomas portion of the proposed project is not likely to result in any take of the beetle. Although beetles are found from the site of the Dry Dam to the mouth of the American River, it is unlikely



that any take will result as a result of impacts from the proposed project. The planting of elderberry shrubs and associated native vegetation in the Natomas East Main Drain area, as described in your letter of November 22, 1991, may benefit the long term survival and recovery of the beetle.

The U.S. Fish and Wildlife Service has developed compensation guidelines for the valley elderberry longhorn beetle (USFWS 1988) that recommend measures to offset adverse impacts to the species and its habitat. Copies of these guidelines were provided earlier to your staff. The Corps has measured the amount of beetle habitat on the North Fork American River and Middle Fork American River above the Dry Dam that will be adversely affected by a 200-year event. The letter indicates that there are 601 acres of Category-1 habitat, 1,739 acres of Category-2 habitat, and 1,660 acres of Category-3 habitat. There are approximately 3,005 shrubs in the Category-1 habitat area, 5,217 shrubs in Category-2 habitat area, and 1,660 in Category-3 habitat area. For the Category-1 habitat, the Corps will be mitigating at a ratio of five elderberry shrubs for every one lost (15,025 shrubs), three to one or 15,651 shrubs for Category-2 habitat, and one to one or 1,660 shrubs for the Category-3. Thus a total of 32,336 elderberry shrubs will be planted at the mitigation area on the South Fork American River.

Based on the foregoing analysis, the proposed project is not likely to significantly reduce the population size of the threatened valley elderberry longhorn beetle and thus reduce the likelihood of its survival and recovery nor will it result in adverse modification or destruction of critical habitat.

Cumulative Effects

Cumulative effects are those impacts of future State, local and private actions affecting endangered and threatened species that are reasonably certain to occur in the action area. This area in the Sacramento Valley is being developed, primarily by private parties for residential and commercial development. However, actions of which we are aware of at this time together with those addressed in this Biological Opinion are not expected to appreciably reduce the likelihood of the survival and recovery of the valley elderberry longhorn beetle.

Incidental Take

Section 9 of the Endangered Species Act prohibits any taking (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct) of listed wildlife species without special exemption. Under the terms of Section 7(b)(4) and 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered prohibited taking within the bounds of the Act provided that such taking is in compliance with this Incidental Take statement. The measures described below are not discretionary, and must be undertaken by the action agency or the project sponsor, as appropriate.

Proposed project actions that may result in the death or injury of listed species have been previously discussed in this Biological Opinion. There is no way to estimate the number of beetle larvae contained within each elderberry. From recent field work on the Cosumnes River and the Folsom Lake area, we know that larvae galleries can be found in stems with no evidence of emergence holes (either the larvae succumb prior to constructing the emergence hole or they have not come far enough along in the developmental process to construct their hole). Larvae appear to be distributed in stems 1.0 inches or larger in diameter at ground level. Because we do not know how many larvae each stem can support, we cannot simply multiply the number of stems by a given number to estimate the number of beetles present. In addition, due to the substantial acreage inhabited by the beetle that will affected by the proposed project and the extreme difficulty of survey this area, we present the estimate of incidental take of the beetle in terms of the number of elderberry plants or acreage containing beetle habitat that will be lost. Based on the available information, the Service anticipates that all valley elderberry longhorn beetles inhabiting all elderberry shrubs with a stem diameter of one inch or greater on 3,900 acres above the Dry Dam along the North Fork American River and Middle Fork American River identified in the Study will be taken as a result of the implementation of the project.

The following reasonable and prudent measures are necessary and appropriate to minimize the take:

1. Loss of valley elderberry beetle habitat on the North Fork American River and Middle Fork American River shall be compensated for prior to construction of the 200 year flood control alternative of the American River Watershed Investigation.

2. Measures shall be implemented to insure the success of the mitigation and maintain the mitigation site as valley elderberry beetle habitat in perpetuity.

In order to be exempt from the prohibitions of Section 9 of the Act, the following terms and conditions, which implement the reasonable and prudent measure described above, must be complied with:

1) The Corps shall acquire fee title for compensation habitat on the South Fork American River for the valley elderberry longhorn beetle.

   a. At least twelve (12) months prior to the initiation of construction of the project, the Corps shall acquire fee title for 2,700 acres of valley elderberry beetle habitat along the South Fork American River. The lands shall be specifically designated as valley elderberry beetle habitat. If fee title is given to an appropriate resource agency or conservation organization, the Service must concur with the transfer.

2. Measures shall be implemented to insure the success of the mitigation and maintain the mitigation sites as valley elderberry beetle in perpetuity.





a. Elderberry seeds for the plantings on the South Fork American River shall be taken from native populations along the American River or the immediate vicinity. Saplings shall be utilized in the restoration areas. Approval of the Service is required for the donor sites.

b. Recent studies have found that beetles were more abundant in more dense native plant communities with a mature overstory and mixed understory versus a low overstory and young understory. Therefore, a mix of native riparian trees including cottonwood (*Populus fremontii*), white alder (*Alnus rhombifolia*), and oak (*Quercus agricolis* and *Q. lobata*) shall be planted at a ratio of at least two of these species for every five elderberry shrubs (64,672 plants total). These plantings also shall be monitored with the same survival criteria utilized for the elderberry plants. The saplings shall be from native populations on the American River or from the immediate project vicinity. The approval by the Service of the native plant donor sites shall be obtained prior to initiation of any of the revegetation work.

c. A planting plan for the mitigation area on the South Fork American River shall be developed by the Corps within twelve (12) months of the date that construction is begun. It shall be approved by the Service prior to its implementation.

d. Cattle and other livestock that feed on elderberry shrubs and other native vegetation shall be excluded from the mitigation area on the South Fork American River.

e. A qualified biologist(s) shall review all aspects of the mitigation plan. The biologist(s) utilized shall be subject to the approval of the Service.

f. Personnel from the Service shall be given access to the mitigation site in perpetuity to monitor implementation and success of the mitigation plan.

g. A minimum of 80 percent of the original 32,336 elderberry shrubs planted in the mitigation area on the South Fork American River must be alive ten years from the date the mitigation program is implemented. If this survival rate is not met, the Corps shall reinitiate formal consultation with the Service.

h. The population of the adults of the threatened valley elderberry longhorn beetle and the general condition of the mitigation site on the South Fork American River shall be monitored annually for the life of the project by a qualified

entomologist. Two visits between February 14 and June 30 of each year shall be made beginning the year the mitigation is begun. The study shall 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 plants, including the number of plants observed and their size, and condition; and a general assessment of the habitat, including any real or potential threats to the beetle, its food plants, such as erosion, excessive grazing by livestock, off-road vehicle use, etc. Random-walk counts shall 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 shall be reviewed and approved by the Service. All appropriate Federal and State permits shall be obtained prior to initiating the field studies.

i. A written annual report analyzing the data from the monitoring of the threatened valley elderberry longhorn beetle at the mitigation site on the South Fork American River shall be prepared annually for the life of the project by a qualified entomologist and submitted to the Service for approval. Three copies of the final report shall be conveyed to the Sacramento Field Office of the Service by August 31 of each year beginning the year the restoration plan is initiated. The report shall include, but not be limited to, the raw data collected during the field surveys and also a thorough analysis of the population dynamics of the valley elderberry longhorn beetle. The following shall be analyzed for the beetle: estimated population size (using both open and closed population models), and spatial distribution. Trends in food plant size and availability shall be analyzed. Maps showing where the individual adult beetles were observed shall be included. Real and likely future threats shall be addressed along with suggested mitigations (e.g. fencing access to off-road vehicles, etc.). At the end of each reporting period, the original field notes, photographs, correspondence, and all other pertinent material, as well as a copy of the report shall be deposited and accessioned into the Natural History Museum of Los Angeles County (Entomology Section, Natural History Museum of Los Angeles County, 900 Exposition Blvd., Los Angeles, California 90007) by September 30 of each year. All of the material shall be prepared to the standards of that institution. The Sacramento Field Office shall be provided with the accession numbers given to this material by the Natural History Museum of Los Angeles County. The Service may confer with the California Department of Fish and Game as part of the review of the progress of the mitigation plan.

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The Service is to be notified within three working days of the finding of any injured or dead valley elderberry longhorn beetles or any unanticipated harm to elderberry host plants associated with project implementation. The Service contact persons for this information is Chris Nagano (916/978-4866 or FTS-460-4866). Any valley elderberry longhorn adult beetles found injured shall be turned in to the California Department of Fish and Game. The agency contact is Dr. Larry Eng (916/455-1383). Any valley elderberry longhorn adult beetles found dead shall be deposited in the Entomology Section of the Natural History Museum of Los Angeles County.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. The term "conservation recommendations" has been defined as suggestions from the Service regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information. We recommend the following additional actions for the listed species.

1) The Corps undertake planting of elderberry shrubs in the 255 acre wildlife mitigation area along the east side of the Sacramento River. These efforts also possibly may benefit candidate species, including the giant garter snake (*Thamnophis gigas*) and the tricolored blackbird (*Agelaius tricolor*).

2) The Corps undertake planting of elderberry shrubs in the restoration areas in the Natomas East Main Drain and other suitable habitats of the American River Watershed Investigation.

This concludes formal consultation on work described in the biological assessment. Reinitiation of formal consultation is required if the amount or extent of incidental take is exceeded, if new information reveals effects of the actions that may affect listed species or critical habitat in a manner that was not considered in this opinion, and/or if a new species is listed or critical habitat is designated that may be affected by the action. We appreciate the time and effort your staff has provided in assisting us with this biological opinion. If you have any questions regarding this opinion, please contact Chris Nagano, staff entomologist, at (916) 978-4866 or FTS 460-4866.

Sincerely

Wayne S. White
Field Supervisor

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

November 29, 1991

Colonel Laurence R. Sadoff
District Engineer
U.S. Army Corps of Engineers
Sacramento District
650 Capitol Mall
Sacramento, California 95814

Subject: American River Watershed Investigation

Dear Sir:

This letter transmits our enclosed detailed report and accompanying substantiating reports on the effects that proposed flood control alternatives for the American River watershed would have on the fish and wildlife resources. Our report has been prepared under the authority, and in accordance with the provisions, of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is for inclusion in your feasibility report. We have made various recommendations regarding protecting fish and wildlife and mitigating for unavoidable fish and wildlife resource losses. Please advise the Fish and Wildlife Service of your proposed actions concerning these recommendations.

Because of the expedited schedule for completing this final Fish and Wildlife Coordination Act Report, we have not received concurrence in our report from the California Department of Fish and Game and the National Marine Fisheries Service.

We appreciate the cooperation and assistance of your staff during this comprehensive planning and reporting effort. For any questions regarding this report, please contact Wayne White at (916) 978-4613.

Sincerely,

Dale A. Pierce

for Wayne S. White
Field Supervisor

Enclosures

December 5, 1991

Environmental Resources Branch

Mr. Wayne S. White, Field Supervisor
Fish and Wildlife Service
Fish and Wildlife Enhancement
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

Dear Mr. White:

We are writing to clarify issues contained in your Biological Opinion and in the Coordination Act Report transmitted by your November 29, 1991 letter. From reading these two documents, it is our understanding that you will require two separate parcels in order to provide mitigation for the project impacts in the upper canyon area. Based on telephone conversations between Chris Nagano of your staff and Mike Welsh of my staff, it was our understanding that it was acceptable to use the same parcel of land to accomplish both the endangered species and general wildlife mitigation. The mitigation plan included in our November 22, 1991 letter anticipated that the elderberry shrubs needed would be included in the mix of vegetative plantings to be accomplished to compensate for the loss of habitat resulting from construction and operation of the detention dam. If it is not acceptable to provide mitigation for endangered species in this manner, please explain why it is not.

We would also like to emphasize that the mitigation plan contained in our November 22 letter was based on the most severe set of assumptions that could reasonably occur: (1) The area behind the dam will be inundated during the first few years of the project life; (2) When a shrub becomes inundated, it no longer provides habitat for the valley elderberry longhorn beetle, VELB, over the 100-year project life; (3) The beetle found in this area is, in fact, the VELB; (4) All elderberry shrubs in the project area provide habitat for the VELB; (5) All of the shrubs in the lowest elevations provide highly effective VELB habitat, and that in the higher elevations (as the shrubs become more isolated) they provide less valuable habitat. As you may know, the chance of all of these assumptions occurring is remote. As stated in our November 22 letter, we will undertake detailed investigations during the preconstruction engineering and design portion of the project to determine the presence or absence of VELB emergence holes in the stems of shrubs located behind the detention dam and to refine the mitigation requirement for this protected species.





Assuming your clarification confirms that the same 2,700-acre parcel may be used for both endangered species and general wildlife habitat mitigation, we offer the following general comments on the Biological Opinion. Although our findings at the field level are subject to review by our higher authority, we are proposing to incorporate the following project features into our feasibility report and accompanying EIS/EIR: (1) the four mitigation provisions; (2) the nine incidental take provisions; and (3) the two conservation recommendations. The quantity of shrubs planted for the two conservation recommendations will be further coordinated with you during preconstruction engineering and design.

Since we have only recently been made aware of the presence of VELB in the foothill areas, our staffs need to continue to work closely in resolving these issues. If you have any questions in this matter, please contact Michael Welsh at (916) 557-6718.

Sincerely,

Walter Yep
Chief, Planning Division

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
Fish and Wildlife Enhancement
Sacramento Field Office
2800 Cottage Way, Room E-1803
Sacramento, California 95825-1846

In Reply Refer To:
1-1-92-TA-157

December 13, 1991

Colonel Larry Sadoff
Planning Division Attention: Mr. Walter Yep
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Subject: American River Watershed Investigation-Mitigation Requirements and Recommendations Pursuant to the Endangered Species Act of 1973, as Amended, and Fish and Wildlife Coordination Act

Dear Mr. Yep:

This responds to your letter of December 5, 1991, requesting clarification of the measures needed to fully mitigate the impacts of the American River Watershed Investigation (project) pursuant to the Endangered Species Act of 1973, as amended (ESA), and the Fish and Wildlife Coordination Act (Coordination Act). At issue are the mitigation measures required for the threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) (beetle) and other recommended measures for other fish and wildlife resources adversely affected by the project.

There are two issues of concern to the U.S. Fish and Wildlife Service. The first issue concerns the measures needed to offset impacts to the beetle that would occur upstream of the detention dam. Your staff was advised about the presence of suitable habitat and the likely presence of the beetle in our special report to your office, titled "CE-American River Watershed Investigation, draft report on the distribution and habitat for the valley elderberry longhorn beetle," dated April 2, 1991. Our biological opinion with its finding of no jeopardy to the beetle is based on the information you provided in your November 22, 1991, letter, addressing impacts to the beetle as subsequently confirmed in your December 5, 1991, letter, as well as other documents. It was our understanding that these documents incorporated the best scientific information available and included your assessment of the impacts along with your proposed mitigation plan as required to initiate consultation (50 CFR 402.14(c)).

The second issue concerns integration of mitigative measures for endangered species and other wildlife to accomplish both ESA and Coordination Act mitigation needs. As you are aware, we have examples of integrated mitigation planning in the Sacramento area in progress, i.e., Sacramento River Flood Control Systems Evaluation (Elkhorn site) wherein both endangered species and other wildlife mitigative measures were planned within the same compensation area. In the case of the Elkhorn site, through careful and detailed planning,

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Mr. Walter Yep

we were able to incorporate vegetative plantings in specific landscape designs so that wildlife habitat goals for both the beetle and other wildlife were met. This detailed integration planning was requested and supported by your agency and we agreed that it was a prudent and reasonable action.

In this project, there was no request for integrated planning to meet ESA and Coordination Act mitigation needs prior to issuance of our biological opinion or completion of the Coordination Act report. For this reason, two separate and independent analyses were completed pursuant to the ESA and Coordination Act requirements. Results of these analyses were included in our biological opinion, dated November 27, 1991, and our Coordination Act report, dated December 6, 1991.

We agree that integrating the mitigation measures needed under both Acts to the maximum extent possible is reasonable and prudent, however, without clear direction, funding and adequate time, we are unable to justify any change in our findings. It may be possible to credit portions of the planting of elderberry (*Sambucus* sp.) and other required vegetation on the lands that will be acquired on the South Fork American River as compensation for the beetle, as described in your letter of November 22, 1991, and our biological opinion, as partial mitigation for impacts for other fish and wildlife resources. However, we caution that such mitigation would need to include sound biological planning, and sufficient mitigation lands, including the correct ecological components, along the South Fork American River to offset the loss of all fish and wildlife values that would be lost above the proposed detention dam.

We remain willing to work with the Corps towards resolution of this issue. Please contact Chris Nagano (endangered species) at 916/978-4866 or Gary Taylor (other fish and wildlife) at 916/978-4613 if you have any questions.

Sincerely,

Wayne S. White
Field Supervisor

cc: Regional Director (AFWE), FWS, Portland, OR

STATE OF CALIFORNIA—THE RESOURCES AGENCY
PETE WILSON, Governor
THE RECLAMATION BOARD
1416 Ninth Street, Room 455-6
Sacramento, CA 95814
(916) 653-5434

December 16, 1991

Colonel Laurence R. Sadoff
District Engineer
Sacramento District
U. S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Dear Colonel Sadoff:

The Reclamation Board and the Sacramento Area Flood Control Agency indicate our intent by this letter, as conditioned below, to be the nonfederal sponsors for the flood control project recommended in the proposed American River Watershed Investigation Final Feasibility Report and Environmental Impact Statement/Environmental Impact Report.

The selected plan contemplates the construction of a flood-control-only dam on the North Fork of the American River near the City of Auburn capable of providing protection from a 1-in-200 flood event and the raising and improvement of federal project levees in the Natomas area, as well as other flood control improvements located in Sacramento and Sutter Counties. The urgent need for these facilities is described in the project feasibility report prepared by the Sacramento District of the U. S. Army Corps of Engineers in cooperation with the Board and SAFCA.

Subsequent to federal, State, and local authorization and appropriation, and only after completion of the review process required under the California Environmental Quality Act, the Board and SAFCA would enter into a local cooperation agreement to provide all nonfederal requirements for lands, easements, rights of way, relocations, and cash contributions as required and in accordance with the Water Resources Development Act of 1986 (PL 99-662). Submittal of this letter of intent is not an obligation of future unappropriated State funds by the California Legislature nor of local agency funds. As part of its review process, the nonfederal sponsors intend to conduct a public hearing/meeting on the reports mentioned above.



If you have any questions, please have your staff contact Raymond Barsch, General Manager of The Reclamation Board, at (916) 653-5434.

Sincerely,

Wallace McCormack, President
The Reclamation Board
State of California

Elwin F. Christopher, Chairman
Sacramento Area Flood
Control Agency

Advisory
Council On
Historic
Preservation

The Old Post Office Building
1100 Pennsylvania Avenue NW #809
Washington DC 20004

Reply to: 730 Simms Street #401
Golden, Colorado 80401

December 16, 1991

Laurence R. Sadoff
District Engineer
Colonel, Corps of Engineers
Sacramento District
1325 J Street
Sacramento, CA 95814-2922

REF: Programmatic Agreement regarding the implementation of the American River Watershed Project

Dear Colonel Sadoff:

The enclosed Programmatic Agreement regarding the American River Watershed Project has been executed by the Council. This action constitutes the comments of the Council required by Section 106 of the National Historic Preservation Act and the Council's regulations. Please send copies of the signed Agreement to the California Historic Preservation Officer, the Bureau of Reclamation, the Reclamation Board, the Sacramento Area Flood Control Agency, and your Federal Preservation Officer.

The Council appreciates the aid of Ms. Sannie Osborn and your cooperation in reaching a satisfactory resolution of this matter. We look forward to working with the Corps on implementation of the stipulations of the agreement.

Sincerely,

Claudia Nissley
Director, Western Office
of Project Review

Enclosure

# RESOLUTION NO. 90-002

Adopted by the Sacramento Area Flood Control Agency
on Date of

February 8, 1990

## AMERICAN RIVER WATERSHED INVESTIGATION PROJECT CONSENSUS

BE IT RESOLVED BY THE SACRAMENTO AREA FLOOD CONTROL AGENCY BOARD OF DIRECTORS THAT:

1. The Corps of Engineers construct a flood control project which provides at least 200-year level of protection consisting of:

   a. An expandable flood control dam at or near the Auburn site, and raise the levees in and around the Natomas area.

   b. Reoperate Folsom Reservoir in order to provide additional flood storage until the flood control dam at Auburn is constructed. At such time as the flood control dam is completed at Auburn, Folsom Reservoir would return to its original operational configuration.

2. The specific additional cost and payment of expandability be refined during the Corps' feasibility study, but that, in the final analysis, the cost be assigned to those benefitting from the water and power supplies when and if the dam were ever expanded.

3. The State Department of Water Resources be requested to assist and work with the local water agencies in order to develop specific proposals in order to resolve the local water supply, storage and/or conveyance problems. Examples of specific proposals to resolve the local short or long term water supply, storage and/or conveyance problems include but are not limited to the following:

   a. A recognition by Congress of its intent to give or honor Sacramento, Sutter, El Dorado, and Placer Counties' priority to any water supply developed by an enlarged flood control dam resulting from State area of origin laws when it considers a bill to authorize the enlargement of the flood control dam. San Joaquin County could be given the same priority by Congress if they agree to take their future share of American River water from the Sacramento River.

   b. The Bureau could be required to fulfill previous commitments to Placer County by furnishing CVP project power to pump American River water into the Auburn Ravine Tunnel until the county's power contracts with PG&E expire in 2013. After that date Placer County could use its own developed power resources to pump the water. Placer County could be required to relieve the Bureau of its contractual obligation to construct a temporary pumping plant for the county as a condition of obtaining CVP power. SAFCA's support would be dependent upon Placer County's willingness to minimize the impacts of the diversions through the tunnel to water that is needed for M&I purposes and by not diverting water into the tunnel that can be practically diverted from the Sacramento River.

   c. The Bureau could assist El Dorado County in developing long term financing for water supply projects in the County through the use of the Small Projects Loan Act.

4. The SAFCA staff be directed to facilitate the execution of a memorandum of understanding among all relevant non-Federal parties regarding specific performance time tables for the construction of flood control as well as water delivery facilities in order that an agreement be reached regarding the specifics of the proposed project. The agreed upon performance timetables must conform to SAFCA's primary goal which is to introduce Congressional authorization legislation by mid-1991.

5. To this end, in cooperation with the Sacramento area's Congressmen, SAFCA develop legislation to be introduced in Congress in 1991 that would include the following:

   a. Authorization to construct a flood control project to include an expandable flood control dam near the Auburn Dam site. The project would be constructed by the Corps.

   b. A requirement that the Bureau provide an additional flood control storage reservation in Folsom Reservoir of 190,000 AF until the flood control project is sufficiently completed to provide the Sacramento area with 100-year level of flood protection. The local sponsor would be required to pay for any power revenue losses and increased pumping costs of local water districts resulting from this flood control operation, and not for any other unrelated reason that Folsom Reservoir storage may be lowered.

   c. A requirement of additional Congressional approval prior to the enlargement of the flood control dam.

   d. Designation of portions of the North and Middle Forks of the American River as a National Recreation Area. The SAFCA decision as to whether or not the Management Plan for the recreation area should provide for future expansion of the flood control dam will be postponed until the study of the Bureau of Land Management (BLM) has been completed in the fall of 1990.

e. A requirement that the additional costs associated with making the flood control dam economical to expand in the future be paid by a non-Federal sponsor. The specific additional cost and payment of expandability be refined during the Corps' feasibility study, but that, in the final analysis, the cost be assigned to those benefitting from the water and power supplies when and if the dam were ever expanded.

f. A requirement that the land now owned by the Bureau be maintained in public ownership.

g. A requirement that the bill would allocate only the costs that the Bureau has expended to date (sunk costs) on Auburn Dam that apply to previously constructed facilities, or portions thereof, that would be needed by the single purpose flood control project as if it had been started from scratch. The remaining sunk costs should be considered non-reimbursable at this time to make sure the existing CVP water and power contractors are not required to repay these costs. The final allocation of the remaining sunk costs would be addressed by Congress when legislation to enlarge the Dam is considered.

6. Finally the SAFCA Board of Directors orders its staff to continue to work with Local, State, and Federal parties to refine and improve the legislation proposed above. A goal should be established by SAFCA to have broad based support for the legislation prior to its introduction in 1991.

Grantland Johnson
CHAIRMAN

ATTEST:

William H. Edgar
SECRETARY

# American River Watershed Investigation, California

# APPENDIX B

# Plan Formulation

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA
FEASIBILITY REPORT

APPENDIX B

PLAN FORMULATION APPENDIX

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# PLAN FORMULATION APPENDIX

## CHAPTER I - INTRODUCTION

1. General. - This appendix describes the process and results used in the American River Watershed Investigation in formulating and selecting a plan for recommended construction.

2. Procedures Followed in Plan Formulation. - The procedure followed in this study for formulating and selecting a plan for recommended implementation was as follows:

- Establish specific objectives for implementing a plan to resolve the identified flood problems and, to the extent possible, related water resources needs.
- Define constraints and criteria for formulating an implementable plan.
- Identify, document, and evaluate, with respect to the planning constraints and criteria, management measures to reduce flood damages and address the other water resources needs.
- From the management measures, assemble, display, and evaluate an array of alternatives to address the study objectives.
- Identify the plan that maximizes national economic development (NED) benefits.
- Compare and evaluate the alternative and select and display a plan for recommended implementation.

3. Planning Objectives. - As described in Chapter III of the Main Report, a serious flood problem exists in the Sacramento area. There is also the need for increased incidental recreation, water supply, hydropower supply, and instream flow enhancement. Based on these problems, needs, and opportunities, the following planning objectives were developed and used in the formulation of a recommended plan.

- Provide increased prudent levels of flood protection for the Sacramento urban area from overflows of the American River and in Natomas and lower Dry Creek. In this regard, the non-Federal sponsor's planning objective is to seek a high level of protection (200 year or greater) from flooding along the American River.

- Enhance recreation opportunities in the study area incidental to the flood control objective.

- If possible, enhance water supply and hydropower opportunities at Folsom Dam and Reservoir and evaluate such opportunities in the watershed incidental to the flood control objective.

- Develop the selected plan in accordance with the Federal objective of water and related land resources planning, which includes features to contribute to NED consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other Federal planning requirements.

4. Planning Constraints and Criteria. -

a. Constraints. - Fundamental to the plan formulation process is an understanding of the constraints within which the process can be accomplished. Three major constraints for this project are described below:

(1) Authorization. - Authorization for the study established several constraints.

- Study Area. - The study area is the American River Watershed, Natomas, and the lower Dry Creek area.

- Project Type. - The authorization directed study primarily of a peak-flow flood control facility on the North (and Middle) Fork of the American River above Folsom. This, coupled with authorization for the reconnaissance scope investigation and coordination with other Federal, State, and local agencies and interests, indicates that (1) Auburn Dam as previously authorized should be assumed to not be constructed in the foreseeable future and (2) any plan selected should neither preclude nor enhance the potential completion of the Auburn Dam project.

- Incidental Benefits. - Other benefits of water, power, and recreation should be considered as incidental and related to the coordinated operation of the peak-flow flood control facility and Folsom Dam. Further, an assessment of water supply needs only within the American River should be a part of the study.

(2) Laws, Regulations, and Policies. - A host of laws, regulations, executive orders, and policies must be considered. Among them are the National Environmental Policy Act (NEPA), the Fish and Wildlife Coordination Act, Clean Air Act, and Clean Water Act. These and others are listed in the EIS.

(3) Existing Projects. - The purpose, operation and limitations of existing projects must be considered. As mentioned, it is assumed here that levee and channel modifications identified as part of the Sacramento River System Evaluation (Sacramento River Flood Control Project) and Sacramento River Bank Protection Project have been completed.

b. Criteria. - To lend more specificity to the project objectives and provide a uniform set of guidelines for further formulation and evaluation, four criteria have been established as follows:

(1) Completeness. - Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.

- Alternative plans should address the objectives.
- Alternatives should need no other actions to assure complete fulfillment of purposes.
- Alternative should be capable of implementation.
- Unavoidable adverse environmental impacts should be mitigated as fully as is found to be reasonable and justified.
- An alternative should be capable of consistently and reliably providing a specified degree of flood protection and other accomplishments.
- Alternatives should fully compensate or offset adverse hydraulic impacts to other areas (i.e., not induce flooding or increase the risk of damaging flooding in adjacent areas).

(2) Effectiveness. - Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified objectives.

- Public health and safety should be considered.
- Displacement of people should be avoided to the extent possible.

- Environmental attributes of the area should be preserved, maintained, or restored.

(3) 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.

- Benefit-Cost Ratio - The benefit-cost ratio of the selected plan must be greater than unity (i.e., average annual benefits must exceed the annual cost).

- NED - The alternatives should recognize the differences associated with the NED (i.e., that alternative which maximizes net economic benefits).

- Estimated first cost is to be based on October 1991 price levels.

(4) Acceptability. - Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public polices.

- There must be a non-Federal sponsor capable and willing to pay its share of the project cost.

- The alternatives should be workable within the constraints of present and potential governmental arrangements in the project area.

- Irreversible effects on the environment and irretrievable commitments of nonrenewable resources should be minimized and avoided, where possible.

## CHAPTER II - FLOOD CONTROL MANAGEMENT MEASURES

5. General. - A variety of measures to help increase the level of flood protection in the American River Watershed were identified by the Corps, the local sponsor, and by other interested organizations and individuals. They were separated into measures specific to the main stem American River and Natomas, and non-traditional flood control. They include:

- Main Stem American River

  - Increase Flood Control Storage Space in Folsom Reservoir
  - Increase Downstream Channel Capacity with Levee and Channel Modification
  - Increase Downstream Channel Capacity with Setback Levees
  - Perform Structural Modification to Folsom Dam
  - Raise Folsom Dam
  - Use Upstream Reservoir Storage Space for Flood Control
  - Construct New Upstream Flood Control Storage
  - Improve Flood Forecasting and Folsom Reservoir Operations
  - Construct Small Detention Facilities in the Upper Basin
  - Construct Offstream Storage Facilities
  - Construct Out-of-Basin Diversion Facilities
  - Divert Floodflows into Sacramento River Deep Water Ship Channel

- Natomas

  - Construct Levee and Channel Improvements in and Around Natomas Area
  - Construct Compartment Levee in Natomas
  - Construct Gated Structures and Pumping Stations
  - Construct Detention Dams Upstream from Natomas
  - Modify Fremont Weir
  - Construct Sacramento River Constriction
  - Construct New Natomas Cross Canal (NCC)
  - Reduce Objective Release from Folsom Dam to Lower Stages in Natomas East Main Drainage Canal (NEMDC)
  - Construct a Detention Basin in North Natomas

- Nonstructural

  - Flood Proofing
  - Flood Plan Evacuation
  - Development Restrictions
  - Flood Warning

6. Main Stem American River. -

a. Increase Flood Control Storage Space in Folsom Reservoir. - This measure would achieve an increase in the existing level of flood protection along main stem American River by seasonally increasing the flood space. This measure would trade water conservation storage for flood control storage.

Reservoir routing studies were made to estimate the effects of increasing the designated flood control storage space in Folsom Reservoir over the current seasonal storage of 400,000 acre-feet. Table B-1 includes the resulting estimates of increased flood protection provided by this measure along the main stem American River for storages of 500,000, 590,000, and 650,000 acre-feet.

TABLE B-1

INCREASING FOLSOM FLOOD CONTROL STORAGE CAPACITIES
OBJECTIVE OUTFLOWS OF 115,000 CFS

| Flood Control Storage[1] (1,000 acre-feet) | Objective Release (1,000 cfs) | Maximum Frequency of Control (Return Period - yrs)[2] | Peak Outflows from Folsom For Given Events of (1,000 cfs) | | |
|---|---|---|---|---|---|
| | | | 100-yr | 200-yr | 500-yr |
| 400 [3] | 115 | 63 | 230 | 430 | 580 |
| 500 | 115 | 75 | 190 | 420 | 580 |
| 590 | 115 | 85 | 153 | 400 | 580 |
| 650 | 115 | 94 | 130 | 380 | 580 |

[1]Use of surcharge reservoir storage was assumed in all routings.
[2]Along main stem American River.
[3]Existing condition.

Table B-1 shows that through this measure, the maximum level of increased flood protection obtainable along the lower American River is about 94 years. This level of protection is obtained assuming the existing objective release of 115,000 cubic feet per second (cfs) and an increase in Folsom flood control storage to 650,000 acre-feet. Also included in this analysis is use of about 50,000 acre-feet of surcharge storage at Folsom and the availability of 47,000 acre-feet of incidental storage in existing upstream reservoirs operated by the Sacramento Municipal Utility District (SMUD) and Placer County Water Agency (PCWA). Table B-1 also shows that the maximum peak outflow for a 100-year flood event from such an operation would be 130,000 cfs. This flow

level would test the capabilities of the existing levee system downstream of Folsom Dam, just as occurred in the 1986 flood (peak flow in 1986 flood was 134,000 cfs).

It is critical to understand that in order to control to the levels of protection shown in Table B-1, encroachment into reservoir surcharge storage is required. Allowing encroachment into reservoir surcharge storage for the purpose of developing flood control alternatives is contrary to standard engineering practice. Reservoir surcharge storage space is typically provided as a safety factor in the sizing of a reservoir. Surcharge storage space is the space above the top of the flood control pool (gross pool). Surcharge storage is not used during the design phase of a project to reduce the required flood control space below gross pool. It is a contingency for control of floods larger than the reservoir design flood. Surcharge storage may be utilized to obtain additional flood control effectiveness or safer operation of an existing project in some cases; however, it is not to be designated as part of the required flood control space. This space provides a margin of safety in the event of unforseen circumstances (e.g., uncertainties in hydrology and flood forecasts, wave action from high winds or sloughing in reservoir area). The consequence of not having adequate surcharge space is a higher potential for dam overtopping.

Maximum frequency of control information provided in Table B-1 is based upon Corps' hydrology. It is important to recognize, however, that by using flow-frequency analysis procedures adopted by the Federal Emergency Management Agency (FEMA), an 85-year Corps-estimated event on the American River would equal about a 100-year FEMA event. To approximate a FEMA 100-year protection level, Table B-1 indicates that 590,000 acre-feet of storage is required in Folsom Reservoir. Again this assumes 47,000 acre-feet of upstream storage available and an encroachment into surcharge space of 50,000 acre-feet. It should also be noted, however, that FEMA procedures would not consider the 47,000 acre-feet in upstream reservoirs as available for flood control purposes since that space is dedicated to power generation purposes, not to flood control. Neither would FEMA procedures allow use of surcharge space.

Storage of 675,000 acre-feet would be required in Folsom Reservoir to control an 85-year (FEMA 100-year) event assuming 47,000 acre-feet of available space in upstream reservoirs without surcharging. Storage of 725,000 acre-feet would be required in Folsom Reservoir to control the 85-year event without upstream space and without surcharging.

Increasing the seasonal flood space would result in losses of existing project accomplishments (water supply, hydropower, and recreation) and adversely affect the environmental resources of the area. Increased flood control storage would reduce the firm

yield water supply available to the Central Valley Project (CVP) and reduce the amount of energy available for sale to existing Western Area Power Administration (WAPA) customers. Reduced average water surface elevations would adversely impact existing recreation activities at the Folsom Reservoir State Recreation Area in the off-season periods, especially operations of the marina and boat launch ramps. In general, because the reservoir would in most years fill in the spring from snow melt runoff, there would not be a large impact on peak summer recreation activities. Recreation in the lower American River is moderately impacted by reduced riverflows in the late summer.

Several water utilities obtain their water supply directly from Folsom Reservoir. By lowering the average water surface elevations, these entities are required to pump for longer durations in order to deliver water to their customers. This is a direct financial cost to these entities. Some of the water utilities have contracts with the U.S. Bureau of Reclamation (USBR) which require that agency to supply the water. The additional pumping energy is obtained from the Folsom Powerhouse, further reducing the amount of energy available for sale through WAPA.

Lower reservoir volumes and reduced flows in the river create higher water temperatures which adversely affect survival of the natural and hatchery fall-run salmon in American River. Low flows can further reduce available spawning habitat for natural spawning in the river, thereby concentrating fish in remaining habitat and allowing increased predation. The loss of cold water resulting from reservoir storage changes would also essentially eliminate the cold water fishery of the reservoir. Changes in downstream flows in spring and winter are expected to adversely affect the survival of wetland vegetation species in the lower American River, creating a gradual shift from high value riparian species to lesser value upland and grassland species.

b. Increase Downstream Channel Capacity With Levee And Channel Modifications. - This measure would consist of increasing the objective release from Folsom Dam to allow better management of the flood space. It would require increasing the height of the levees, stabilizing the existing levees (i.e., levee strengthening through lengthening and installation of toe drains, etc.) and placing additional bank protection along the American River to allow the greater safe releases. It would also require lengthening the Sacramento Weir and raising levees along reaches of Yolo Bypass to accommodate the greater safe release from Folsom Dam. Up to a 100-year (Corps) level of protection could be achieved with this measure. Routing studies were made to estimate the potential increase in flood control for the existing flood control storage space of 400,000 acre-feet with objective releases of 115,000, 130,000, 150,000, and 180,000 cfs. This study included an analysis of the effects of combining the increased

flows with the previously discussed measure of increased storage at Folsom Lake. Table B-2 includes a summary of the increased levels of downstream flood protection provided by these measures, singly and combined. Again, these measures were developed assuming use of Folsom surcharge space and 47,000 acre-feet storage in existing upstream storage facilities.

Levee raising or placement of bank protection on the waterside face of the levee or riverbank would require little, if any, right-of-way. Also, there would be little interference with adjacent residential, commercial, and public developments. Any work on the landside levee face would require acquisition of a permanent right-of-way for construction and operation.

TABLE B-2

INCREASING FOLSOM OBJECTIVE OUTFLOWS
WITH ALTERNATIVE FLOOD STORAGE CAPACITIES[1]

| Flood Control Storage[1] (1,000 acre-feet) | Objective Release (1,000 cfs) | Maximum Frequency of Control (Return Period - yrs) | Peak Outflows from Folsom for Given Events of Control (1,000 cfs) | | |
|---|---|---|---|---|---|
| | | | 100-yr | 200-yr | 500-yr |
| 400 [2] | 115 | 63 | 230 | 430 | 580 |
| 500 | 115 | 75 | 190 | 420 | 580 |
| 650 | 115 | 94 | 130 | 380 | 580 |
| 400 | 130 | 75 | 210 | 430 | 580 |
| 500 | 130 | 84 | 170 | 410 | 580 |
| 650 | 130 | 102 | 130 | 370 | 580 |
| 400 | 150 | 88 | 180 | 420 | 580 |
| 500 | 150 | 97 | 160 | 400 | 580 |
| 650 | 150 | 113 | 150 | 350 | 580 |
| 400 | 180 | 100 | 180 | 400 | 580 |
| 500 | 180 | 108 | 180 | 380 | 580 |
| 650 | 180 | 125 | 180 | 340 | 580 |

[1]Use of surcharge reservoir storage was assumed in all routings.
[2]Existing condition.

Depending on the level of objective releases, there would be losses of riparian vegetation along the American River Parkway. These losses could result in impacts to fish, wildlife, recreation, and endangered species resources as well as the status

of the river as a component of both the Federal and State wild and scenic river systems. The increased flood storage space in Folsom Reservoir would result in reservoir and downstream impacts as described for the previous measure.

c. Increase Downstream Channel Capacity with Setback Levees. - The first 5 miles of the north levee of the American River, beginning at the mouth, were constructed an existing setback of about 1,700 feet. Increased releases from Folsom Dam could be accommodated by widening the channel enclosed by levees along the full length of the American River to Nimbus Dam. The channel widening could be accomplished by relocating the existing 14.1 mile north levee or relocating the existing 10.9 mile south levee. Relocating either levee would affect 10 bridge crossings including the Interstate 5, Interstate Business 80 and State Highway 160 bridge crossings, the Western Pacific and Southern Pacific Railroad crossings, several major thoroughfare crossings and one pedestrian/bike crossing. The Sacramento Regional Transit District Light Rail transportation system, a key element of the local public transportation system, would also be impacted. The impacts to the bridge crossings and Light Rail would significantly disrupt transportation in the area. The increased flows and velocities within the channel would impact wildlife habitat, cause loss of riparian vegetation, reduce the recreational value of the American River Parkway, and could affect the status of the American River as a component of both Federal and State wild and scenic river systems. This project would also require the following: additional bank protection and levee stabilization along the American River, modify the Sacramento Weir, and raising sections of the Sacramento River and Yolo Bypass levees as in the measure to increase downstream channel capacity with levee and channel modifications.

A computerized hydraulic analysis was made of the potential to reconstruct the downstream levee system through Sacramento. An objective of the analysis was to widen the levee system enough so that the river stage for a discharge of 180,000 cfs would be no greater than that for the current system design capacity of 115,000 cfs. It was found, however, that even widening the channel as much as 2,000 feet, the flow stage of a discharge of 115,000 cfs in the existing channel would be significantly exceeded by the river stage for a discharge of 180,000 cfs in the widened channel. Increasing the levee height in addition to a 2,000 foot setback would accommodate the discharge 180,000 cfs flow while maintaining design freeboard. Using a smaller setback with an appropriate increase in levee height could accommodate the increased flow while maintaining design freeboard and reduce impacts to existing development. However, the increased height would be significant and detailed engineering analysis would be necessary to evaluate the stability of levees at such increased heights.

The proximity of development to the existing levees prohibits relocating the north or south levee without significant impacts. There are less than 3 miles of levee within the entire reach without adjacent development which would be impacted by removing and relocating the levee. Expanding these 3 miles alone to the limits of development would not contribute significantly to increasing the channel capacity since they are not contiguous and the setbacks would be less than 2,000 feet.

Relocating the north levee involves removing the existing levee and reconstructing a new levee an additional 2,000 feet further away from the river. It also requires extending it over 1 mile to tie into high ground and to maintain a smooth transition to the upstream floodway. This relocation would directly impact nearly 3,500 acres. This area includes approximately 6,000 single family residences, 2 elementary schools, 2 high schools, several apartment complexes and over 150 commercial and industrial properties. The relocation would also affect the California State Exposition Center, the City of Sacramento's sewage treatment facility, one church, existing roads, and other infrastructure. Approximately 500 additional acres of residential, commercial and industrial properties would be impacted by the realignment of State Highway 160, the Sacramento Regional Transportation District Light Rail and the relocation of several major thoroughfares and related infrastructure.

Relocating the south levee involves removing the existing levee and reconstructing a new levee an additional 2,000 feet further away from the river. It also requires extending it over 2 miles to tie into high ground and to maintain a smooth transition to the upstream floodway. This relocation would directly impact nearly 2,700 acres. This area includes approximately 5,000 single family residences, 4 elementary schools, several apartment complexes and over 140 commercial and industrial properties. The relocation would also affect the California State University, Sacramento campus; State Highway 50 and the adjacent Sacramento Regional Transit Light Rail corridor; the Sacramento City water treatment plans; 2 churches; a fire station; existing roads; and other infrastructure. About 800 additional acres of residential, commercial and industrial property would be affected by the realignment of State Highway 50, the Sacramento Regional Transit Light Rail corridor, the Southern Pacific Railroad, several major thoroughfares and related infrastructure.

Activities related to the construction of the setback levees would impact wildlife habitat of the American River which has been Federally designated as a critical habitat for the valley elderberry longhorn beetle. The area is also a known habitat of the bank swallow and Swainson's hawk which are both State threatened species. Other species of special concern which could be impacted by construction activities within the area include the

great blue heron, the great egret, the black shouldered kite, Coopers hawk, and the burrowing owl. Construction activities could also affect prehistoric, historic, and culturally significant sites within the project area. There are 13 prehistoric sites on the north bank and 7 prehistoric sites on the south bank, but more information is needed to assess the potential of historic and cultural resource impacts.

d. Perform Structural Modifications to Folsom Dam. - This measure involves increasing the flood control operating efficiency of Folsom Dam through modifying the existing spillway. One method would be to lower the crest of the spillway. This would allow greater flows to be released earlier in the flood event. Initial investigations of the effects of lowering the spillway have shown that, by itself, lowering the spillway 10 or 15 feet has little effect. Additional reservoir operation studies were conducted to determine the potential for controlled objective releases of 115,000, 130,000, 150,000, and 180,000 cfs using storage spaces of 400,000, 500,000, and 650,000 acre-feet in Folsom and lowering the spillway 15 feet. The results of these studies are included in Plate 2. As can be seen on the plate, this measure would increase the degree of downstream protection only slightly when considered in conjunction with the various objective releases but fairly significantly for greater levels of space dedicated to flood control.

Lowering the spillway would be accomplished one bay at a time and would therefore require longer than one construction season to complete. It is estimated that the degree of downstream flood protection would be reduced slightly during construction due to the limited spillway capacity. It should be mentioned that lowering all eight bays at Folsom would permit full regulation of the probable maximum flood event. No vehicles could move across the dam during the construction period. There would be no known long-term impacts on water supply, hydropower, recreation, or environmental resources from this measure.

e. Raise Folsom Dam. - Increased flood control storage space could be accomplished by raising the height of Folsom Dam and related structures. The resultant increased storage capacity, when allocated for flood control purposes, would increase the level of protection downstream.

The topography of the existing Folsom project site required the construction of the main dam, eight dikes, two wing dams, and one auxiliary dam, to contain the reservoir storage. The use of the dikes is an indication of the extent the existing reservoir was increased beyond the natural capacity of the site. Folsom Dam consists of a 340-foot-high concrete gravity section across the American River. It is 1,400 feet long, including the spillway. There are wing dams on either side of the main concrete section totalling 8,800 feet in length. Mormon Island Dam, an auxiliary

dam, crosses Blue Ravine about 2.5 miles east of the main dam. It is a rolled earthfill dam with an embankment section composed of dredge tailings and a narrow impervious center core. This auxiliary dam is 110 feet high and 4,820 feet long. The eight dikes along the perimeter of the reservoir total 11,655 feet in length. The dikes are composed of a rolled impervious earthfill embankment section with protection rock blankets on the waterside and landside slopes. Individual lengths vary from 740 to 2,060 feet, while heights vary from 10 to 100 feet. The existing reservoir gross pool storage capacity is 1,010,000 acre-feet, including 400,000 acre-feet allocated for flood control.

Enlarging Folsom Reservoir using structural features would require approximately 190,000 acre-feet of additional flood control storage to contain the 100-year (FEMA) event. An additional 500,000 acre-feet of flood control storage (above the existing flood control storage allocation) is needed to contain the 200-year event. This measure examines the potential of providing this increased flood protection by increasing the height of Folsom Dam and its associated facilities and allocating storage above elevation 427 for flood control. This elevation is the bottom of the existing flood control pool elevation and allows maintaining current allocations within the reservoir associated with other purposes (e.g., water supply).

Increasing the height of Folsom Dam, the auxiliary dam, and the eight dikes about 20 feet would provide an increased storage capacity of 190,000 acre-feet. The addition of this increased storage would control the 100-year (FEMA) event. The quantity of material needed to raise these structures would be about 12,500,000 cubic yards. Increasing the height of Folsom Dam, the auxiliary dam and the eight dikes about 50 feet could provide an increased storage capacity of 590,000 acre-feet. The addition of this increased storage contain the 200-year event. The quantity of material needed to raise the structures 50 feet would be about 27,000,000 cubic yards. Increasing the heights of the dikes by 20 or 50 feet would also require appropriate lengthening of these structures in order to tie into high ground. It should be noted also, however, that the quantity of material necessary to raise the structures could increase significantly if existing structures are found to be structurally inadequate to raise, thereby requiring complete reconstruction.

Attempting to increase the storage capacity of the existing Folsom Reservoir would cause several problems. The increased storage during flood events would inundate areas outside the existing project boundaries unless additional dikes are constructed at several locations along the perimeter. The areas which would be inundated by raising the structures 20 feet include over 15 residential and commercial structures, recreational facilities, fire access roads, the Zantgraf Mine, the PG&E Newcastle Powerhouse, Salmon Falls Road, and 2 cemeteries. The

realignment of Salmon Falls Road would impact additional residences as well as nearby wetlands. Additional areas would be inundated by an increased height of 50 feet.

The construction of higher dikes increases the susceptibility to embankment failure during flood events. The increased heights of the embankments in combination with the assorted soils used in their construction affect the factors of safety for stability incorporated within the original embankment designs. Such considerations include the structural stability of each embankment at the increased heights and susceptibility to seismic liquefaction. Foundation material density too is also important to determine the effect of increased embankment heights on internal stresses. Of particular concern, is the Mormon Island Auxiliary Dam which has been the subject of extensive seismic reconstruction work.

The quantity of material necessary to raise the facilities would require extensive borrow areas. Since the size of the borrow areas and transportation of the material for construction would pose significant logistical problems, it would likely come from the reservoir storage area. This would reduce the impacts associated with the borrow areas, but would significantly impact Bureau of Reclamation Central Valley Project water and power operations. The reservoir would have to be drawn down for a construction period of several years to maintain availability of these sites which would impact the CVP power production capability as well as their ability to control downstream flows and temperatures. The reduced water level would restrict recreational opportunities in the reservoir and adversely affect operations at the Nimbus Fish Hatchery. Environmental resources and recreational opportunities along the lower American River would also be impacted by reduced water levels.

Construction activities would impact reservoir operations, recreational facilities, and critical infrastructure. Waterside construction would require temporary reduction of water levels that are normally stored in the reservoir, thereby affecting the water supply for recreational opportunities and CVP operations. Landside construction would directly impact the North Fork Pipeline (water supply for the City of Folsom and Folsom State Prison), Folsom Dam Road, and Green Valley Road. Construction would also restrict access to picnic and camping areas in the project area. The relocation of two 230 kv electrical transmission lines, the Orangevale Lake and White Rock/Orangevale, on the western boundary of the reservoir may be necessary to accommodate construction activities. Construction could also affect prehistoric, historic and culturally significant sites within the project area.

f. Use Existing Storage Space in Upstream Reservoirs for Flood Control. - Storage in existing reservoirs, upstream of Folsom Dam, was considered when analyzing the flood threat and determining the amount of flood control space required for control of a given flood. The upstream storage space that can reasonably be expected during a major flood event was determined in the five major upstream reservoirs, French Meadows, Hell Hole, Loon Lake, Union Valley, and Ice House. These non-Federal reservoirs account for about 90 percent of the total upstream storage. They were constructed and are operated for hydropower generation and water supply. They do not include dedicated space or physical features for flood control operation.

The owners and operators of these reservoirs were contacted about their willingness to operate the facilities for flood control. They have stated that they are not interested in operating for flood control for the following reasons: (1) water rights concerns due to lost water supply, (2) significant loss of hydropower generation potential and associated costs for providing alternate sources of power, (3) inaccessibility during storm periods, and (4) costs associated with structural modifications for flood control operations. Also, the SMUD has recently changed the operation of its three reservoirs--Loon Lake, Union Valley, and Ice House--to that of maximizing storage for base load power generation. This would reduce the potential space available for flood control.

In addition to the above mentioned operational constraints, the location of these reservoirs limit their effectiveness in controlling large floods. All the reservoirs are high in the basin and control 14 percent of the drainage area above Folsom Dam. Historically, on a seasonal basis (October 1 through September 30), they control 15 percent of the total runoff into Folsom Lake. During major floods, as little as 12 percent is captured during the critical 3 to 5 days of the flood event, with an average of 18 percent captured for the entire duration of the flood. The storm centering dictates the percentage captured.

The upstream storage was analyzed using data from 21 years of record, 1966 through 1986, during the rain flood season. The rain flood season starts October 1 and ends May 31. The historical record shows that Union Valley, Ice House, and French Meadows Reservoirs are full or nearly full over half of the time by the end of the rain flood season. In terms of available space upstream, 52,000 acre-feet, 8 percent of the total of all the storage space in the five reservoirs (about 665,900 acre-feet) is normally available at the end of the rain flood season. These reservoirs usually reach their lowest levels during December and start to store with the first storm that produces runoff. The operational goal is to maintain the reservoirs as full as possible throughout the flood season. Records have shown that all of these reservoirs, except Loon Lake, have filled at least once by the

middle of January and remained full until the end of the flood season. These records also show that during the 1982, 1984, and 1986 major flood events most of these reservoirs filled and or spilled. Table B-3 is a tabulation of these events.

TABLE B-3
UPSTREAM STORAGE
1982, 1984, 1986 EVENTS WITH RESPECT TO THE 15-DAY MAXIMUM EVENT AT FOLSOM LAKE

| | | Upstream Storage - Percent Full After Start Date | | | |
|---|---|---|---|---|---|
| Start Date At Folsom | Date Filled and/or Spilled | After Start | After 7 Days | After 15 Days | After 30 Days |
| February 14, 1982 | | | | | |
| French Meadows | Feb 15 | 91 | 103 | 101 | 101 |
| Hell Hole | Feb 16 | 85 | 100 | 100 | 100 |
| Loon Lake | May 26 | 29 | 47 | 52 | 58 |
| Union Valley | Feb 16 | 87 | 89 | 99 | 101 |
| Ice House | Mar 22 | 50 | 77 | 85 | 97 |
| December 24, 1984 | | | | | |
| French Meadows | Dec 30 | 84 | 102 | 102 | 97 |
| Hell Hole | Jan 6 | 88 | 98 | 100 | 95 |
| Loon Lake | Dec 26 | 96 | 98 | 97 | 93 |
| Union Valley | Dec 25 | 99 | 102 | 100 | 93 |
| Ice House | ------ | 10 | 22 | 28 | 36 |
| February 14, 1986 | | | | | |
| French Meadows | Feb 19 | 62 | 102 | 103 | 102 |
| Hell Hole | Mar 8 | 65 | 94 | 96 | 100 |
| Loon Lake | ------ | 57 | 80 | 86 | 94 |
| Union Valley | Feb 19 | 73 | 103 | 103 | 102 |
| Ice House | Mar 2 | 62 | 98 | 98 | 101 |

NOTES:

1. Upstream winter reservoir capacities are: French Meadows Reservoir-110,700 acre-feet; Hell Hole Reservoir-207,600 acre-feet; Loon Lake-76,500 acre-feet; Union Valley Reservoir-235,100 acre-feet; and, Ice House Reservoir-36,000 acre-feet.
2. Values over 100 percent mean the reservoirs were full and spilling.
3. Loon Lake has a small drainage area (8 square miles) and a large storage capacity. The reservoir rarely fills during the rain flood season and captures less than 1 percent of the runoff into Folsom Lake. This reservoir is not effective for flood control.

The outlet capacity of the reservoirs is extremely small. Each reservoir is capable of releasing only a few hundred cubic feet per second through the powerhouse to the river. In some cases, backwater effects below the powerhouse inhibit releases being made during a flood event. This happens when the stilling basin below the powerhouse becomes inundated, requiring that operation of the turbines cease in order to avoid damage to the facilities. Historically, large releases have only occurred when the reservoirs are spilling. Often, this has happened at an undesirable time, such as during the peak flood period. Inter-basin transfer only diverts the water into an adjacent reservoir. In effect, a series of minor storms could exhaust essentially all of the storage space in these reservoirs, if the storms occurred prior to the main flood wave.

A series of storm fronts typifies the major Pacific storm systems in this region. Many storms are preceded and/or followed by other storms. Operational studies must therefore not only consider the largest flood event in the series but also the potential for smaller events infringing on space in the reservoirs. For these reasons, there is an inherent risk when determining available incidental upstream space; space not dedicated to flood control but expected to be available prior to any major flood event.

(1) Incidental Flood Control Storage Available Under Historical Operations. - In order to determine the amount of available incidental space in upstream reservoirs that can reliably be considered available for flood control purposes several factors have to be considered. The frequency, duration, and type of flood a reservoir can control is determined by the outlet capacity of the dam, the downstream channel capacities, and the operating criteria. Based on these factors, the critical duration for controlling the 100-year rain flood into Folsom Lake is eight days. However, if incidental upstream storage is to be considered for flood control purposes, periods of 15 to 30 days, or more, must be examined.

Incidental space in the major upstream reservoirs was calculated using the historical high flow periods during 21 years of record, 1966-1986. The amount of storage that actually existed before each event was determined. The analysis considered the effect of storage in each reservoir during these historical flood events. Based on discussions with representatives of the PCWA, it was assumed that future operation of their reservoirs, French Meadows and Hell Hole, would be similar to past operation. However, as stated earlier, SMUD has now changed its operation so that less space will be available. This was a recent development and was therefore not available during the analysis.

The available space in these reservoirs, below spillway crest, was tabulated for the period prior to the maximum 15-day

inflow into Folsom Lake. This was done for each year of record. French Meadows, Union Valley, and Ice House Reservoirs have spillway gates; however, for dam safety reasons, the operating agency is required to open the gates fully by November 1. The gates are not closed until after April 1. For this reason, only empty space below the spillway crest was considered. The upstream storage was calculated by the following process:

- For each year, since completion of the five major reservoirs (21 years of record), the largest 15-day runoff flow period was determined.
- The storage in each reservoir, at the beginning of the 15-day flow period, was obtained.
- The empty storage space available in each reservoir, at the beginning of the maximum 15-day flow period, was then computed for each year, see Table B-4. The space available in each reservoir was also totalled for each year and presented in Table B-4. This total represented the maximum storage space potentially available in these upstream reservoirs.
- These total storage space amounts, for each year, were evaluated statistically to determine the probability of availability of a specific storage amount during a given year.

Based on this analysis, an initial estimate of 47,000 acre-feet of usable space was determined. This amount represents the sum of the minimum amounts, in each upstream reservoir, for the 21 years of record. The minimum in each reservoir did not necessarily have to occur during the same year. Later, under closer examination, the minimum amount was determined to be slightly less, as shown below:

| Reservoir | Beginning Date of Annual Flood | Storage Available (Acre-Feet) |
|---|---|---|
| French Meadows | Dec 28, 1966 | 8,800 |
| Hell Hole | Dec 24, 1984 | 25,300 |
| Loon Lake | Dec 24, 1984 | 2,800 |
| Union Valley | Dec 24, 1984 | 3,400 |
| Ice House | Jan 14, 1970 | 5,100 |
| Total of Minimums | | 45,400 |

**TABLE B-4**

**AN HISTORICAL TABULATION OF UPSTREAM STORAGE AVAILABLE AT THE BEGINNING OF THE 15 DAY MAXIMUM RUNOFF PERIOD FOR EACH YEAR; AND THE ADJUSTED CREDITABLE STORAGE FOR 200TAF OF UPSTREAM STORAGE THAT WOULD HAVE BEEN AVAILABLE AT THE BEGINNING OF EACH FLOOD.**

| | | NORTH & MIDDLE FORKS OF AMERICAN RIVER | | | | | | | | SOUTH FORK OF AMERICAN RIVER | | | | | | TOTAL STORAGE IN UPSTREAM RESERVOIRS | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RESERVOIR -----><br>RIVER ----->| | FRENCH MEADOWS<br>M. F. AMERICAN R. | | HELL HOLE<br>RUBICON RIVER | | LOON LAKE<br>GERLE CREEK | | TOTAL NORTH & MIDDLE<br>FORKS OF AMERICAN R. | | UNION VALLEY<br>SILVER CREEK | | ICE HOUSE<br>S. F. SILVER CREEK | | TOTAL SOUTH FORK<br>AMERICAN RIVER | | | |
| DRAINAGE AREA | | 47.0 SQ.MI. | | 114.0 SQ.MI. | | 8.0 SQ.MI. | | 169.0 SQ.MI. | | 83.6 SQ.MI. | | 27.2 SQ.MI. | | 110.8 SQ.MI. | | 279.8 SQ.MI. | |
| DAM CREST ELEVATION | | 5271.0 FT. | | 4650.0 FT. | | 6418.0 FT. | | | | 4883.0 FT. | | 5454.0 FT. | | | | | |
| OPERATOR | | PCWA | | PCWA | | SMUD | | PCWA & SMUD | | SMUD | | SMUD | | SMUD | | SMUD AND PCWA | |
| STORAGE AT SPILLWAY CREST | | 110.7 T.A.F. | | 207.6 T.A.F. | | 76.5 T.A.F. | | 394.8 T.A.F. | | 235.1 T.A.F. | | 36.0 T.A.F. | | 271.1 T.A.F. | | 665.9 T.A.F. | |
| STORAGE WITH GATES UP | | 136.4 T.A.F. | | 207.6 T.A.F. | | 76.5 T.A.F. | | 420.5 T.A.F. | | 271.0 T.A.F. | | 46.0 T.A.F. | | 317.0 T.A.F. | | 737.5 T.A.F. | |
| % OF UPSTREAM STORAGE | | 16.8 % | | 40.7 % | | 2.9 % | | 60.4 % | | 29.9 % | | 9.7 % | | 39.6 % | | 100.0 % | |
| F.C. SPACE (T.A.F.) 7./ | 200.0 | 33.6 T.A.F. | | 81.5 T.A.F. | | 5.7 T.A.F. | | 120.8 T.A.F. | | 59.8 T.A.F. | | 19.4 T.A.F. | | 79.2 T.A.F. | | 200.0 T.A.F. | |
| D.A. (SQ.MI.) | 279.8 | | | | | | | | | | | | | | | | |
| WATER YEAR | 15-DAY FLOOD START DATE | START STORAGE T.A.F. | FLOOD CONTROL STORAGE T.A.F. | START STORAGE T.A.F. 8./ | FLOOD CONTROL STORAGE T.A.F. | START STORAGE T.A.F. | FLOOD CONTROL STORAGE T.A.F. | TOTAL STORAGE AVAILABLE T.A.F. | TOTAL STORAGE AVAILABLE FOR F.C. T.A.F. | START STORAGE T.A.F. | FLOOD CONTROL STORAGE T.A.F. | START STORAGE T.A.F. | FLOOD CONTROL STORAGE T.A.F. | START STORAGE T.A.F. | FLOOD CONTROL STORAGE T.A.F. | TOTAL STORAGE AVAILABLE T.A.F. | TOTAL STORAGE AVAILABLE FOR F.C. T.A.F. |
| 1966 | 28 DEC | 101.9 | 8.8 | 104.0 | 81.5 | 23.0 | 5.7 | 165.9 | 96.0 | 138.4 | 59.8 | 5.5 | 19.4 | 127.2 | 79.2 | 293.1 | 175.2 |
| 1967 | 16 MAR | 87.0 | 23.7 | 159.6 | 48.0 | 12.6 | 5.7 | 135.6 | 77.4 | 116.7 | 59.8 | 7.7 | 19.4 | 146.7 | 79.2 | 224.1 | 156.6 |
| 1968 | 18 FEB | 62.2 | 33.6 | 94.9 | 81.5 | 14.1 | 5.7 | 223.6 | 120.8 | 134.3 | 59.8 | 15.4 | 19.4 | 121.4 | 79.2 | 242.2 | 200.0 |
| 1969 | 19 JAN | 60.1 | 33.6 | 99.8 | 81.5 | 26.7 | 5.7 | 208.2 | 120.8 | 132.8 | 59.8 | 15.2 | 19.4 | 123.1 | 79.2 | 243.9 | 200.0 |
| 1970 | 14 JAN | 64.6 | 33.6 | 69.0 | 81.5 | 16.5 | 5.7 | 244.7 | 120.8 | 191.6 | 43.5 | 30.9 | 5.1 | 48.6 | 48.6 | 169.4 | 169.4 |
| 1971 | 25 MAR | 47.5 | 33.6 | 51.0 | 81.5 | 20.4 | 5.7 | 275.9 | 120.8 | 131.8 | 59.8 | 20.4 | 15.6 | 118.9 | 75.4 | 239.7 | 196.2 |
| 1972 | 04 MAR | 45.5 | 33.6 | 60.3 | 81.5 | 15.0 | 5.7 | 274.0 | 120.8 | 126.0 | 59.8 | 17.2 | 18.8 | 127.9 | 78.6 | 248.7 | 199.4 |
| 1973 | 09 JAN | 58.3 | 33.6 | 62.6 | 81.5 | 36.1 | 5.7 | 237.8 | 120.8 | 138.2 | 59.8 | 20.4 | 15.6 | 112.5 | 75.4 | 233.3 | 196.2 |
| 1974 | 13 JAN | 58.4 | 33.6 | 139.1 | 68.5 | 59.5 | 5.7 | 137.8 | 107.8 | 188.1 | 47.0 | 30.6 | 5.4 | 52.4 | 52.4 | 160.2 | 160.2 |
| 1975 | 21 MAR | 45.8 | 33.6 | 103.8 | 81.5 | 37.6 | 5.7 | 207.6 | 120.8 | 85.2 | 59.8 | 16.7 | 19.3 | 169.2 | 79.1 | 290.0 | 199.9 |
| 1976 | 28 OCT | 80.9 | 29.8 | 130.6 | 77.0 | 55.9 | 5.7 | 127.4 | 112.5 | 151.0 | 59.8 | 24.4 | 11.8 | 95.7 | 71.4 | 208.2 | 183.9 |
| 1977 | 18 FEB | 40.2 | 33.6 | 83.0 | 81.5 | 4.8 | 5.7 | 266.8 | 120.8 | 212.0 | 23.1 | 4.8 | 19.4 | 54.3 | 42.5 | 175.1 | 163.3 |
| 1978 | 05 JAN | 51.2 | 33.6 | 88.3 | 81.5 | 25.9 | 5.7 | 229.4 | 120.8 | 75.5 | 59.8 | 13.8 | 19.4 | 181.8 | 79.2 | 302.6 | 200.0 |
| 1979 | 15 FEB | 76.3 | 33.6 | 90.4 | 81.5 | 31.8 | 5.7 | 196.3 | 120.8 | 160.8 | 59.8 | 25.3 | 10.7 | 85.0 | 70.5 | 205.8 | 191.3 |
| 1980 | 10 JAN | 49.4 | 33.6 | 106.5 | 81.5 | 40.1 | 5.7 | 198.8 | 120.8 | 179.9 | 55.2 | 28.0 | 8.0 | 63.2 | 63.2 | 184.0 | 184.0 |
| 1981 | 14 MAR | 55.8 | 33.6 | 87.2 | 81.5 | 29.3 | 5.7 | 222.5 | 120.8 | 102.3 | 59.8 | 16.6 | 19.4 | 152.2 | 79.2 | 273.0 | 200.0 |
| 1982 | 14 FEB | 100.5 | 10.2 | 175.6 | 32.0 | 22.0 | 5.7 | 96.7 | 47.9 | 203.4 | 31.7 | 18.0 | 18.0 | 49.7 | 49.7 | 97.6 | 97.6 |
| 1983 | 01 MAR | 51.1 | 33.6 | 117.6 | 81.5 | 27.9 | 5.7 | 198.2 | 120.8 | 209.0 | 26.1 | 24.6 | 11.4 | 37.5 | 37.5 | 158.3 | 158.3 |
| 1984 | 24 DEC | 92.7 | 18.0 | 182.3 | 25.3 | 73.7 | 2.8 | 46.1 | 46.1 | 231.7 | 3.4 | 3.7 | 19.4 | 35.7 | 22.8 | 81.8 | 68.9 |
| 1985 | 08 FEB | 57.9 | 33.6 | 99.9 | 81.5 | 29.5 | 5.7 | 207.5 | 120.8 | 186.4 | 48.7 | 18.0 | 18.0 | 66.7 | 66.7 | 187.5 | 187.5 |
| 1986 | 14 FEB | 68.7 | 33.6 | 134.9 | 72.7 | 43.8 | 5.7 | 147.4 | 112.0 | 171.1 | 59.8 | 22.4 | 13.6 | 77.6 | 73.4 | 189.6 | 185.4 |
| AVERAGE | | 64.6 | 29.9 | 106.7 | 73.6 | 30.8 | 5.6 | 192.8 | 109.1 | 155.5 | 50.3 | 18.1 | 15.6 | 97.5 | 65.8 | 209.9 | 174.9 |
| MAXIMUM YEAR | | 101.9 | 33.6 | 182.3 | 81.5 | 73.7 | 5.7 | 275.9 | 120.8 | 231.7 | 59.8 | 30.9 | 19.4 | 181.8 | 79.2 | 302.6 | 200.0 |
| MINIMUM YEAR | | 40.2 | 8.8 | 51.0 | 25.3 | 4.8 | 2.8 | 46.1 | 46.1 | 75.5 | 3.4 | 3.7 | 5.1 | 35.7 | 22.8 | 81.8 | 68.9 |
| SUM OF MIN. YRS | | | 8.8 | | 25.3 | | 2.8 | | | | 3.4 | | 5.1 | | | 45.4 T.A.F. | |

NOTES:
1. SMUD - SACRAMENTO MUNICIPAL UTILITY DISTRICT
2. PCWA - PLACER COUNTY WATER AGENCY
3. UPSTREAM SPACE COMPUTED FROM CREST OF SPILLWAY DOWN.
4. UPSTREAM SPACE DISTRIBUTIONS ARE 60% NORTH & MIDDLE FORKS AND 40% SOUTH FORK OF THE AMERICAN RIVER.
5. 21 YEARS (1966-1986) OF DATA WERE USED FOR THIS TABLE, WHEN ALL 5 UPSTREAM RESERVOIRS WERE AVAILABLE.
6. DEFINITIONS: T.A.F.=THOUSAND ACRE FEET; F.C.=FLOOD CONTROL SPACE; D.A.=DRAINAGE AREA; FT.=FEET; SQ.MI.=SQUARE MILES.
7. THESE 5 RESERVOIRS WOULD UTILIZE ONLY 200,000 ACRE FEET OF STORAGE IN THE 8-DAY 100-YR FLOOD. THIS IS BASED ON 12% OF FOLSOM'S UNREGULATED 8-DAY 100-YR INFLOW.
8. START STORAGE IN HELL HOLE IN 1966 WAS 11.9 T.A.F.- AN ESTIMATE OF MEDIAN STORAGE OF 104 T.A.F. WAS USED BECAUSE 1966 WAS THE 1ST YEAR OF OPERATION.

The single year with the least amount of space since 1966 was 1984. The beginning of the maximum 15-day runoff period was December 24, 1984. On this date, the total empty space in the five upstream reservoirs was 81,800 acre-feet. The amount of effective space that would reduce a major flood, if it were to occur that year, was only 68,900 acre-feet. Much of the storage space in Ice House Reservoir was ineffective because its drainage area did not produce enough runoff to fill all of the available space. Also, under SMUD's new operation plan, Loon Lake, Union Valley, and Ice House would have even less than 50,000 acre-feet available.

Two different graphical statistical analyses were conducted, which confirmed using 47,000 acre-feet of space. The first analysis used total available storage at the beginning of the 15-day event, as computed above (the second to last column in Table B-4). This data was plotted in descending order on probability paper. A best fit line was graphically drawn through the points. As a result, the 47,000 acre-feet of storage was about a 30-year event.

The second analysis used adjusted data with respect to area and storm depth distribution of a 100-year flood. It was assumed the storage was available at the beginning of an 8-day, 100-year rain flood, and that the five upstream reservoirs would capture 12 percent of the runoff from this flood into Folsom Lake, or about 200,000 acre-feet. Only 12 percent of the maximum 3 days of unregulated runoff, during the February 1986 flood, was captured by the five upstream reservoirs. The storage data was adjusted to reflect the amount available in each reservoir, for each year, at the start of the maximum 15-day flow period. The storage was distributed according to the drainage areas above each of the reservoirs. A new tabulation was made of the sum of the new storage for each year. These values were plotted as described above (the last column in Table B-4). A best fit line was graphically drawn through the points. The resulting frequency for 47,000 acre-feet was a 25-year event.

Both 25- and 30-year storage events are a reasonable concurrent occurrence at the beginning of a 100-year event. It is possible, under extreme circumstances, these reservoirs could have less storage available. Above these reservoirs, historical distributions of runoff during major floods has varied by as much as 25 percent. Even more variable is the upstream percentage of runoff on a daily basis, during any single flood event. Daily ratios can vary from 0 to 30 percent of the unregulated flow, at Fair Oaks, during the course of the flood event. The result may mean as much as 100,000 acre-feet of additional upstream space would be necessary to account for this variability.

In order to assess the reasonableness of this analysis, other approaches were studied: (1) A regression analysis was performed in an attempt to establish a relationship between flood flow volume and upstream storage space, prior to a storm. This analysis resulted in low correlation, and low coefficients, and therefore was not used; (2) During major flood events, the number of days until peak inflow occurred into Folsom Lake was determined, using the 82 years of flow record at Fair Oaks. This helped to establish criteria for flood routings; (3) An analysis of storm runoff distributions in the upstream reservoirs for different durations was performed. This was helpful in identifying runoff percentages between each of the five upstream reservoirs, and between the upstream reservoirs and the total basin yield, and (4) Storage duration curves for Folsom Lake and for the upstream reservoirs were examined. This helped to understand historical operation of these upstream reservoirs.

As a result of the above analyses, it would be unwarranted to rely on more than 47,000 acre-feet of effective incidental space being available upstream, during a major flood event. Upstream storage space must be distributed in an effective manner when needed, during the main flood wave. The 47,000 acre-feet is generally not available throughout the season (i.e., there is more than 47,000 acre-feet during the months of September through November), but as winter storms occur runoff diminishes the upstream storage space. Generally, during the months of January, February, and March, the upstream reservoirs start filling. Historically, they have filled and spilled several times. Once the reservoirs have filled, they loose their effectiveness to store runoff from subsequent storms because of their limited outlet capacity. The small outlet capacity severely limits the drawdown capabilities of each reservoir. Whether upstream space is effectively utilized, when needed, is also dependent on the following variables:

- The distribution of the storm center could impact some of the reservoirs, but possibly not others. Several of the reservoirs may fill and spill while appreciable space may remain in other reservoirs even after a flood.

- The snow pack on the drainage area of each upstream reservoir may vary, which will impact on the runoff into the reservoir during the storm event.

- The freezing temperature elevation in the mountains will vary during each day, which will change the nature of the precipitation that will fall (rain/snow).

- The storm centerings will vary with each storm front that moves into the American River basin. This would impact the amount and distribution of inflow into the upstream reservoirs.

(2) Acquired Flood Control Storage Requiring Changes to Historical Operations. - These non-Federal reservoirs were constructed and are operated for hydropower generation and water supply. They do not include dedicated space or physical features for flood control. An order-of-magnitude estimate was prepared of the amount of storage space required in the five upstream reservoirs in conjunction with Folsom Reservoir to control the 100-year flood along the main stem of the American River. The results are shown on Plate 3. As can be seen from this plate, this level of protection can be achieved through a number of combinations of either increased Folsom objective releases in addition to storage and/or increased Folsom objective releases in addition to storage acquired in the upstream reservoirs.

SMUD and PCWA were requested to estimate the impacts to their reservoir system should a total of 200,000 acre-feet of flood control space be acquired in them. SMUD estimated that the use of 85,000 acre-feet of storage in Loon Lake, Ice House, and Union Valley Reservoirs would result in an energy loss over a 30-year period (beginning in 1990) costing between $150 and $300 million. PCWA was unable to estimate the precise economic impact to their system of the use of 115,000 acre-feet of storage in French Meadows and Hell Hole Reservoirs. However, impacts to hydropower similar to that estimated by SMUD would seem reasonable. Assuming (1) impacts at the PCWA would be similar to SMUD's and (2) the cost to acquire the space would be similar to the economic loss in hydropower generation, a major first-cost element of this aspect of the measure could amount to between $350 and $700 million.

Coupled with the impacts on hydropower at the reservoirs is the fact that the outlet works of each would need major modifications in order to be capable of evacuating the flood space in a timely manner. On the basis of cost estimates for other projects, it is likely that modification of each of the outlet works could be about $10 to $20 million. Assuming $550 million to acquire the space and $15 million to modify each of the outlet works, cost of this measure would be on the order of $625 million. Assuming (1) a 100-year level of downstream flood protection (200,000 acre-feet of effective seasonal flood control storage in the upstream reservoirs and 500,000 acre-feet in Folsom Reservoir), (2) a 6 percent allowance on the costs for operation and maintenance, and (3) costs associated with Folsom reoperation, the annual costs of this measure would exceed the flood control benefits.

It should be stressed that there are many variables that affect the determination of the amount of storage available in the upstream reservoirs, for both incidental use of the space and acquired use of space. A change in the flow distribution above the upstream reservoirs, due to variations in the distribution of reservoir space and/or storm centering, can significantly affect the results of the routings determining the amount of space

available or required. All the reservoirs are high in the basin and control only 14 percent of the drainage above Folsom Reservoir. Historically on a seasonal basis (October 1 through September 30) they account for 15 percent of the total runoff into Folsom Reservoir. During major floods as little as 12 percent is captured during the critical 3 to 5 days of the flood, with an average of 18 percent of the entire duration of the flood. An increase in the rate of inflow into the upstream reservoirs could cause the space to be exhausted early in the storm, prior to the peak. An antecedent flood or small wave prior to the main wave for a given series of storms, critical for the upstream reservoirs, could exhaust a significant amount of space upstream. A series of storm fronts typifies the major Pacific storm systems in this region. Many storms are preceded and/or followed by other storms. Operational studies must therefore not only consider the largest flood event in the series but also the potential for smaller events infringing on space in the reservoirs. This is extremely important for these reservoirs because drawdown rates are low, due to the limited outlet capacities. Following a storm event, it may take well over a month to evacuate the space upstream, and then only if the owners and operators were inclined to do so. Failure to evacuate the space, prior to a major flood, would mean increased surcharge with a recommended increase in releases at Folsom.

The 100-year (FEMA) flood, assuming an 18 percent flow capture rate, could be controlled with 400,000 acre-feet of flood space in Folsom, 5,000 acre-feet of surcharging, and 200,000 acre-feet of effective storage upstream. This is true only for the following factors: (1) there is no variability in the flow rate into these reservoirs (significant variation inflow rates between reservoirs and over time has historically occurred), (2) all of the 200,000 acre-feet of space is utilized (historically, even if a significant amount of space was available, in many cases, it was not filled during the critical peak-flow period because the inflow into these reservoirs was not great enough), and (3) the 200,000 acre-feet of upstream space must be available just prior to the peak-flow period (typically, small storms preceding a major flood event encroach on the storage space upstream). However, historically the flow capture rate is 12 percent during the critical 3 to 5 day period of the major flood events. This relatively small change in the flow capture rate at the upstream reservoirs, translates to major operational impacts in Folsom Reservoir. This change results in a requirement to use nearly 50,000 acre-feet of surcharge space (rather than 5,000 acre-feet) and also requires increasing maximum outflow from 115,000 cfs to 122,500 cfs. These results are consistent with the above mentioned factors. It must further be emphasized that to assure 200,000 acre-feet of effective storage in the upstream reservoirs, it may be necessary to have upwards of 300,000 acre-feet of available space to account for any variability.

In addition, it should be noted that the owners and operators of these upstream reservoirs were contacted about their willingness to operate the facilities for flood control. The owners have said that they are not interested in operating the reservoirs for flood control because of (1) water rights concerns and lost water supply, (2) significant loss of hydropower generation potential, (3) inaccessibility during storm periods, and (4) the costs associated with structural modifications for flood control operations. In addition to these owner and operator constraints, SMUD has changed the operation of its three reservoirs to that of maximizing storage for base load power generation. This would reduce the potential creditable space for flood control.

g. Construct New Flood Control Detention Upstream from Folsom Reservoir. - This measure involves creating new detention space for flood control upstream from Folsom Reservoir. Potential detention sites in the upper American River basin are listed in Table B-5. The most practical location for an upstream detention facility with a capacity large enough to provide flood space necessary to significantly reduce downstream flood flows is on the North Fork of the American River, below the confluence of the North and Middle Forks in the vicinity of the Auburn Dam site (see Appendix J). Numerous agencies including the DWR, USBR, and local water agencies have evaluated potential sites in the area.

TABLE B-5

POTENTIAL DETENTION SITES IN THE UPPER AMERICAN RIVER BASIN

| Site | Stream [1] | Drainage Area (sq mi) | Av. Ann. Runoff (acre-feet/yr) | Detention Capacity (acre-feet) |
|---|---|---|---|---|
| Granite Canyon | N.F. | 96 | 226,000 | 300,000 |
| Giant Gap | N.F. | 200 | 396,000 | 650,000 |
| Growlersburg | M.F. - Canyon Cr. | 12 | 13,900 | 17,500 |
| Salmon Falls | S.F. | 807 | 940,000 [2] | 200,000 [3] |
| Alder | S.F. - Alder Cr. | 19 | 18,600 | 80,000 |
| Auburn | N.F. and M.F. | 982 | 1,486,000 | 2,300,000 |

[1] N.F. - North Fork American River
M.F. - Middle Fork American River
S.F. - South Fork American River
[2] Does not include adjustments for upstream regulation.
[3] Maximum capacity which will not inundate Gold Discovery site at Coloma.

The Corps reviewed the existing geologic, hydrologic, and engineering studies to identify the best locations for new upstream detention facilities. Based on this information, it was concluded that the most logical site for a new flood control detention facility is the location of the present USBR project at Auburn.

Studies have concluded that effective additional flood control detention capacity can be achieved at or near the Auburn Dam site.

Estimated average annual flood control benefits for various levels of flood protection and the estimated first and annual costs of a new flood control dam sized to provide those levels of protection are provided later in this report.

This measure would have no known significant adverse impacts on recreation, water supply, or hydropower at Folsom Lake. A single-purpose dam would allow temporary inundation of lands behind the structure; fewer acres of terrestrial habitat and miles of stream would be affected than with the authorized full-sized Auburn project.

h. Improve Flood Forecasting for Folsom Reservoir Operations. - This measure includes modifying the flood control operation of Folsom Dam and Reservoir to rely more heavily on weather forecasting and making flood control a priority operation of Folsom Dam. Prior to, and as a result of, the February 1986 flood, various claims were made that Folsom Dam and Reservoir was not properly operated for flood control. It has been claimed that more efficient operations could control larger flood events.

State-of-the-art runoff forecasting technology is currently used in the operation of Folsom Dam and Reservoir. This forecasting includes projections of inflow into Folsom Reservoir from the watershed. Forecasts are issued by the California-Nevada River Forecast Center (CNRFC) and State Department of Water Resources. Inflow forecasts are generated as needed during flood events by the Bureau of Reclamation, CNRFC, and DWR personnel. The current system includes 12 telemetered weather monitoring stations within the upper watershed. These stations transmit pertinent data on rain, snow, and temperatures to the National Weather Service River Forecast Center in Sacramento. This information, along with computed bi-hourly inflow estimates and information regarding antecedent watershed moisture conditions, is fed into complex meteorological models from which projections of inflow to Folsom Reservoir are made. Forecasts are made for one or more 6-hour periods, up to 24-hours.

Despite the sophistication of meteorological technology, weather forecasts are not currently precise enough to operate a reservoir for even a 6-hour period following the prediction. The

Weather Service's Quantitative Precipitation Forecast (QPF) is used to indicate the intensity of a storm up to a 24-hour period. Converting this information to reliable information regarding inflow into Folsom Reservoir has proved to be difficult. Converting precipitation forecasts to inflow forecasts is limited by uncertainties in storm related factors such as timing, intensity, and trajectory. Actual inflows may vary considerably from those predicted from the QPF. Furthermore, 24-hour forecasts are not consistently reliable over the full 24-hour period. Experience has shown that the first 6-hour period of a forecast is not always accurate, and predictions for the last 12-hour increment of a 24-hour forecast can only be used as a general indicator of potential conditions. Consequently, it is impossible for dam operators to reliably determine whether increased flows during the first 6-hour period will dissipate in the next 6- to 8-hour period. There is a high degree of error in predicting storm tracks as the fronts move into northern California, as was experienced in February 1986. Storm fronts tend to move in a south-easterly direction through the State, but can, on occasion, stall out and stay in one latitude. The location of this latitude can vary from event to event. Given current predicting capabilities, rapidly evacuating Folsom's flood control space whenever there is a hint of a large incoming storm would, on net, be highly inefficient and in many cases not good operation.

It is possible that anticipatory releases could be made from Folsom Reservoir based upon measured runoff occurring in the watershed. However, dam operations are legally constrained in that large releases should not exceed maximum inflow rates that have recently occurred into the reservoir. A legal liability could be incurred if releases exceed inflow, and downstream damages occur. A case could be built that natural inflows would not have caused the same damage. Hence, the damage would have been operationally induced, leaving liability for damages in the hands of the operators. Anticipatory releases early in a storm would be limited by the ability to predict, through a proven meteorological model, accurate basin runoff. Operational decisions must be made considering not only flood inflow forecasts, but also downstream channel conditions, the combined effects of releases from other reservoirs, and the need for giving downstream interests advanced warning.

Present restrictions to allow early releases are confined to the ability to calculate inflow into Folsom Reservoir. Under the current system, inflows are calculated using reservoir water surface elevation and elevation-capacity information for the reservoir. By measuring the change in volume of stored water over a period of time (usually a 2-hour period), the inflow rate can be calculated. The time required to make this calculation further restricts the efficiency of timely releases.

Determination of inflow rates could be improved by the establishment of an extensive telemetered stream flow gaging system within the upper basin. However, efficiencies of such a system would continue to be constrained by physical capabilities of the existing outlet works, legal restrictions associated with matching inflow rates, and limitations on allowable flow rate increases into the downstream channel based upon downstream safety criteria. Operational efficiencies are also limited by the nature of the basin and by storm patterns. For example, peak inflows from a particular storm may not be extreme, but many days of high volume inflow can overwhelm Folsom, thus a large storm of continuous rain, but no major high intensity period, could be more dangerous than a shorter storm with highly intense cells.

Mechanical operation of the outlet works and spillway gates can also delay increases, thereby decreasing the efficiency of an improved forecasting system. Delays in releases can also occur as a result of a legitimate desire to avoid inundation impacts to the lower American River Parkway. Finally, during periods of drought, there may be a natural reluctance to release what otherwise would be valuable water supplies until it is clear that such releases are necessary.

i. Construct Small Detention Dams in the Upper Reaches of the Watershed. - This measure consists of constructing numerous small capacity dams on tributary creeks to the American River in the headwaters of the watershed. A detailed analysis was not accomplished on this measure. However, based on existing conditions in the American River Watershed and results of studies regarding similar concepts in other basins, this option was not viewed as practical. Because of the nature of rainfall patterns and runoff distributions within the upper watershed, it is unlikely that any number of the small dams could provide high level of protection similar to one large facility. Further, the accumulated total environmental impact of the smaller facilities would significantly exceed that for one facility.

j. Construct Offstream Storage Facilities. - Opportunities are scarce for diverting floodflows from Folsom Reservoir to a potential offstream storage site; however, two possible measures for diverting floodflows to a potential offstream storage site nearby were examined.

The Willow Creek site would be immediately adjacent to Folsom Reservoir at the Mormon Island Dam. As envisioned, the basin would augment the storage in Folsom. It would require construction of a new dam about 8,000 feet long with a maximum height of 120 feet (above natural ground) and removal of the Mormon Island Dam. Topography limits the size of the new basin to about 55,000 acre-feet. With this additional storage, the degree of downstream protection would be only slightly increased (from about 63 to 70 years).

DWR estimated the cost to be $100 million in 1982, which would be about $120 million at 1991 prices. On a per acre-foot of storage basis, this is more than twice as expensive as detention at the Auburn site. For higher levels of flood protection, this measure does not eliminate the need for detention capacity at the Auburn site, even with increased flood control storage at Folsom. Furthermore, this site is within the city limits of Folsom and residential and commercial developments are beginning to encroach on the basin.

It is believed that this measure has essentially no potential for effective implementation because (1) downstream flood protection would not significantly increase, (2) the cost would be high compared to other alternatives, and (3) the feasibility of this alternative would be questionable given current and expected development in the basin.

k. Construct Out-of-Basin Diversion Facilities. - This measure would divert flows to the Cosumnes River basin via a bypass conveyance system into a detention basin in the Deer Creek watershed about 10 miles south of Folsom. The diverted flows would decrease the flows downstream in the American River. A detailed cost estimate was not made for this measure. However, based on a preliminary hydraulic analysis and results of recent flood control studies in the Cosumnes River basin, it was determined that the measure would be significantly more costly than other available options. In addition, there would be significant impacts in the Deer Creek basin, Cosumnes River basin, and east Delta area due to the increased floodflows.

l. Divert Floodflows into the Sacramento River Deep Water Ship Channel. - This measure involves diverting a portion of the floodwaters of the Sacramento River through the navigation lock and barge canal by use of a pump and siphon to the ship channel. Sufficient gradient would be created for the water to flow to the Sacramento River near Collinsville.

The Sacramento River Deep Water Ship Channel is a manmade channel extending 43 miles from Collinsville to the Port of Sacramento in West Sacramento. The channel is currently maintained at a depth of 30 feet and varies in width from 250 feet to 350 feet. Authority has recently been given for deepening the channel to 35 feet below mean lower low water. A barge canal and navigation lock connect the Port to the Sacramento River below its confluence with the American River. If the gates of the lock are closed, water from the Sacramento River does not enter the ship channel. The west levee of the ship channel is now the east levee of the Yolo Bypass between Cache Slough and about river mile (RM) 41 on the ship channel. The east levee for the ship channel is the original project levee for the Yolo Bypass.

Analysis showed, however, that the available increased flow capacity into the channel is relatively insignificant compared with that of the American River during flood stage. Also, hydraulic balancing of flows in the American River and Yolo Bypass via the Sacramento and Fremont Weirs indicated that this measure would be highly inefficient in reducing flood stages in the system.

7. Natomas and Vicinity. -

a. Construct Levee Improvements in and Around Natomas. - Sections of levees along the west NEMDC, NCC, and Pleasant Grove Creek Canal would need to be raised to prevent potential flooding in Natomas resulting from high river stages. The extent of the modifications depends mostly on the level of protection desired. Below is a brief description of each. A primary assumption is that floodflows are occurring simultaneously in all the waterways. As mentioned, it is also assumed for each of the measures that the existing levee and channel system is structurally stable.

(1) NEMDC West Levee. - To decrease the likelihood of failure of the NEMDC west levee would require raising the levee in excess of 3 feet. During high flows, however, this modification would result in induced flooding in the Dry and Arcade Creek areas. To offset this impact, levee and related modifications are required at various locations along the east levee of the NEMDC and along Dry and Arcade Creeks.

(2) Pleasant Grove Creek Canal. - The East Side and Pleasant Grove Creek Canals are a levee system that extends to the north and south from NCC. The levee system of the Pleasant Grove Creek Canal is a single levee that impounds water from Curry and Pleasant Grove Creeks and conveys it north to the NCC; the levee system of the East Side Canal impounds water primarily from Coon and Markham Creeks and Auburn Ravine and conveys it south to the NCC. During flooding, the waters commingle. Natomas is subject to flooding from the south end of the Pleasant Grove Creek Canal where Sankey Road can be overtopped and the floodflows would enter Natomas or NEMDC. Measures along this area include increasing the height of the Pleasant Grove Creek Canal levees at selected locations and modifying East Levee Road at Sankey Road. Also, any plan that raises these levees may require measures to lower the water surface on lands east of the raised levees that would be subject to induced flooding.

(3) Natomas Cross Canal. - The NCC conveys flows from the Pleasant Grove Creek and East Side Canals to the Sacramento River. Potential overtopping and failure of the south canal levee into Natomas can be caused by high stages in the Sacramento River combined with runoff from the Pleasant Grove Creek Canal. The flood potential for this area could be decreased by raising the

levee at selected locations, providing a pumping plant/gated closure structure on the NCC, or providing a flow restriction structure upstream in the Sacramento River.

b. Construct Compartment Levee in Natomas. - This measure consists of compartmentalizing Natomas by constructing levees across Natomas between the Sacramento River and the NEMDC. The two cross levee locations considered are (1) just north and parallel to Elverta Road and (2) just north and parallel to Del Paso Road (other locations are possible). Areas north of the cross levee would not be provided additional flood protection.

A cross levee at Del Paso Road would run along most of the length of the road. At the eastern end, just east of the Sacramento city limits, the levee alignment would veer to the north and run parallel to and just west of Sorento Road. This would offer protection to the group of homes that lie between Sorento, East Levee, and Del Paso Roads. At the western end, just west of Powerline Road, the levee alignment would veer southwest to intersect Garden Highway. This is to keep the length of the levee to a minimum. The levee alignment would curve north of the I-5/Del Paso Road interchange to avoid altering the interchange. This option would offer protection for the I-80 freeway and south Natomas. This option would also include a ring levee around the Sacramento Metropolitan Airport.

The cross levee at Elverta Road would run north of and parallel to Elverta Road from the Sacramento River to the NEMDC. This option would provide protection to the Sacramento Metropolitan Airport, I-5, I-80, Sacramento City area, and a portion of Sacramento County.

These levees could be constructed to a crown elevation of about 44 (NGVD) for the Elverta Road cross levee and about 42 (NGVD) for the Del Paso Road cross levee. The levees would average almost 24 and 25 feet in height for the Elverta and Del Paso cross levees, respectively.

Estimates of costs and benefits associated with this measure are discussed in the following chapter.

c. Construct Gated Structures and Pump Facilities. - This measure consists of constructing a gated embankment structure and a pump station at the NCC at the Sacramento River. During normal flow conditions, the gates on the embankment would be open, allowing water from the canal to discharge downstream. During high flows in the Sacramento River, the gates would be closed, preventing riverflows from entering the canal and causing backflow. Large capacity pumps in the canals at the structure would accommodate tributary inflows. The pumps would control the stages in the canal to avoid encroachment into the freeboard on the adjacent and upstream levees for specified design events.

Another pump structure with gated embankment was considered on the NEMDC north of Dry Creek. Its purpose would be to prevent American River backwaters from entering upper NEMDC during periods of high stages and to pump high tributary flows without encroaching on levee freeboard along the NEMDC levee north of the pumping plant.

d. Construct Detention Dams Upstream from Natomas. - This measure consists of constructing small impoundment reservoirs on various tributaries to the NCC and the NEMDC. The objective of these upstream reservoirs would be to reduce inflows to the NCC and the NEMDC. They would also reduce flooding on the respective creeks downstream from the structures.

e. Modify Fremont Weir and Yolo Bypass. - The following alternative options focus on evaluating modifications to the Fremont Weir and Yolo Bypass to improve their conveyance capabilities. Such improvements were evaluated to determine their ability to divert greater flows into the Yolo Bypass thereby reducing the water stages along the Sacramento River and in the NCC.

(1) Lengthen Weir. - Lengthen the Fremont Weir and widen the Yolo Bypass at Fremont Weir by 1,000 feet. The east levee of the Yolo Bypass would be setback in order to better align the inlet of the Yolo Bypass with the outlet of the Sutter Bypass. The length of the levee to be setback (in a landward direction) is approximately 20,000 linear feet when widening the bypass 1,000 feet. The weir would be extended 1,000 feet, matching the current design. The embankment material would be replaced with a concrete weir and riprap to match the current design.

(2) Lower Weir. - Lowering Fremont Weir would involve lowering the crest elevation and reshaping approximately 9,120 linear feet of concrete weir. To ensure proper functioning of the weir, additional sediment removal would be necessary to lower the land surface to an elevation equal to or less than the weir crest elevations. Approximately 400,000 and 600,000 cy of material would need to be removed and disposed of when lowering the weir by 0.5 and 1.0 foot, respectively.

(3) Yolo Bypass Modifications. - Widening the Yolo Bypass in conjunction with modifying the Fremont Weir was also examined to determine its effectiveness in diverting more water from the Sacramento River, thus resulting in lower water surfaces along the river.

f. Construct Sacramento River Constriction. - This measure consists of constructing a check structure between the Fremont Weir and the mouth of the NCC to constrict the Sacramento River just downstream of the Feather River. The purpose of the structure is to check the Sacramento River flows which would

divert sufficient flows into the Fremont Weir such that cross canal flows can be conveyed down the Sacramento River safely.

g. Construct New Natomas Cross Canal. - This measure consists of constructing a canal, similar to the Cross Canal, across Natomas. It could help divert flows from Pleasant Grove and Curry Creeks to Sacramento River.

h. Release Objective Release from Folsom Dam to Lower Stages in NEMDC. - This measure consists of lowering the 115,000 cfs objective release from Folsom Dam. This would be achieved by either increasing the flood control storage space in Folsom Reservoir and/or new flood control detention upstream from Folsom Reservoir. A lowered release to between 100,000 to 80,000 cfs would reduce the stages for a major flood event in the NEMDC by about 0.7 to 2 feet, respectively. This effect diminishes upstream in the canal as the backwater effects from the river has a lessening influence. For example, at the mouth of Dry Creek during a major event the stage reduction is about 0.5 to 1 foot for objective release reductions to 100,000 and 80,000 cfs.

An estimate was made to determine if this resource would be more cost effective than levee and channel improvements in the NEMDC and vicinity. The savings in levee construction in the canal would consist of potential improvements along American River to Dry Creek. At the mouth of Dry Creek and upstream along the creek, significant levee improvements would be needed. (This is more cost effective than levee modifications along the NEMDC upstream from Dry Creek.) This saving in construction cost would amount to about $35 million. The estimated increased flood control storage space in Folsom Reservoir and in new upstream detention facilities to achieve a reduction in the objective release to 75,000 cfs (approximate requirement to provide the design freeboard in the NEMDC at the 100-year event) is 230,000 acre-feet. The estimated first cost to achieve this space $51 million.

i. Construct a Detention Basin in North Natomas. - This alternative examined the potential of constructing a detention pond in north Natomas. This pond could temporarily store excess floodwaters originating from tributary drainages into the NCC and Pleasant Grove Creek Canal.

8. Use Non-Traditional Methods. - Most traditional structural flood damage reduction measures are directed at the source of flooding. They attempt to change the direction of floodflows, decrease the area of inundation, alter the timing of floodflows, or store floodflows. In contrast, most non-traditional measures are directed at protection of individual property, land usage, or actions during a flood. Non-traditional measures fall into several broad categories: flood proofing, evacuating structures

from the flood plain, restricting development in the flood plain, and using flood warning systems.

a. Flood proofing. - Flood proofing structures would involve raising existing structures so that habitable portions are above the expected flood level. Flood proofing could also involve the construction of walls around individual homes or pockets of homes to hold back the floodwater. This latter alternative is not considered a viable alternative for the Sacramento area because the "walls" would in fact be "levees" in most instances. For developed portions of Sacramento, there is nowhere to construct a "ring levee" system without extensive relocations. In this case, upgrading of the existing levee system is much less environmentally damaging and more cost effective.

Raising structures above the flood level is possible if the lower portion of the structure is used only for parking or storage. The lower portion is expected to flood and is designed to equalize hydrostatic flood forces on exterior walls by allowing entry and exit of floodwater. Flooding would result in damage to contents in the lower portion such as automobiles and contents; however, the habitable portion of the home and upper level contents would be spared. Estimates of costs to raise a typical slab-on-grade house 10 feet above grade, including all finish work, have been done. For a 1,296 square foot house, the estimated cost is $39,552, or $31/square foot of slab. An elevation of 10 feet is reasonable for most parts of Sacramento. However, for Natomas additional elevation would be required.

For Natomas, there are an estimated 13,516 structures. Therefore, the cost to raise residential structures would be a staggering $535 million. In the remainder of the Sacramento area, 162,290 residential units in the flood plain would entail a cost of about $6.4 billion.

b. Flood Plain Evacuation. - Flood plain evacuation involves either moving the structure and its contents to a flood free site, or removing only the contents and demolishing the structures or using them for some other purpose. In other cases, evacuation of only the population may be possible.

The City of Sacramento has a flood evacuation plan in place for Natomas. A plan is currently being prepared for the remainder of the Sacramento area and is expected to be completed within 2 years. An evacuation plan for the unincorporated area of Sacramento County is in progress also. The Sacramento County Sheriff's Department is preparing evacuation routes out of each of the eight levee breach areas. In Sutter County, an evacuation plan exists for the portion of the county south of the NCC. The general plan describes areas where people should be evacuated and the routes to get them there.

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

In response to concerns of flooding in Natomas, the City of Sacramento has sought to develop a land use policy for the Sacramento area that established a "reasonable balance between responding to the risk of flooding and continuing the orderly development of the community". Ordinance 90-005, adopted on February 6, 1990, was established to attain this "reasonable balance". This ordinance prohibits any more residential construction in Natomas until completion of any future projects providing greater levels of protection.

d. Flood Warning. - Flood warning consists of forecasting flood potential; warning the population; evacuation before, during, and after a flood; and postflood reoccupation and recovery.

The City of Sacramento has in place (since November 1990) an emergency plan manual which addresses the effects of various hazards. Included are evaluations of flood related emergencies such as levee failure, overtopping of secondary levees with inadequate freeboard, failure of one of the 16 floodgates located throughout the City, or breakout of floodwater from the Natomas East Main Drain.

The City has established emergency warning and response criteria based upon a four-stage warning and response system:

- River/Stream Advisory Stage: The level at which the water surface elevation is one foot below the river/stream warning stage.
- River/Stream Warning Stage: The level at which patrol of levees becomes mandatory or water is channeled to bypass areas.
- Project Flood Alert Stage: The level at which the flow is at the maximum design capacity as defined by the Corps (normally 3 to 5 feet of freeboard).
- Flood Danger Stage: The level at which the flow exceeds the design capacity or when the structural integrity of the levee appears at risk through sloughing or boils.

Two levels of pre-emergency flood readiness are recognized:

- Normal Preparedness Phase: This occurs each year on November 1.

- Increased Readiness Phase: This occurs when the Sacramento River stage at the I Street bridge reaches 23 feet and is rising fast (condition 1) or 25 feet (condition 2).

During the flood emergency, three more phases are recognized:

- Project Flood Alert Stage: This occurs when the Sacramento River stage at the I Street bridge reaches 41 feet and/or the American River stage at the H Street bridge reaches 41 feet or planned dam discharges are expected to cause this to occur.

- Immediate Impact Phase: This occurs when the Sacramento River reaches 31 feet and/or the American River reaches 42.8 feet.

- Flood Danger Stage: This occurs when the Sacramento River reaches 32 feet.

Historical information on the effects of levee failures to water elevations, the extent of flooding, and time and inundation is used to determine likely warning and evacuation plans. The City's flood warning plan includes estimates of time-inundation relationships for several subareas within the flood plain. These areas include the Pocket area (based on scenarios for 3 different levee failures), the Central/Old Sacramento-East Sacramento-North Sacramento areas (based on 13 levee failures scenarios), and Natomas (based on 4 levee failure scenarios).

The City estimates that for the Pocket area, flooding would occur so rapidly that evacuation time would be limited to less than 2 hours for most of the area and less than 1 hour for another portion of the area. The resulting evacuation would impede entry or exit of emergency vehicles. For the Central/Old-East-North Sacramento areas, failure of the levees in most of the 13 scenarios would result in zero response time and substantial damage and probable loss of life. Although there is little response time, some evacuation time is still possible for failures occurring along the Sacramento River east levee near Richards Boulevard, the American River south levee at the Business 80 bridge, the American River north levee at Guy West bridge, the NEMDC below Main Avenue, and the Arcade Creek north levee below Norwood Avenue or below Marysville Boulevard. For Natomas, failure of the levees would result in major flooding in 1 to 7 hours depending on where the failure occurred. Evacuation is possible for levee breaks at the Sacramento River at Orchard Lane and the NEMDC at Arcade Creek. Levee breaks at the American River at the Garden Highway or the Sacramento River at Gateway Oaks would probably not give sufficient evacuation time.

Sacramento County has a Multi-Hazard Functional Plan that addresses flooding hazards from a dam breach or levee failure. Inundation areas from various levee failures on the Sacramento and American Rivers were considered. Large colored maps have been prepared for each of eight scenarios of levee failure. These maps can be used to carryout flood warning and evacuation activities. The eight flood breach maps are based on a depth of water of one foot. A depth of one foot was selected because this level was judged as the depth that would prevent the exit of vehicles from the area. The County feels that an evacuation plan could be effective for the unincorporated area if enough lead time is available before a levee breach occurs. If there is a spontaneous levee breach, the County acknowledges potential loss of life; safe evacuation of concentrated population centers may not be possible in certain areas.

## CHAPTER III - COMPARISON OF MEASURES

9. General. - Table B-6, a summary comparison of the flood control measures considered, includes an indication of relative accomplishments, costs, impacts, and status of further development. Also included is a relative comparison of each pertinent planning criterion and a statement as to whether or not the measure was retained for further study or whether it was deleted from consideration along with the primary reason(s) why. Below is also a summary statement as to why the measure was considered for development into alternative plans. The criteria used to compare the measures are described in Chapter I of this appendix.

10. Measures Deleted from Further Consideration. - The following flood control measures have been identified but were deleted from development into alternative flood control plans.

a. Main Stem American River. -

(1) Increase Downstream Channel Capacity with Setback Levees. - This measure was deleted from formulation into an alternative plan primarily because of the likely cost and high socioeconomic impacts. The large number of relocations required makes this measure socially inviable.

(2) Raise Folsom Dam. - This measure was not considered further because of the inherent difficulties associated with enlarging the existing structure, the prohibitive construction and relocation costs, as well as social and environmental impacts. The existing structure currently uses all available natural capacities formed by the topography of the site. Enlargement of the existing site provides unique problems since the topography does not lend itself to expansion.

(3) Use Upstream Reservoir Space for Flood Control. - The acquisition of additional flood control storage was not considered further because of the significant high cost to acquire the space and modify the outlet works in conjunction with the relatively small beneficial impact of the limited available space for flood control.

The use of incidental flood control storage space was carried forward as a measure. A total of 47,000 acre-feet of incidental flood control storage space was used in developing 100-year (FEMA) levels of flood protection.

(4) Improve Flood Forecasting for Folsom Reservoir Operations. - This measure was deleted from consideration because of the low potential to confidently increase the level of flood

Table
SUMMARY OF FLOOD

| Measures 1/ | Level of Flood Protection | Construction Cost ($Millions) | Resource Replacement | | Environmental Resou | |
|---|---|---|---|---|---|---|
| | | | Water Supply (1,000 ac-ft/yr) | Hydropower (GWH/yr) | Recreation | Fish & Wildlife |
| | | | | | | Mainstem Ameri |
| Increase Folsom Flood Space from 400,000 to 650,000 acre-feet. | 94 | 0 | 33 Reduction | 41 Reduction | Moderate Reduction | Moderate Reduction |
| Increase Channel Capacity via Levees Mod. from 115,000 to 180,000 ac-ft. | 100 | 236 | None | None | Moderate Reduction | Moderate Reduction |
| Increased Channel Capacity via Setback Levees from 115,000 to 180,000 cfs. | 100 | Very High | None | None | Increase | Increase |
| Structural Modification of Folsom Dam (Lower Spillway). | 65-70 | 40.6 | None | None | None | None |
| Raise Folsom Dam. | 100+ | Very High 4/ | Moderate Increase | Moderate Increase | Moderate Increase | Moderate Reduction |
| Existing Upstream Storage Space Use. | 100 | 600+ | Moderate Reduction | High Reduction | Moderate Reduction | Low |
| New Upstream Storage - Single Purpose (545,000 ac-ft). | 200 | 549 | None | None | None | Low Reduction |
| Improved Flood Forecasting. | Marginal Increase | None | High Reduction | Moderate Reduction | Moderate Reduction | High Reduction |
| Small Upstream Dam | 65-100 | Very High | None | None | None | Moderate Reduction |
| Offstream Storage | 70 | High 4/ | None | None | None | Moderate Reduction |
| Out-of-Basin Diversions | 100+ | Very High 4/ | None | None | None | High Reduction |
| Sacramento Deep Water Shipping Channel | 65-70 | Marginal | None | None | None | Moderate Reduction |
| | | | | | | Natomas 5 |
| Levee Improvements in and around Natomas. | 100(200) 7/ | 80+ | None | None | None | Minimal Reduction |
| Compartment Levees | 100(200) | 100+ | None | None | None | Moderate Reduction |
| **Gated Structures and Pump Facilities** | | | | | | |
| NEMDC & Mouth | 100(200) | 70 | None | Reduction | None | Moderate Reduction |
| Natomas Cross Canal | 100(200) | 20 | None | Reduction | None | Moderate Reduction |
| NEMDC @ Dry Creek | 100(200) | 10 | None | Reduction | None | Low |
| Upstream Detention Dams | Moderate Increase | High4/ | None | None | None | High Reduction |
| Modify Fremont Weir | 100(200) | 10-20 | None | None | None | Low |
| Sacramento River Constriction | 100(200) | High 4/ | None | None | None | Moderate Reduction |
| New Natomas Cross Canal | 100(200) | Very High 4/ | None | None | None | Increase |
| Reducing American River Flow | 100(200) | 0 | None | None | Moderate Reduction | Moderate Reduction |
| North Natomas Detention Basin | 100(200) | 5.6 | None | None | None | Moderate Reduction |
| Non-Traditional (Non-Structural) | N/A | 6,900 | None | None | None | None |

1/ Assumes structural stability of all levee reaches.
2/ Retained or deleted from formulation into an alternative plan.
3/ High likelihood for significantly increased effectiveness when combined with other measures.
4/ Cost not estimated.
5/ Cost for Natomas measures do not include those to offset induced flow impacts.
6/ Measures in Natomas can provide indicated levels of protection only when in combination with others.
7/ 100(200) = 100-and 200-year levels of flood protection when in combination with certain other Natomas measures.

## Table B-6
## SUMMARY OF FLOOD CONTROL MEASURES

| acement | Environmental Resources | | | Relative Comparison | | | | |
|---|---|---|---|---|---|---|---|---|
| Hydropower (GWH/yr) | Recreation | Fish & Wildlife | Vegetation | Effectiveness | Efficiency | Acceptability | Completeness | Fe |
| **Mainstem American River** | | | | | | | | |
| 41 Reduction | Moderate Reduction | Moderate Reduction | Moderate Reduction | Low | Very High | Moderate | Moderate | |
| None | Moderate Reduction | Moderate Reduction | High Reduction | Moderate | Moderate | Low | Moderate | |
| None | Increase | Increase | Increase | Moderate | Very Low | Very Low | Moderate | |
| None | None | None | None | Very Low | Moderate | High | High | |
| Moderate Increase | Moderate Increase | Moderate Reduction | Moderate Reduction | Moderate | Very Low | Very Low | Very Low | |
| High Reduction | Moderate Reduction | Low | None | Low | Low | Low | Moderate | |
| None | None | Low Reduction | Low Reduction | Very High | High | Moderate | Very High | |
| Moderate Reduction | Moderate Reduction | High Reduction | Moderate Reduction | Very Low | Low | Low | Low | |
| None | None | Moderate Reduction | High reduction | Low | Low | Very Low | Moderate | |
| None | None | Moderate Reduction | Moderate Reduction | Low | Low | Low | High | |
| None | None | High Reduction | High Reduction | Moderate | Very Low | Very Low | High | |
| None | None | Moderate Reduction | None | Very Low | Very Low | Low | Moderate | |
| **Natomas 5/ 6/** | | | | | | | | |
| None | None | Minimal Reduction | Low | High | High | High | High | |
| None | None | Moderate Reduction | Moderate Reduction | High | High | Very Low | High | |
| | | | | | | | | |
| Reduction | None | Moderate Reduction | Low | Moderate | Low | Moderate | Moderate | |
| Reduction | None | Moderate Reduction | Low | Moderate | Low | Moderate | Moderate | |
| Reduction | None | Low | Low | High | High | High | High | |
| None | None | High Reduction | High Reduction | Low | Very Low | Low | High | |
| None | None | Low | Low | Very Low | Low | Low | Very Low | |
| None | None | Moderate Reduction | Low | High | Low | Very Low | Moderate | |
| None | None | Increase | Increase | High | Very Low | Very Low | High | |
| None | Moderate Reduction | Moderate Reduction | Moderate Reduction | Low | High | Moderate | Very Low | |
| None | None | Moderate Reduction | Moderate Reduction | Moderate | Moderate | Moderate | Low | |
| None | None | None | None | Moderate | Low | Moderate | Low | |

rs.
omas measures.

2

| Relative Comparison | | | | Status | |
|---|---|---|---|---|---|
| tiveness | Efficiency | Acceptability | Completeness | Formulation Status 2/ | Primary Reason |
| | | | | | |
| Low | Very High | Moderate | Moderate | Retained | Low cost, ease of implementation and low adverse impacts. |
| lerate | Moderate | Low | Moderate | Retained | Effectiveness in reducing flood threat. |
| lerate | Very Low | Very Low | Moderate | Deleted | High cost and very high socioeconomic impacts. |
| ry Low | Moderate | High | High | Retained | Potential for effective combination with other measures. |
| derate | Very Low | Very Low | Very Low | Deleted | High cost and moderate effectiveness. |
| Low | Low | Low | Moderate | Deleted | High cost and low effectiveness. |
| y High | High | Moderate | Very High | Retained | Potential to provide high levels of flood protection. |
| ry Low | Low | Low | Low | Deleted | Low effectiveness with high annual system impacts. |
| Low | Low | Very Low | Moderate | Deleted | High cost with low flood control benefits. |
| Low | Low | Low | High | Deleted | High cost and high environmental impacts. |
| derate | Very Low | Very Low | High | Deleted | High cost and high environmental impacts. |
| ry Low | Very Low | Low | Moderate | Deleted | Little to no flood control benefits. |
| | | | | | |
| High | High | High | High | Retained | Effective in reducing flood threat. |
| High | High | Very Low | High | Deleted | High cost and high environmental impacts. |
| | | | | | |
| derate | Low | Moderate | Moderate | Deleted | Relatively high cost. |
| derate | Low | Moderate | Moderate | Deleted | Relatively high cost. |
| High | High | High | High | Retained | High effectiveness and acceptability. |
| Low | Very Low | Low | High | Deleted | High cost and low acceptability. |
| ery Low | Low | Low | Very Low | Deleted | Low level of effectiveness. |
| High | Low | Very Low | Moderate | Deleted | High environmental impacts. |
| High | Very Low | Very Low | High | Deleted | High environmental impacts. |
| Low | High | Moderate | Very Low | Deleted | Low effectiveness and completeness. |
| loderate | Moderate | Moderate | Low | Retained | High effectiveness when combined with other measures. |
| loderate | Low | Moderate | Low | Deleted | Significant socioeconomic impacts and high cost for some non-structural measures. |

protection without a severe adverse impact on the accomplishments of Folsom Dam and Reservoir project as well as resources and facilities along the lower American River (more frequent releases of higher floodflows).

(5) Construct Small Upstream Detention Dams. - This measure was deleted from further consideration because of the relatively small influence such dams would have on the downstream floodflows and the comparatively much higher economic and environmental costs.

(6) Construct Offstream Storage. - This measure was not considered further in this study due to significant high costs and relatively little potential for increasing downstream flood protection.

(7) Construct Out-of-Basin Diversions. - This measure was eliminated from further study due to high costs and potential significant flood impacts in the Cosumnes River basin.

(8) Use Capacity in Sacramento River Deep Water Ship Channel. - This measure was deleted from further consideration due to high cost, adverse impacts to the ship channel, and, at best, marginal flood reduction impact.

b. Natomas. -

(1) Construct Detention Dams Upstream from Natomas. - This measure was not considered further because of the high cost of the reservoirs, high potential adverse impacts in the reservoir areas, and relatively low impact on controlling downstream stages in the NEMDC and NCC.

(2) Construct Compartment Levees In Natomas. - This measure was deleted from further development because it would not offer protection to much of north Natomas, its high cost, and it would not likely prevent future development in north Natomas.

(3) Modify Fremont Weir and Yolo Bypass. - This measure was deleted from further consideration as a measure in lowering stages in the Sacramento River at the mouth of the NCC because of its questionable ability to reduce river stages.

(4) Construct Sacramento River Check Structure. - This measure was deleted from further consideration primarily because of possible high adverse environmental impacts.

(5) Construct New Natomas Cross Canal. - This measure was deleted from further development because of its high cost and higher environmental impacts compared to other alternatives.

(6) Lower Stages in NEMDC by Reducing Flow in American River. - This measure was deleted from further consideration because it would be significantly more costly than the other solutions.

c. Non-Traditional. - Nonstructural measures were considered as potential partial solutions. However, because of the large numbers of existing residential, commercial, industrial and institutional structures, high flood depth, and extensive flood plain area, raising or removing structures from the flood plain would not be economically feasible. Similarly, flood proofing would not be economically, socially, and environmentally feasible. Flood warning and evacuation plans are already in place for the City and County of Sacramento. Consequently, this measure was not formulated into a specific alternative.

11. Measures Considered in Alternative Plan Development. -

a. Main Stem American River. -

(1) Increase Flood Control Storage Space in Folsom Reservoir. - This measure was retained for further study primarily since it can be accomplished with no new construction and because reservoir storage offers a higher degree of confidence in achieving specific levels of flood protection than other forms of structural flood protection.

(2) Increase Downstream Channel Capacity with Levee and Channel Modifications. - This measure was retained for further study because initial analysis indicated that it would likely be economically feasible.

(3) Make Structural Modification of Folsom Dam to Permit Increased Releases. - Although, as an independent measure, lowering the spillway would not result in significant increases in flood protection, this measure was retained for further study as it could easily be considered with the measures above to increase their viability.

(4) Construct New Upstream Flood Control Storage Facilities. - This measure was retained for further study primarily because it was the only measure found capable of resulting in high (greater than about 200 year) levels of flood protection. Also, in the Sacramento area there is a higher degree of confidence in detention of floodwaters behind a dam than in managing floodflows with levee and channel improvements.

b. Natomas and Vicinity. -

(1) Construct Levee and Channel Improvements in and Around Natomas. - This measure was retained for further development since it is the only known measure capable of either singularly or in combination with other measures to provide protection to Natomas.

(2) Construct Gated Structure and Pumping Facilities. - The gated pump structure facility near Dry Creek was retained for further study because of its likely high economic viability. However, a gated pump structure at the mouth of the NCC was deleted from consideration due to the high cost and limited pumping capacity.

(3) Construct a Detention Basin in North Natomas. - This measure was deleted as a stand-alone measure to reduce flooding in Natomas. This is because of the large capacity of facilities that would be required to effectively reduce flooding. It was found, however, that this measure could slightly reduce induced flooding potentially occurring in the NCC area due to construction at levee features along the canal to help protect Natomas. Accordingly, this measure was retained for further studies for that purpose.

## CHAPTER IV - SPECIAL PLAN FORMULATION CONSIDERATIONS

12. General. - Several primary plan formulation considerations warrant separate presentations because of their complexity and importance. They are presented in this chapter in advance of descriptions of alternative plans, to build a better understanding of those plans. These topics are divided into four categories:

- Other Water Resource Needs
- Related Water Resource Opportunities
- Engineering Considerations
- Auburn Dam Project Creditable Expenditures To Date

13. Other Water Resource Needs. - Discussions here of water supply, recreation, hydropower, and instream uses are in response to language accompanying the Fiscal Year 1988 Continuing Appropriations Act. In this language, Congress directed the Corps to assess how the operation of Folsom Dam and any new peakflow flood control facility identified in this investigation might relate to these water resource opportunities. The remaining topics in the chapter are significant when evaluating flood problems and potential solutions and were considered during plan formulation.

a. Water Supply. - Estimates of future water use and supply in the American River basin were developed from information provided by DWR, USBR, and local agencies. A detailed description of these estimates is contained in the Water Supply Needs Appendix and summarized below. The basin includes portions of El Dorado, Placer, and Sacramento Counties. Water requirements were compiled according to these subareas:

- El Dorado County

  El Dorado Irrigation District (EID)
  Georgetown Divide Public Utility District (GDPUD)

- Placer County

  Western Placer
    Future American River Service Area
    Other Potential Service Areas

  Placer County Water Agency (PCWA) Zone
  City of Roseville and San Juan Suburban Water
    District (SJSWD)

- Sacramento County

  North-Northeast Area
  City of Sacramento Water Rights Place of Use
  Folsom South Service Area

The subarea "City of Sacramento Water Rights Place of Use" includes some lands outside the City of Sacramento. For brevity, however, the subarea will be referred to simply as "City of Sacramento."

Although not included in DWR's study, San Joaquin and Sutter Counties have shown an interest in a future water supply from the American River. San Joaquin County, which is part of the USBR's Folsom South service area, has indicated a supplemental water need of 221,000 acre-feet. Sutter County is studying potential developments in the county.

(1) Water Use. - DWR developed estimates of present (1983 and 1985) and future (2015 and 2020) water use in the various subareas on the basis of countywide projections of population by the State Department of Finance and DWR's projected change in agricultural conditions. The estimates for El Dorado and Placer Counties were based on investigations conducted in 1983. Estimates for Sacramento County were based on information from 1984 land use surveys. Local agencies and USBR also have estimated future water use. The various estimates are summarized in Table B-7.

(2) Water Supply. - DWR estimates the total available water use, or demand, in the American River basin in 2015/20 to be 1.22 million acre-feet. Table B-8 shows the use and source for each subarea. The sources are the American River, non-American River, ground water, and reuse. The quantities are based on present water rights and water contracts and do not include uncommitted USBR water supply. Some of these amounts depend on construction of significant water delivery systems. Without the systems, the supply amount would be much lower.

(3) Water Shortage or Surplus. - Table B-8 shows the estimated water shortage (-) or surplus (+) in 2015 and 2020 for each subarea. These estimates were derived by subtracting the estimated water uses from the total supplies. Placer County will need facilities for its water supply conveyance, whereas El Dorado and possibly Sacramento Counties will require both additional supply and conveyance facilities.

Placer County has an adequate water supply to meet its needs beyond 2020. However, about 212,000 acre-feet of the net surface-water supply is not yet deliverable. The county is

# TABLE B-7

## AMERICAN RIVER BASIN PROJECTED WATER USE (1,000 AC-FT) 1/

| Location | 1983/85 DWR | | | 2015/20 DWR | | | 2015/20 LOCAL | | | 2015 USBR 2/ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AG | M&I | Total | AG | M&I | Total | AG | M&I | Total | AG | M&I | Total |
| **El Dorado** | | | | | | | | | | | | |
| | Year 1983 | | | Year 2020 | | | Year 2020 | | | | | |
| EID | 11 | 13 | 24 | 15 | 34 | 49 | - | - | - | - | - | 55 |
| GDPUD | 4 | 2 | 6 | 8 | 5 | 13 | 8 | 5 | 13 | - | - | 3 |
| Total | 15 | 15 | 30 | 23 | 39 | 62 | 8 | 5 | 13 | - | - | 58 5/ |
| **Placer County** | | | | | | | | | | | | |
| | Year 1985 | | | Year 2020 | | | Year 2020 | | | | | |
| Western Placer Future American River Service Area | 74 | 3 | 77 | 78 | 5 | 83 | - | - | 156 3/ | - | - | 0 |
| Other Potential Service Area | 138 | 4 | 142 | 144 | 9 | 153 | - | - | - | - | - | 0 |
| PWCA Zone | 28 | 16 | 44 | 29 | 33 | 62 | - | - | 110 3/ | - | - | 237 |
| Roseville and SJSWD 4/ | 0 | 15 | 15 | 0 | 27 | 27 | - | - | 62 | - | - | 32 |
| Total | 240 | 38 | 278 | 251 | 74 | 325 | - | - | - | - | - | 269 5/ |
| **Sacramento County** | | | | | | | | | | | | |
| | Year 1985 | | | Year 2015 | | | Year 2015 | | | Year 2015 | | |
| North-Northeast | 0 | 120 | 120 | 0 | 163 | 163 | 11 | 181 | 192 | 0 | 213 | 213 |
| Sacramento City | 0 | 175 | 175 | 0 | 275 | 275 | 16 | 228 | 244 | - | - | 230 |
| Folsom-South | 306 | 30 | 336 | 323 | 76 | 399 | 287 | 88 | 357 | 293 | 132 | 425 |
| Total | 306 | 325 | 631 | 323 | 514 | 837 | 314 | 497 | 811 | - | - | 868 |

1/ Uses are at user site.
2/ USBR Technical Papers No. 1 & 2 for Draft Water Contracting EIS.
3/ Placer County Water Agency memo dated June 13, 1989.
4/ San Juan Suburban Water District.
5/ Supplemental water needs.

# TABLE B-8

## AMERICAN RIVER BASIN DWR WATER BALANCE (1,000 AC-FT)

| Location | Water Demands | | | Net Surface 1/ Water Supply | | Ground Water Supply | Reuse | Total 2/ Water Supply | Shortage (-) 3/ or Surplus (+) |
|---|---|---|---|---|---|---|---|---|---|
| | AG | M&I | Total | Non-American River | American River | | | | |
| **El Dorado County (2020)** | | | | | | | | | |
| EID | 15 | 34 | 49 | 12 | 16 | 0 | - | 28 | -21 |
| GDPUD | 8 | 5 | 13 | 0 | 9 | 0 | - | 9 | -4 |
| Total | 23 | 39 | 62 | 12 | 25 | 0 | - | 37 | -25 |
| **Placer County (2020)** | | | | | | | | | |
| Western Placer Future American River Service Area | 78 | 5 | 83 | 2 | 81 | 40 | 33 | 156 | 73 |
| Other Potential Service Area | 144 | 9 | 153 | 87 | 0 | 27 | 16 | 130 | -23 |
| PWCA Zone | 29 | 33 | 62 | 54 | 96 | 0 | - | 150 | 88 |
| Roseville and SJSWD | 0 | 27 | 27 | 0 | 62 | 0 | - | 62 | 35 |
| Total | 251 | 74 | 325 | 143 | 239 | 67 | 49 | 498 | 196 |
| Amount surplus if water transfer does occur within the County | | | | | | | | | 173 |
| Local agency's projected shortage or surplus | | | | | | | | | 40 |
| **Sacramento County (2015)** | | | | | | | | | |
| North-Northeast | 0 | 163 | 163 | 0 | 90 | 41 | - | 131 | -32 |
| Sacramento City | 0 | 275 | 275 | 78 | 218 | 73 | - | 369 | 94 |
| Folsom- South | 323 | 76 | 399 | 2 | 0 | 223 | - | 225 | -174 |
| Total | 323 | 514 | 837 | 80 | 308 | 337 | - | 725 | -206 |
| Amount needed if water transfer does occur within the County | | | | | | | | | -112 |
| Local agency's projected shortage or surplus | | | | | | | | | -193 |

1/ Net surface water supply is supply minus conveyance losses.
2/ Total water supply is net surface plus ground water.
3/ Shortage (-) or surplus (+) is the total water supply minus the total demand.

studying ways to deliver American River water. PCWA has indicated that development in the area will probably be much more rapid than projected by the Department of Finance, so the agency disagrees with projected water needs contained in this report.

DWR projections for El Dorado County show a water shortage of about 25,000 acre-feet in 2020 (21,000 for EID and 4,000 for GDPUD). El Dorado County Water Agency has stated that it is concerned that DWR projections possibly understate the true magnitude of future needs and shortages and the urgency for development of supplemental water supplies in the EID service areas. GDPUD's projected shortages are the same as DWR's. Water agencies in the county are studying alternative ways to provide for this shortage.

Sacramento County is projected to have a supplemental need for about 206,000 acre-feet of water in 2015. The county has been studying a combination of the following actions to meet these supplemental needs:

- A contract with USBR.
- Full use of existing water supplies.
- Water conservation.

Examples of alternatives being considered under each of these actions are described below.

(a) Contracts with USBR for CVP Water. - A contract with USBR would involve purchase of both firm and intermittent CVP water from USBR, delivered from the American River and/or the Sacramento River, to meet the long-term water program. Contracting efforts have been stalled the past few years because of opposition from interests that believe the CVP must fully mitigate fish and wildlife impacts before selling its remaining supply.

Other uncertainties related to the amount of water available to the CVP include:

- A future decision by the State Water Resources Control Board (SWRCB) after its review of water rights on the American River. This decision could revise the instream flow requirement in USBR's permit.
- The SWRCB's Bay/Delta estuary proceedings, which are now under way.

Sacramento County has indicated that if the amount of CVP water available for new contracts is reduced to the point that uncontracted CVP water is insufficient to meet the county's water

supply needs, then the county may, after review of all options, exercise its area-of-origin water rights.

(b) Full Use of Existing Supplies. - Sacramento County could use:

- Water that would be surplus to the needs of the City of Sacramento and others with water entitlements that are greater than their current needs.
- The unused contractual entitlement for CVP water of the SMUD.
- Reclaimed wastewater.

(c) Water Conservation. - Additional water conservation measures could further reduce the need for additional water. Installing meters and charging according to the amount of water delivered could be such a measure.

b. Recreation. - The lower American River, Folsom Lake, and upper American River canyons provide prime and unique resources for outdoor recreation opportunities. The lower river is officially designated a "recreational river" within both the State and Federal wild and scenic river systems. Paralleling the lower river in Sacramento is the American River Parkway, a 5,000-acre greenbelt used by about 5 million visitors each year. All these areas, because of their location within a large surrounding population base with a large potential for growth nearby, will experience significantly increased recreation demand in the future.

A 1987 report by the State Department of Parks and Recreation on "Public Opinions and Attitudes on Outdoor Recreation" showed that demand is high for the types of activities suitable within the study area, including walking, hiking, boating, cycling, beach use, nature study, picnicking, and camping. Additionally, the report indicated that nature-oriented parks or preserves and back-country natural areas are the two types of recreation areas most preferred by Californians. The City and County of Sacramento have identified similar priorities for recreation land and facility development in their long-range master plans. Of particular concern because of the rapidly expanding population of the area is the need for open-space areas that preserve important natural values of the landscape. The popularity of the American River Parkway and its Jedediah Smith trail results in highly intensive use, often to the point of exceeding a safe capacity. Additional paved bicycle trails and equestrian trails, especially along "natural" appearing areas such as the NEMDC, would help relieve crowding on the existing trails and help meet local open-space goals.

c. Other. - Two other water resource opportunities in the study area are (1) future power needs and (2) instream flows for fisheries. The continuing rapid growth in California's economy is increasing the use of electricity statewide. In northern California specifically (including the SMUD service area), peak load/consumer demand is projected to increase about 30 percent between 1985 and 1999. Energy conservation and load management programs continue to play a vital role in California's electric system growth trends. Even with these trends and uncertainties in California Energy Commission forecasts of power demands, California's diverse economy and associated population growth will ensure some significant rate of growth in demand for energy, estimated to be between 1.5 and 2.5 percent annually.

(1) Power. - The California Energy Commission estimates that northern California currently has adequate capacity from its basic system plus non-deferrable sources to meet requirements through 1997. After 1997, power developments which are fundamentally under way but may be awaiting regulatory approvals are projected to supply all of the remaining capacity needs in northern California through 1999. Needs for electric power in the Sacramento area and the State as a whole are expected to exceed available supplies between the years 2000 and 2007. By the end of the California Energy Commission's forecast period (2007), northern California is expected to experience a capacity deficit of nearly 4,100 MW. No projections are made for periods past 2007.

(2) Instream Flows. - Increased instream flows in the American River during fall may be necessary to maintain the river's nationally significant anadromous fisheries. The flow regime from Folsom Dam is mandated by SWRCB Decision 893 (D-893), which requires the USBR to release a minimum flow of 500 cfs below Nimbus Dam from September 15 to January 1 and 250 cfs the remainder of the year, except in critical dry years. As shown in Figure 1, existing monthly average flows are well above these minimums.

In 1972, the SWRCB issued Decision 1400 (D-1400), which established a new flow regime in anticipation of additional water supplies resulting from the construction of the multipurpose Auburn Dam. D-1400 and subsequent modifications established minimum fishery releases of 1,250 cfs from October 15 to July 15 and 800 cfs for the remainder of the year. D-1400 also established minimum recreation flows of 1,500 cfs between July 16 and October 14. D-1400 was conditioned on the construction of the Auburn Dam and, as such, has not been implemented.

The minimum flows required by D-893 and D-1400 are of considerable concern among fish and wildlife agencies and environmental and recreation interests, who believe the flows are too low to sustain the existing fishery and recreation use in the

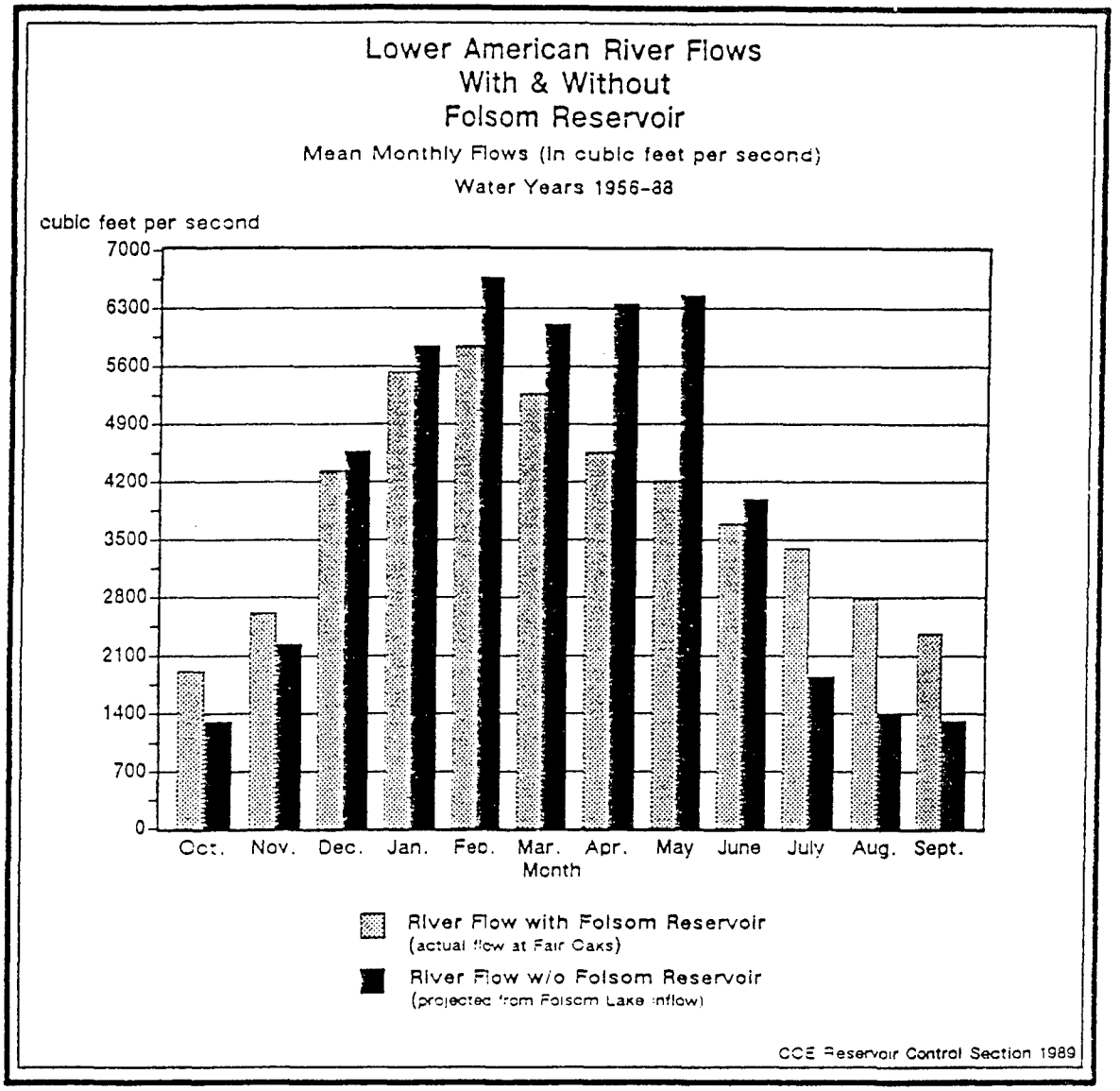



FIGURE 1 **Mean Monthly Flows for the Lower American River Below Nimbus Dam With and Without Folsom Reservoir**

river. This concern will probably grow in the future for several reasons, one of which is a recent decision by the Superior Court of Alameda County concerning East Bay Municipal Utility District's (EBMUD) contract with USBR to divert water from the lower American River. The court, in its decision on a lawsuit filed by the Environmental Defense Fund against EBMUD, established flow diversion criteria for the district. EBMUD could divert water from the Folsom South Canal so long as these flow conditions in the river were being maintained: (1) 2,000 cfs from mid-October to March 1, (2) 3,000 cfs from March 1 to July 1, and (3) 1,750 cfs from July 1 to mid-October.

The SWRCB is also initiating a review of the American River water rights of the USBR and the City of Sacramento. This will include a review of existing instream flow standards for the lower American River. A draft work schedule for these water rights reviews is under way. Additionally, the SWRCB is involved in the Bay/Delta hearings on Delta water quality, which could affect future operations and water diversions for the American River.

14. Water Resource Opportunities. - The congressional authorization for this investigation requires that the relationships between the flood-control-only project and other related water resource needs be evaluated. A basic premise in the formulation of the flood control project has been neutrality with respect to any multipurpose water development. The intent has been to move forward with flood control without either advancing or impeding the prospects for any future development of water and power facilities at the Auburn site. Accordingly, the selected plan and alternatives include only features that are necessary for flood control.

Early in the plan formulation process, however, a number of potential measures relating to other water resource needs in the American River basin were identified. They are highlighted here and include three local benefits options plus a multipurpose Auburn Dam.

a. Upstream American River Options. - New reservoir storage at or near the Auburn Dam site has been considered for years. Until recently, the primary focus for the storage has been for water supply. However, it is now known that cost effective flood-control-only storage space can be implemented at the site. Because of concerns that a flood control detention dam would not meet other resources needs, such as local water supplies, efforts were made to identify the range of possible options available in conjunction with a primarily flood control detention dam at the Auburn site. At one end of the new storage spectrum is a flood control detention dam. At the other is the multipurpose Auburn Dam project. In the middle are other options with potential local water resources benefits. A brief description and preliminary

comparison of several of the potential new storage options follows.

b. Flood Control Dam at Auburn Project Site. -

(1) Description. - A flood control dam at Auburn would create a flood inundation zone periodically inundating up to about 4,000 acres. Studies of alternative sites for flood control dams (see Damsite Selection Appendix) were conducted along the North Fork American River from the upper reaches of Folsom Lake to the confluence with Middle Fork. Primarily for geotechnical reasons, the sites considered were narrowed to the RM 19.0 site and the RM 20.1 site. The RM 20.1 site was selected by the USBR for construction of Auburn Dam. Recent studies showed that if the RM 19.0 site were investigated in detail (similar to past efforts at the RM 20.1 site) and no significant differences in the assumed foundation conditions were found, construction costs at the RM 19.0 site would probably be less than for the RM 20.1 site. However, when including the costs of extensive geotechnical evaluations, cost inflation due to delayed start of construction, flood control benefits foregone by extending the time to investigate the downstream site, increased environmental impacts at the RM 19.0 site, and costs to restore the RM 20.1 site, the RM 20.1 site was determined to be the most cost effective.

The degree of inundation would range from a fairly small pool (several thousand acre-feet) once every 4 to 5 years or so and lasting only a day or two to a filling of the reservoir for a 200-year event lasting up to about 12 days. The total fill and drawdown time for a 200-year event would be approximately 21 days. The canyon upstream of the dam would appear similar to the way it looks today. Plate 4 and 5 show the relationship between pool elevation and the duration of inundation for various frequency flood events for a project with a flood control detention capacity of 545,000 and 894,000 acre-feet. These stages, in conjunction with 400,000 acre-feet of flood space at Folsom, would limit the objective release from Folsom to 115,000 cfs for the 200- and 400-year flood events, respectively. Plate 6 shows the relationship between elevation and flooded areas and volume at the site.

The dam would be a concrete gravity design (placed with roller compaction techniques) located about 800 feet downstream of the existing Auburn Dam foundation. For alternatives described here, flood control releases from the dam would be made via 12 gated (normally open) sluices in the dam. The emergency spillway would be constructed over the face of the dam. Figure 2 shows an artist's conception of the dam in the American River canyon.

The project would also include relocating Highway 49 (described separately in this chapter).

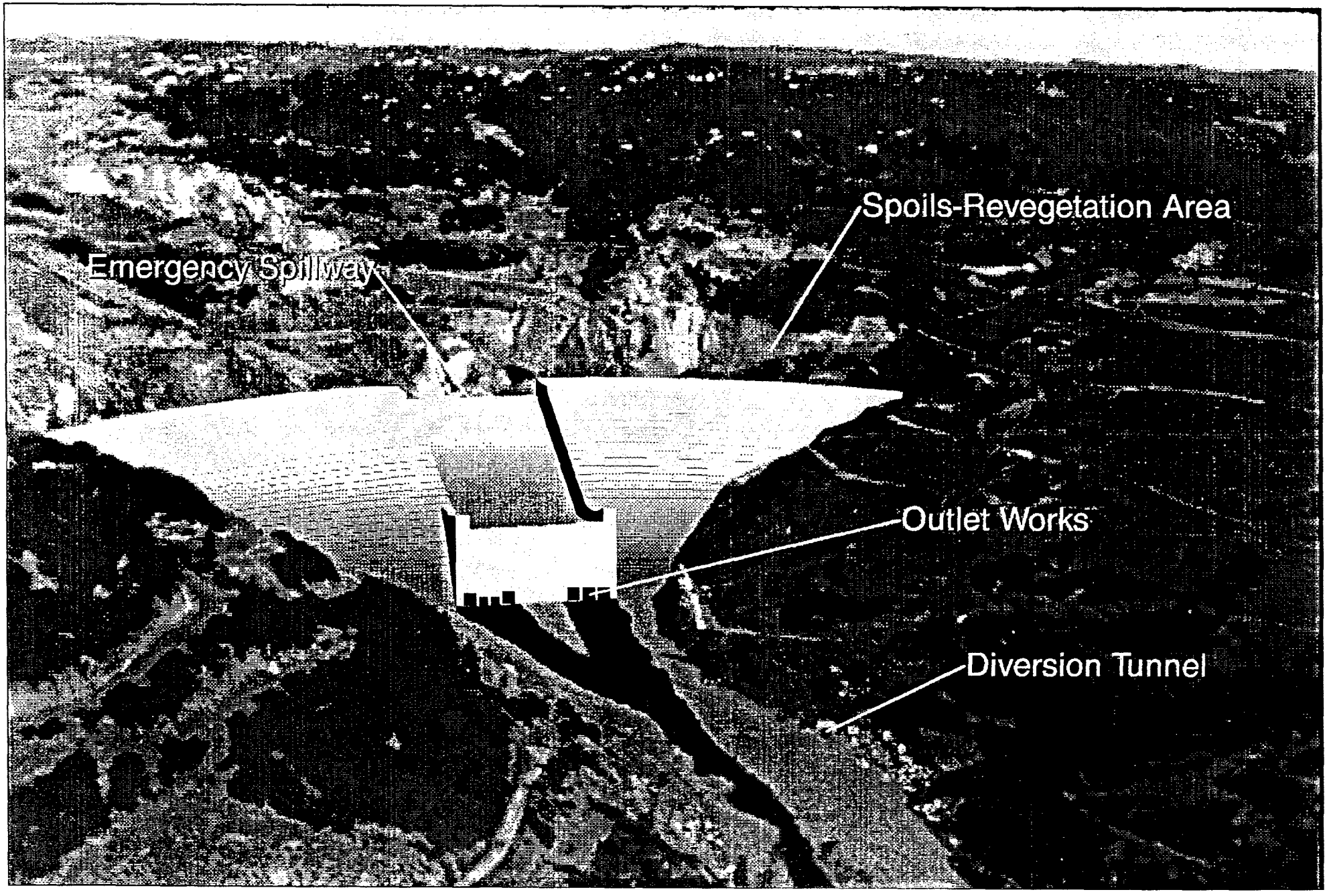



**FIGURE 2 200–YEAR FLOOD CONTROL DAM**

Environmental impacts associated with a flood control dam would primarily include change in vegetation character in the reservoir area and are described more fully in the EIS/EIR.

(2) Costs. - Preliminary estimated first costs for various sizes of a flood control detention dam, not including mitigation for adverse environmental impacts, are shown in Table B-9. The lands cost feature is for all lands needed for a flood control detention dam. The creditable expenditures to date are intended to account in the project costs for expenditures by USBR on the Auburn project that would also be needed for a flood control dam (acquired in fee for damsite and easement in reservoir area).

TABLE B-9
PRELIMINARY FLOOD-CONTROL-ONLY DAM COSTS
(OCTOBER 1991 PRICE LEVELS)

| Level of Protection (Return Period, Years) | 100 | 200 | 400 | 500 |
|---|---|---|---|---|
| Flood Control Storage Space (Ac-Ft)[1] | 190,000 | 545,000 | 894,000 | 1,064,000 |
| First Cost ($ Millions) | | | | |
| Lands[2] | 38.8 | 43.4 | 49.2 | 52.4 |
| Relocations | 110.0 | 110.0 | 110.0 | 110.4 |
| Dam | 154.4 | 212.3 | 274.0 | 324.0 |
| E, D, S, & A[3] | 52.7 | 64.3 | 76.5 | 80.9 |
| Subtotal | 355.9 | 430.0 | 509.7 | 567.7 |
| Creditable Expenditures to Date[4] | 77.7 | 77.7 | 77.7 | 77.7 |
| Total | 433.6 | 505.7 | 587.4 | 645.4 |

[1]Storage space in new facility assuming 400,000 acre-feet in Folsom Reservoir.
[2]Reservoir lands expressed as easement costs. Fair market value of private and Federally owned lands.
[3]Engineering, design, supervision, and administration.
[4]Portion of Federal expenditures to date creditable to alternative (described later in this chapter).

(3) Summary. - The detention-dam-only option has the potential for providing high levels of flood protection to the flood prone areas of Sacramento. The Reclamation Board, City of Sacramento, and other local and State agencies have passed resolutions and expressed support for a minimum 200-year level of flood protection. The alternative, however, would not provide

water supply and hydropower opportunities in the American River Watershed incidental to the flood control objective.

C. Local Benefits Concepts. - A flood-control-only project would not address water resources related needs of the local area. Many water development interests have planned on water deliveries from the multipurpose Auburn Dam project. In addition, both Placer and El Dorado County interests have invested much in facilities relating to the Auburn project. In the mid-1960's, the PCWA constructed a 9,600-foot-long, 12-foot-diameter, horse-shoe-shaped tunnel (Ophir Tunnel) under the town of Auburn to divert water from Auburn Reservoir to the western portion of the county for agricultural purposes. Also, in early 1960's, the PCWA, counting on the Auburn project, abandoned plans to construct a water supply dam and reservoir near the existing Auburn Dam site. Both counties have had thousands of acres of lands removed from their tax rolls for years because of the Auburn project.

Local benefits options highlighted below include (1) an advance feature dam, (2) a local benefit pool plan, and (3) several local water delivery concepts. Design and cost estimates were made for the advance feature dam and minimum pool options only. Conceptual layouts and cursory level costs for the local water delivery concepts were obtained from existing information provided by Placer and El Dorado Counties and DWR.

For each of the following local benefit concepts, the costs of features allocated to flood control could be shared by the Federal Government and the remainder by the non-Federal sponsor. The non-flood control features would need to be fully funded by the non-Federal sponsor.

(1) Advance Feature Dam. -

• Description. - This concept consists of a single-purpose flood control dam with minimum facilities that would need to be included in order that the project not preclude expansion by non-Federal interests for other purposes. As with the single-purpose-only project, the Federal action would be complete when construction is complete.

The dam configuration and materials placement methods would be similar to the flood control detention dam. The volume of concrete may be somewhat larger due to a slightly wider cross section. As with the detention dam, the flood releases would either pass through the flood control sluices. Included in the dam would be two penstocks. Each would be bulkheaded during initial construction. The provision of penstocks could allow easy addition of a powerplant in the future for power and water supply. The foundation for a future wet well will be included at the upstream end of the penstocks.

A primary feature of this concept is the non-Federal sponsor's acquisition of all lands in fee title necessary for a multipurpose project.

Impacts associated with this concept would be similar to a flood-control-only dam.

• Costs. - Table B-10 includes the estimated costs for this concept in addition to a 200-year flood control detention dam project (545,000 ac-ft maximum storage). As with the flood-control-only project, most of the costs expended to date which would not have been needed to construct expandable facilities were therefore considered as sunk. The table also shows a breakdown for lands and an estimate of the cost for the advance feature portion of the option.

TABLE B-10

PRELIMINARY ESTIMATES OF ADVANCE FEATURE AND MINIMUM POOL OPTIONS
PRELIMINARY ESTIMATE OF FIRST COSTS - 200-YEAR PROTECTION[1]
(OCTOBER 1991 Price Levels)

| Costs ($ Million) | | | | | |
|---|---|---|---|---|---|
| Advance Feature Dam | | | Local Benefits Pool | | |
| First Cost | Flood Control Only | Total | Net Cost for Advance Feature | Total | Net Cost for Minimum Pool Plus Expandability |
| Lands[2] | 43.4 | 100.5 | 57.1 | 107.4 | 64.0 |
| Relocations | 110.0 | 110.0 | 0 | 110.0 | 0 |
| Reservoir | 0 | 0 | 0 | 5.2 | 5.2 |
| Dam | 212.3 | 233.0 | 20.7 | 262.3 | 50.0 |
| Rec Fac[3] | 0 | 0 | 0 | 1 | 1 |
| E, D, S, & A | 64.3 | 68.4 | 4.1 | 75.4 | 11.1 |
| Subtotal | 430.0 | 511.9 | 81.9 | 561.3 | 131.3 |
| Creditable Expenditures to Date | 77.7 | 74.1 | 0 | 77.7 | 0 |
| Total | 507.7 | 589.6 | 81.9 | 639.0 | 131.3 |

1/Does not include environmental and related mitigation.
2/Costs for 6,032 acres (flood-control-only in easement) and 42,100 acres (for expandable dam and minimum pool) in fee. Includes 200 acres for Highway 49 relocation.
3/Minimum recreation facilities for public health and safety.

• Summary. - This concept allows the project sponsor to achieve a high level of downstream flood protection while preserving the potential to expand the project for other water resources-related needs in the future, should conditions warrant. The non-flood control features would need to be 100 percent funded by a non-Federal entity during construction without a guarantee that the investment would ever result in an expanded project. Future expansion would require new authorization and environmental documentation.

(2) Local Benefits Pool. -

• Description. - In the 1960's, the planning and pre-construction engineering and design for Auburn Dam was well underway, and it was generally perceived that the dam would be constructed in a timely manner. About the same time, the PCWA constructed its Middle Fork American River project to provide additional water for Placer County. This project included the Ophir Tunnel which was to convey water from the proposed Auburn Reservoir to Auburn Ravine and then to western Placer County. However, without the Auburn Dam, the water surface of the streambed is several hundred feet below the inlet portal of the tunnel. Accordingly, the tunnel has been used only in very dry years by pumping relatively small amounts of water from the American River below. This operation currently has limited capacity and is very costly because the pumping plant is removed in the winter and replaced in the spring, and because of the large amount of energy required to pump the water to the elevation of the tunnel entrance.

One method of placing the tunnel into useful service with respect to a flood control dam at the Auburn Dam site would be with a permanent minimum pool holding approximately 130,000 acre-feet. A minimum pool of this size produces a water surface elevation of about 715 feet, which is sufficient for the water surface to reach the tunnel inlet. For a 200-year level of downstream protection, the total facility storage would be about 675,000 acre-feet with the upper 545,000 acre-feet dedicated to flood control. As with the flood control detention dam, this flood space would be subject to inundation very rarely. No new water supplies would be developed through this concept. The pool would be only a diversion facility for existing PCWA supplies and entitlements from CVP. The local benefits pool option also has a potential use as a diversion facility for water to the Georgetown Divide/Pilot Hill areas via a pumping plant and pipeline.

Impacts of a minimum pool project would be similar outside the pool area to the flood control detention dam option above. In the reservoir area there would be a complete loss of existing vegetation (including riparian habitat) and wildlife and displacement within the permanent pool zone. With this option,

there could be additional impacts associated with growth inducement in the water supply service areas.

• Costs. - Included in Table B-8 is a breakdown of the estimated first for this option in relation to the flood control detention dam.

• Summary. - This concept would allow delivery of water supply for Placer County and would reduce the pumping lift needed to deliver water to GDPUD. The facility could accommodate run-of-the-river hydropower generation facilities, and it could also be expandable. The permanent pool would have potential as an excellent recreation resource, as the water surface during the recreation season would be constant. It would require a non-Federal sponsor to provide a substantial financial contribution during construction for the non-flood control facilities. Further, it would cause a permanent inundation of about 37 miles of American River canyon and elimination of whitewater recreation below Ruck-A-Chucky rapids.

(3) Local Water Delivery. -

• Description. - Numerous plans have been developed to convey water from the American River to areas of need in western Placer County, to EID, and the GDPUD service areas. Some of the different concepts have been identified by DWR and are described below. These concepts would generally be independent of a flood control dam.

- Western Placer County. - As described, PCWA has contractual and other rights to American River water, but it does not have an economical method of delivering this supply. Another concept (besides the Local Benefits Pool) to provide water to the entrance portal of the Auburn Tunnel is to continue to expand the current procedure of pumping from the American River. This would require a large pumping plant and pipeline to the tunnel and large annual purchases of energy by PCWA. Water supplies for this and the below listed options would come from releases by PCWA from French Meadows and Hell Hole Reservoirs and their CVP entitlements.

Another concept to provide water to western Placer County includes a large diameter (84-inch±) transmission pipeline from Folsom Reservoir to a service area northwest of Roseville (about 10 miles). A new outlet would be required from Folsom Reservoir.

- El Dorado Irrigation District Service Area. - EID has need of additional water supplies to meet the needs projected to occur by 2020 within its service area. Several different facilities are being considered by EID to meet these needs. Among the facilities in the American River Watershed are Small Alder Dam and Reservoir and the White Rock Penstock

Diversion. The White Rock Penstock Diversion consists of diverting up to 100 cfs from SMUD hydroelectric facilities on the South Fork American River to EID's storage and distribution facilities near Placerville. The maximum quantity of water that can be diverted under the contract is about 40,000 acre-feet.

The Small Alder Dam and Reservoir project would include a dam and 32,000 acre-feet reservoir with provision for enlargement to 185,000 ac-ft. Water would be conveyed to the EID service area via the El Dorado canal to the El Dorado Forebay to Sly Park Reservoir via Hazel Creek Tunnel. Small Alder Dam would be located across Alder Creek approximately 4 miles upstream of the confluence of Alder Creek and the South Fork. The yield of Small Alder Reservoir would be about 11,300 acre-feet.

- Georgetown Divide Public Utility District Service Area. - DWR and GDPUD have identified several river pumping options. One includes a pumping lift of about 1,140 feet to the Auburn Lake Trails Treatment Plant in the Pilot Hill/Cool area. Untreated water could be released directly to the Georgetown Divide Ditch. Water rights for direct year-round diversion to consumptive use should be required. Another option involves pumping from the vicinity of the proposed Auburn Dam site.

The upstream river diversions concept consists of facilities to divert flows from the Rubicon River to service areas in the GDPUD. Water from SMUD's Robbs Peak Diversion on the Rubicon would be diverted into a gravity flow 7.7 mile pipeline which would terminate in the headwaters of Pilot Creek. From this point, the supply would be gravity fed to GDPUD's Stumpy Meadows Reservoir. Rights to use the water consumptively would need to be acquired and an agreement entered into to reimburse SMUD for revenue forgone from power generation .

DWR and others have identified several potential dam and reservoir sites to provide a water supply to GDPUD in the headwaters of the American River. One of the most attractive sites is on Canyon Creek and would consist of a 17,500 acre-feet facility capable of providing about 12,500 ac-ft per year at elevation 2,300 feet. About 1.4 miles of tunnel and 2.6 miles of pipeline conveyance would also be required.

• Costs. - Potential ranges in first costs for the various local water delivery plans are provided in Table B-11. This cursory quality cost information was obtained from existing (and in some cases dated) information on the various plans.

(4) Enlarged Flood Control Dam. - Authorization for this investigation directed the Corps to assess the relationship between a peak-flow flood control facility on the American River and the operation of Folsom Dam, as they may pertain to incidental

## TABLE B-11

## COST INFORMATION FOR LOCAL WATER DELIVERY PLAN

| Area and Item Alternative | Folsom Diversion | American River Pumping Plant | Upstream Diversion | Upstream Storage |
|---|---|---|---|---|
| Western Placer County | 10 mile pipeline from Folsom Reservoir through Roseville. | River diversion downstream from detention dam with pumping plant and pipeline to the tunnel portal. | | 1/ |
| Water Delivery (TAF/Year) 2/ | 114 | 114 | | |
| First Cost ($Millions) | 55 | 3 | | |
| Annual Cost ($Millions) 3/ | 5 | 2 | | |
| Water Cost ($ AF) 4/ | 35 | 17 | | |
| GPUD | | River Diversions near Maine Bar, pumping plant and 3 mile pipline to Georgetown Divide Ditch. Acquisition of Water Supply from PCWA. | Diversion from Robbs Peak on South Fork of Rubicon to Stumpy Meadows Reservoir. Reimburse SMUD for hydropower forgone. | 17,500 AF Canyon Creek Dam, Reservoir and conveyance to service area. |
| Water Delivery (TAF/Year) | | 7 | 7 | 7.8 |
| First Cost ($Millions) | | 9 | 7 | 49 |
| Annual Cost ($Millions) 3/ | | 1.4 | 0.7 | 4.8 |
| Water Cost ($ AF) 4/ | | 220 | 105 | 760 |
| EID | | 1/ | Diversion from SMUD's White Rock facilities and conveyance by pipeline to Bray Reservoir. | 31,700 AF Small Alder Reservoir and conveyance to the existing El Dorado Canal. |
| Water Delivery (TAF/Year) | | | 34 | 11.3 |
| First Cost ($Millions) | | | 40 | 32 |
| Annual Cost ($Millions) 3/ | | | 3.8 | 3.8 |
| Water Cost ($ AF) 4/ | | | 117 | 344 |

1/ No option identified for this appendix.
2/ TAF = thousand acre-feet.
3/ Economic life of 100 years with interest of 8-7/8% was assumed. Cost of water purchase or power forgone not included.
4/ Water cost is to be used only for comparison of alternatives for a single agency. It does not reflect the actual cost of water.

water supply, power, and recreational benefits. In other words, assuming a constant level of flood protection, by increasing the size of a peakflow dam at the Auburn site, flood storage requirements at Folsom Reservoir would be decreased. This could, in turn, result in more water being available for longer periods of time in Folsom Reservoir. The increased volume in Folsom Reservoir could potentially provide an additional water supply, the higher average head at the powerplant would yield increased power generation, and higher average water surface elevations could increase the recreational use at the Folsom State Recreation Area.

Plate 7 shows the relationship between degree of flood protection versus total flood control storage space for 200,000, 300,000; 400,000; 500,000; as well as 600,000 acre-feet in Folsom Reservoir. As can be seen, the total flood space required for a specific level of flood protection is influenced by the amount of flood space considered in Folsom Reservoir. This is primarily because transfer of space from Folsom to a new upstream site would allow a more effective system operation for flood control.

To estimate the potential economic feasibility of substituting, or swapping, flood space in Folsom to Auburn, estimates were made of the monetary benefits and costs for two levels of flood protection--200 and 300 years. For each level of protection, estimates were made using information from Plate 7 of the required storage space at Auburn for 200,000, 300,000, and 400,000 acre-feet flood space in Folsom. The USBR estimated that a firm yield of only about 1,250 acre-feet per year and between about 9 and 17 GWh per year would be gained by decreasing the flood storage space in Folsom from 400,000 acre-feet to 300,000 and 200,000 acre-feet, respectively. Using this information and assuming water supply and hydropower unit benefit values previously described ($300/ac-ft and 100 mils/Kwh), it was estimated that the annual economic benefit of reducing the flood space in Folsom from 400,000 to 300,000 and 200,000 acre-feet would amount to about $1.3 and $2.1 million, respectively.

Assuming a 200-year level of flood protection, it can be estimated from Plate 7 that an additional 55,000 acre-feet and 195,000 acre-feet are required at a new peak-flow dam should Folsom flood space be decreased to 300,000 and 200,000 acre-feet, respectively. The estimated annual costs for adding the increased space to the peak-flow dams are $1.3 and $4.9 million, respectively.

Accordingly, the costs of the space swapping concept are estimated to exceed the benefits or there is only insignificant positive benefit. There was no local support for the space swapping concept. Recreation benefits from the higher seasonal pools in Folsom would be sizable, but not expected to add enough to justify the concept.

(5) MultiPurpose Auburn Dam Project. -

(a) Description. - This option consists of completing construction of the full 2.3 million acre-feet multipurpose Auburn Dam project. There are other sizes of multipurpose projects which are being assessed by the USBR. The project includes a conventional concrete gravity main dam with a straight axis alignment. The location would be similar to the flood control detention alternative. Relocation of Highway 49, construction of a powerplant and recreation facilities, and features for wildlife mitigation would be included.

The general plan of operation would be to (1) generate water supply and hydropower, (2) operate the new facilities in accordance with flood control regulations during the fall, winter, and early spring and, (3) make releases in the late spring and summer to help improve the water surface elevation of Folsom Lake for recreation and instream flow conditions in the lower American River. Water supply diversions could be made into western Placer County, via the Auburn Tunnel and GDPUD, by way of a pipeline in the left abutment of the dam. Releases made for instream flow improvement, water supply, and some flood control would also pass through the powerplant. Because Folsom Reservoir can provide short-term and seasonal re-regulation of Auburn Dam releases, considerable operational flexibility is possible, particularly for power and lake recreation purposes. With the multipurpose Auburn Dam, the average summer flows in the American River could be enhanced over expected future conditions without the project.

The multipurpose reservoir would cause a complete loss of vegetation (including riparian habitat) and wildlife within a permanent pool zone. There would also be significant inundation impacts to cultural resources and whitewater and river-oriented recreation. The environmental community has expressed a continuing concern about the Auburn Dam project. Because of construction delays to date, cost increases, changes in project scope, and environmental concerns, it is likely that, at minimum, the existing EIS for the Auburn Project will need to be supplemented. Also, for the multipurpose Auburn project, or any project requiring Federal participation, to be constructed at the Auburn site, re-authorization legislation will probably be required.

(b) Costs. - Costs provided by the USBR in a July 1987 Auburn Dam Report (updated by USBR and Corps to 1991 price levels) are shown in Table B-12. Because this concept consists of continuing with construction (not a new construction effort), all the accumulated costs to date are included.

Table B-13 suggests the general scope of one possible cost-sharing scenario for a multipurpose Auburn project between Federal and non-Federal participants, as defined by the USBR. It

is based on benefit and cost information included in the USBR's July 1987 Auburn Dam Report, updated by price level to October 1990.

TABLE B-12

COSTS -- MULTIPLE-PURPOSE 2.3 MILLION AC-FT AUBURN DAM[1/2]

| Item | Cost ($/Millions) |
|---|---|
| First Costs | |
| Cost to Date | 341 |
| Administrative Costs[2] | 15 |
| Auburn Dam and Reservoir | 1,116 |
| Auburn Power Facilities | 169 |
| Recreation Lands & Facilities[3] | 13 |
| Permanent Operating Facilities | 4 |
| Total Construction Cost[4] | 1,658 |

[1]Source USBR October 1989 to October 1991 projected costs by Corps using an increase of 8 percent.
[2]Administrative costs incurred during 1990-1999 by the California Division of Forestry, California Department of Parks and Recreation, and USBR.
[3]Includes fish and wildlife lands costs.
[4]Does not include adequate costs to offset adverse environmental impacts

TABLE B-13

MULTIPURPOSE AUBURN PROJECT APPROXIMATE COST-SHARING[1]
($ Millions)

| Purpose | Total | Non-Federal | Federal |
|---|---|---|---|
| Flood Control | 647 | 167 | 480 |
| Instream Flows | 125 | 63 | 62 |
| Water Supply | 386 | 386 | 0 |
| Hydropower | 480 | 480 | 0 |
| Recreation | 20 | 10 | 10 |
| TOTAL | 1,658 | 1,096 | 552 |

[1]Source USBR October 1989 to October 1991 projected costs by Corps using an increase of 8 percent. Cost allocation for repayment will be subsequently determined by USBR.

(c) Summary. - The multipurpose Auburn Dam project can service multipurpose water resources and related needs of the study area and other areas of CVP. It can provide increased instream flows along the lower American River. It has support from a number of interests. Several actions are critical to effectively move forward with the project. One action includes obtaining substantial non-Federal funding for the water and power elements during construction. This alternative has the potential for significant environmental impacts.

d. Comparisons and Status. - Table B-14 shows a summary comparison of these options. Included are the main features, accomplishments, first and annual costs, and list of major advantages and disadvantages. Following is a brief explanation of the option retained for development in the alternative plans and the options deleted from further consideration.

- Flood Control Dam at Auburn Site. - This option was retained for development into a alternative plan. The option is highly cost effective and has an identified non-Federal sponsor - State of California.

- Local Benefits Options.

  - Advanced Features. - Studies indicated that should expansion occur within 5 to 10 years from construction of a flood control project, it would be economically feasible to add the advanced features. Beyond about 10 years, it would be better to wait and include the features as part of expansion. The DWR indicated it would not fund inclusion of the advanced features.

  - Local Benefits Pool. - Preliminary cost estimates indicated that this option would cost about $120 million more than flood-control-only project. No non-Federal sponsor was identified to fund this cost.

  - Local Water Delivery Plans. - DWR advised the Corps that none of the local water delivery plans should be considered. They either do not have local support or are being pursued separately by the local non-Federal entity.

  - Enlarged Flood Control Dam. - The costs of the space-swapping concept would exceed the benefits. Recreation benefits from the higher seasonal pools in Folsom would be sizable, but not enough to justify the concept. No non-Federal sponsor was identified to pay for the added cost.

- Multipurpose Auburn Dam. - The cost to complete the 2.3 million acre-foot Auburn Dam would probably be about

TABLE B - 14
Comparison of Auburn Area Projects

| ITEM | AUBURN AREA PROJECT | | | | | |
|---|---|---|---|---|---|---|
| | FLOOD CONTROL ONLY | LOCAL BENEFITS OPTIONS | | | | MULTIPURPOSE AUBURN DAM |
| | | ADVANCE FEATURES DAM | LOCAL BENEFITS POOL | LOCAL WATER DELIVERY PLANS | ENLARGED FLOOD CONTROL DAM | |
| Basic Project Description | Provide flood detention capacity only. | Develop single purpose flood control with features necessary for potential expansion to multipurpose facility. | Establish permanent minimum pool for water supply in conjunction with flood control detention space. | Develop conveyance facilities for delivery of water supplies. | Transfer Folsom Reservoir flood control space to Auburn single purpose flood control dam to develop increased yield to Folsom Reservoir. | Develop hydropower, water supply, and recreation as project purposes in addition to the flood control purpose. |
| Storage or Detention Capacity | 180,000 acre-feet to 894,000 acre-feet dependent upon level of protection. | Same as flood control only dam. | 130,000 acre-foot permanent pool; flood control detention capacity dependent upon level of protection. | Not applicable. | 330,000 acre-feet to 998,000 acre-feet depending on level of protection and amount of flood control space transferred from Folsom. | 2.3 million acre-feet. |
| Water Supply Accomplishments | No effect. | No effect. | Allows convenient pumping pool to meet existing demands. | Allows conveyance of existing and future demands. | Allows increased yield from Folsom Reservoir. | Develops additional water supplies to meet future demands. |
| Hydropower Accomplishments | No effect. | No effect. | Possible run-of-river powerplant. | No effect. | Potential increased generation at Folsom Reservoir. | Full development of additional power supplies. |
| Status | Recommended for implementation. | Deleted from further consideration. | Deleted from further consideration. | Deleted from further consideration. | Deleted from further consideration. | Deleted from further consideration. |

$1 billion more than a flood-control-only dam. Completion of construction would likely require significant additional studies identifying qualified non-Federal cost-sharing sponsors, and overcoming substantial opposition from numerous environmental interests. Because of these factors and the authorization for this study, this option was not considered in detail.

15. Engineering Considerations. - Flood control dams considered in this report are based on the same design components: a detention dam of trapezoidal design with a gated outlet, constructed of roller compacted concrete at RM 20.1. Several engineering considerations were critical in the selection of this new upstream detention location and design and formulation of alternatives which incorporate this feature. A number of damsites, as well as design and operation options, were important in the formulation of new upstream detention facilities.

a. Damsite Selection. - A critical activity in formulating new upstream detention alternatives is the selection of the most appropriate damsite. Interest in potential damsites on the three forks of the American River dates back to at least the turn of the 20th century.

Numerous damsites have been investigated. Most sites were eliminated from further consideration due to potential impacts or limited size and locations. Some sites are now included in the State and Federal wild and scenic rivers systems or on significant historical lands like the Coloma historical gold discovery site on the South Fork of the American River. Consequently, the range of potential sites was narrowed to locations on the North Fork downstream from the confluence with the Middle Fork, the USBR Auburn Dam site. Sites in this area would allow a single dam to control floodwaters from both forks, whereas upstream sites could control only one fork. Both forks carry about the same amount of runoff, and damming just one fork would not provide a high level of flood protection.

The USBR focused its study on sites on the North Fork at river miles 19.1 and 20.1. The 20.1 mile site was eventually chosen as the least-cost site. No serious physical shortcomings were discovered at the mile 19.1 location, however.

When construction was halted on the USBR's dam following the 1975 Oroville earthquake, the site evaluation process began anew. In addition to reevaluation of the mile 20.1 location, potential sites at miles 22.1, 19.0, and 19.1 were investigated. Because it would be the most cost-effective site, given the type of dam construction, mile 20.1 site was selected.

These same four sites were reevaluated by the Corps for this study. (See the Damsite Selection Appendix.) The mile 19.1 and 22.1 sites were rejected because of poor foundation conditions. The mile 19.0 site--although potentially the least-cost alternative--was rejected because geologic conditions there are not well known. No faults have been found at the site, but discovery of one could very likely lead to abandonment of the site. Because of the need for further geological investigation and the considerable environmental impacts associated with the construction of new roads, staging areas, foundations, and other facilities, a dam at RM 19.0 would require approximately 5 more years to construct than a dam at mile 20.1. During those 5 years, the Sacramento area would continue to be exposed to a serious flooding threat with no guarantee that the 19.0 site would be found equal to or superior to the 20.1 site. Given the prolonged exposure to serious flooding and extensive costs of future explorations and investigations, the site at RM 20.1 was chosen for the selected plan.

b. Seismic Conditions at Auburn Dam. - Seismic safety has been a major issue surrounding the Auburn Dam project since the 1975 earthquake. that earthquake, centered about 50 miles north of the damsite and measuring 5.7 on the Richter scale, resulted in halting construction of the USBR dam (a double curvature concrete-arch design). The proposed damsite is located in a region of relatively low to moderate seismicity. Historically, occasional tremors have been felt in the Auburn area. The tremors, however, have resulted from distant earthquakes in regions of high seismicity. Examples include the April 1906 San Francisco earthquake (Richter magnitude 8.25) located approximately 110 miles west of Auburn and the September 1955 Truckee earthquake (magnitude 5.8) located approximately 65 miles east of Auburn.

Small to moderate earthquakes have occurred in the western foothills of the Sierra Nevada. Most seismic activity is concentrated in the Nevada City-Grass Valley area and the Oroville-Chico area. The largest earthquakes recorded since records have been kept (1850) were the 1940 Oroville event (magnitude 5.7) located approximately 18 miles north of Lake Oroville and the August 1975 Oroville event (magnitude 5.7) located approximately 7 miles south of Oroville.

Geologic evidence gathered in the vicinity of Oroville Dam and the Auburn RM 20.1 damsite, following the August 1975 Oroville event, has established a precedence for considering the Foothills Fault system to be active. Faults of the Foothills Fault system within a 2-mile radius of Auburn damsites are considered to be capable of generating a Maximum Credible Earthquake (MCE) of magnitude 6.5.

MCE's from areas having high seismicity outside the area of the Auburn damsite range from magnitude 8.5 within the Coast Range

100 miles west of Auburn, to magnitude 6.5, 25 miles north near Nevada City. These sources would not impose seismic ground motions as great as the MCE (magnitude 6.5) generated from the Foothills Fault system in the vicinity of the damsite.

The Foothills Fault system consists of northwest-trending, subparallel, near-vertical fault zones. The faults are located within the Western Metamorphic Belt and divide it into several large terrains (blocks). South of Placerville, the fault zones are generally well defined linear features having relatively few structural complexities. North of Placerville, the fault zones branch out, forming a network of structurally complex and less well-defined systems. The easternmost fault zone is referred to as the Melones Fault zone. It projects southeastward to approximately 9 miles east of the damsites. The westernmost fault zone is referred to as the Bear Mountains Fault zone. It branches and projects through the vicinity of the damsite.

The last major movement along the Foothills Fault system occurred in response to the tectonic regime in existence during the Mesozoic Era about 140 million years ago. Other significant movement along the fault system occurred approximately 65 million years ago. Some faults within the Foothills Fault system have been reactivated in late Cenozoic time, beginning approximately 5 to 10 million years ago.

Branches of the Bear Mountains Fault zone are not well defined in the vicinity of the proposed damsite. However, two north-northwest-trending zones have been identified which have general structural continuity with branches of the Bear Mountains Fault zone to the north and south.

These zones, termed lineaments, are locally 400 to 600 feet wide and exhibit "aligned linear elements" which are "...generally coincident with zones of Mesozoic deformation..." within the metamorphic bedrock. They include the DeWitt-Salt Creek lineament located about 0.5 mile east of the RM 20.1 site and the Pilot Hill-Maidu East-Deadman lineament zone passing about 800 feet west of the site.

In 1979, the State presented its official position to the Secretary of the Interior, Cecil Andrus. This position was developed after studies by the California Division of Mines and Geology (CDMG) and the State Department of Water Resources, Division of Safety of Dams.

DWR, in the development of the official position of the State of California, engaged a Consulting Board for the Earthquake Analysis of Auburn Dam, a board of eminent dam design engineers, geologists, and seismologists. The Board, chaired by George W. Housner with members John H. Blum, Bruce A. Bolt, Douglas D. Campbell, Alan L. O'Neill, and H. Bolton Seed concluded that the

following design parameters for a dam at Auburn sites were appropriate:

- A magnitude 6.5 earthquake, with peak ground acceleration of 0.6 g and a response spectral acceleration of 0.5 corresponding to a period of vibration of 1.0 second in the spectrum.

- A fault slip in the foundation of up to 5 inches; this may or may not be distributed over several faults.

In 1979, CDMG issued Special Publication 54, Review of Safety of Auburn Dam Site, which included the Board's report. The State Geologist, together with CDMG staff, concurred with the Board's design parameters except in the area of foundation displacement. CDMG concluded that three-quarters of a foot of foundation displacement is a reasonable design parameter.

The seismic design parameters for an adequately safe dam were communicated by H. Johnson, Secretary of Resources, State of California, to Cecil Andrus, Secretary of the Interior, on March 5, 1979. The State considered the 5-inch displacement on fault(s) at the mile 20.1 site as the minimum, but, in view of the State Geologist's opinion, encouraged the use of 9 inches.

On July 30, 1979, Secretary of the Interior Cecil Andrus announced that the seismic design parameters for Auburn Dam would be those recommended by the State of California. In a December 30, 1980, press release, Secretary of the Interior Andrus announced that "a safe dam can be constructed at the Auburn site." He also announced that a concrete gravity dam (CG3) be selected rather than a rockfill embankment dam.

As mentioned, full consideration has been given to the seismicity of the mile 20.1 site in the preliminary design of a potential flood control dam. The seismic design parameters included are fault displacement of 9 inches, MCE magnitude 6.5 with a peak ground acceleration of 0.64 g in the horizontal direction and 0.39 in the vertical direction. These parameters are considered to be quite conservative by both the Corps and the USBR. The dam's present alignment is outside the surface trace of fault F-1 in the footprint of the original arch dam. Due to the steep dip of the fault, it passes about 100 feet below the dam base. Changes in the alignment of the dam may be made in the final design to improve safety.

A related issue is the possibility of reservoir-induced seismicity (RIS) caused by the filling of a reservoir. The weight of the water and the increase in hydrostatic pressures in the rock mass could increase the pore pressure along pre-existing fault surfaces. This increase could induce seismic activity along faults already experiencing critical stress and threaten the

integrity of the dam. The potential for RIS appears to increase with both the depth and volume of the reservoir. However, the possibility for RIS is very low for a flood-control-only dam since large volumes of water are not regularly impounded over long periods of time.

Numerous technical issues will have to be resolved during the Engineering and Design phase. The non-Federal sponsor has recommended that an Independent Consulting Board of Experts be established to guide the detailed design and construction effort. This panel will bring together the best knowledge and experience available at the national and international level to ensure a safe project.

c. California State Highway 49 Relocation. - Operation of a flood control dam at the Auburn site would impact existing State Highway 49. Analysis of these impacts was required to determine if the extent of impacts would be sufficient to warrant a relocation of the highway, and if warranted, determine the most appropriate relocation.

(1) Description of Impacts. - Factors contributing to the decision to relocate Highway 49 include inundation potential, the existing and future need for the highway, economic dislocation to users of the facility, engineering considerations, and public and safety factors.

• Inundation Potential. - The existing bridge crossing, located just downstream of the confluence of the Middle Fork with the North Fork American River (approximate RM 23.5), would be subject to inundation if a flood control dam is constructed at the Auburn site. The existing bridge crosses the North Fork American River at elevation 587. On the basis of information in Plates 4 and 5, Table B-15 shows inundation periods for various frequency-flood events and their probability of occurrence over the life of the project with both the 200- and 400-year flood control dam structures. The elevation of the existing bridge is exceeded in a 4-year event. There is a 25 percent chance that this size flood would occur in any particular year and about a 50 percent chance that this inundation would occur every 2 years. These statistics indicate that there is significant potential for inundation on a relatively frequent basis.

• Need for the Highway. - Highway 49 is an important State route connecting the Foothill communities with the Cities of Auburn and Sacramento. Highway 49 also connects Auburn and Placerville. In recent times, Highway 49 has been upgraded from 2-lanes to 4-lanes along much of its length from Nevada City to its junction with Interstate-80 in Auburn. The California Transportation Department (CALTRANS) recognizes the need to upgrade the remainder of the road but has delayed work on the

portion of Highway 49 south of Auburn because of potential impacts resulting from the authorized Bureau of Reclamation multipurpose dam at the Auburn site. Existing traffic use indicates about 7,000 vehicles per day use Highway 49 between Cool and Auburn. CALTRANS anticipates that use of this road will continue to increase and is against any inundation of the road. There is consensus that Highway 49 is an important State highway and the need for it will continue to increase over time.

TABLE B-15

ESTIMATING INUNDATION IMPACTS TO EXISTING STATE HIGHWAY 49 BRIDGE

| Flood Event (Return Period-Yrs | Probability of Occurrence Once During 100-Year Life of Project Project (Percent) | Inundation Period (Days) |
|---|---|---|
| | 400-Year Flood Control Dam | |
| 400 | 21 | 18 |
| 200 | 40 | 16 |
| 100 | 63 | 14 |
| 5 | 100 | 2 |
| | 200-Year Flood Control Dam | |
| 200 | 40 | 11 |
| 100 | 63 | 9 |
| 5 | 100 | 1 |

• Economic Dislocation. - Closure of the existing Highway 49 bridge, due to inundation, and repairs of damages resulting from inundation, will block access on Highway 49 between Auburn and Placerville and cause increases in commuting times for the public to and from Auburn, Placerville, Sacramento, and nearby communities. The public could be cutoff or have extended commuting times to schools, hospitals, doctors, employment, stores, banks, and other necessary services. Businesses dependent on access via the bridge would suffer significant economic impacts. Closure of the bridge for extended periods of time could reduce public access to parts of western El Dorado County, and a prolonged closure would impact the Coloma and the Marshall Gold Discovery State Historic Park, Pilot Hill, Greenwood, Georgetown, Volcanoville, and other small communities in the area. Areas in western Placer County would also be adversely impacted. Many businesses depend on this travel for their economic survival.

Closure of the Highway 49, American River bridge would increase traffic on already clogged metropolitan highways at Folsom and Sacramento. Rerouting traffic potentially increases congestion on Highway 50 in certain sections by over 10 percent. CALTRANS has indicated that a diversion through Folsom and US-50 would increase traffic congestion of an increasingly congested area, and that is unacceptable. Large commercial trucks, such as logging trucks, are not allowed on potential alternative routes through Folsom, so their detour must occur through Sacramento. Knowlwdgeable locals are likely aware of alternative routes to Auburn via unimproved roads but these could not handle significant traffic, would have severely limited speeds, and large vehicles would be prohibited.

For an average speed of 30 miles per hour, people in the Cool area would spend at least 1 hour 15 minutes to go the 38 miles around Folsom Dam to Auburn, one way. This is an increase of about 1 hour over normal travel time. The public would be forced to assume the additional burden of the increased travel time as well as the increased costs in vehicle operations and maintenance during the time Highway 49 is impassible. When Highway 49 was closed for about 2 months after the 1986 flood, there was heavy pressure from residents in the area to make repairs as quickly as possible.

- Engineering Considerations. - Inundation of the American River canyon impacts geologic stability on the access roads to the bridge as well as the highway along the steep valley walls. Most of the existing Highway 49 in the canyon is not built in cuts through bedrock, and is therefore subject to the road sliding downhill. Basic geotechnical evaluations of the canyon have concluded that the repetitive filling and emptying of the reservoir behind the proposed dam will continue to remove those portions of the slopes which are already prone to failure. It is difficult to determine the frequency and extent of future slope failure.

In 1986, a slope failure occurred on the highway which caused major road failure as a result of the inundation by floodwaters and rapid drawdown of the water level from the cofferdam break at the Auburn site. This failure closed the road from February 17 through April 10, 1986. Inundation from the proposed dam during floods is likely to rejuvenate slope failures, and could create new slope failures. Wetting the toes of the current slope failures could cause instability resulting in the movement of material above the line of inundation, threatening the existing roadway. These conditions indicate that a relocation of the highway is appropriate.

The structural integrity of the existing bridge does not appear to be a factor which indicates a relocation is necessary. The current bridge was inundated under 90 feet of water in 1986 without major problems. The bridge could likely withstand occasional inundation with little problem if the rise and fall of water was not rapid. There would be increased stress and risk on the bridge, but it should be insignificant. Occasional inundation would increase operation and maintenance costs, however. Corrosion would likely increase. Repaving would also likely be increased.

• Public Health and Safety. - If the existing roadway and bridge are not relocated there will also be an increased risk to public health and safety. Public services such as medical, ambulance, fire, and police could be blocked or have increased response times. Rerouting of traffic may also increase the number of traffic accidents as people will be traveling unfamiliar routes, traveling farther distances, and driving in more congested traffic.

(2) Alternative Realignments . - As a result of the determination of the need to relocate the bridge several alternatives were examined. These alternatives include the RM 19, RM 17, Middle Fork crossing, low level RM 23, and high level RM 22.3 alignments. These alternatives are described below.

• Middle Fork Crossing. - This alternative includes a new road and high steel truss bridge from Interstate 80 via Auburn/Foresthill Road to Cool. In addition to a new high bridge, it includes adding one additional lane to the existing Auburn/Foresthill bridge. It provides a locally desirable route for the highway to service areas to the north towards Nevada County. The estimated cost of this alignment is $130 million.

• River Mile 17. - The alignment of this alternative diverts from Highway 49 just north of Pilot Hill, crosses the North Fork of the American River at RM 17, and rejoins Highway 80 at the existing Newcastle intersection. Alternatives 2 and 3 share the same alignment from the Newcastle intersection for approximately 3 miles. This bridge crossing can be achieved at a lower elevation than others, consequently, a concrete bridge would be constructed. This bridge would be a post-tensioned concrete double box girder utilizing cast-in-place segmented cantilever construction methods. Again, the Newcastle intersection would have to be upgraded. This alternative has an estimated first cost of about $98 million.

• River Mile 19. - This alternative includes a new road and high steel truss bridge from Interstate 80 near Newcastle to Highway 49 about midway between Pilot Hill and Cool. The existing Newcastle interchange is more easily upgradable than others to accommodate the alignment and increased projected traffic levels.

The bridge length for this alternative would be greater than for the other alternatives. The estimated cost for this alternative is about $133 million and is the most expensive alternative examined.

• River Mile 22.3. - This alternative includes a new road and a new steel truss bridge that crosses the North Fork of the American River at RM 22.3. The bridge crosses the river at about elevation 1,300 feet. The relocated highway begins about 1/2 mile north of the community of Cool, continues westward, across the North Fork of the American River (elevation 1,300), and intersects High Street in Auburn. The bridge is about 0.9 miles long. The road realignment would be about 2.8 miles long. The estimated cost of this bridge is $99 million.

• River Mile 23.0. - This alternative includes a new road and a concrete bridge that crosses the North Fork of the American River at RM 23.0. This alignment crosses the North Fork at a lower elevation than the RM 22.3 alternative allowing the construction of a concrete bridge. The road alignment deviates from the existing road near the Middle Fork of the American River (between Louisiana Bar and New York Bar), travels westward, crossing the North Fork, and then enters the Auburn area near High Street.

(3) Relocation Alignment Selection. - The selected alignment for this project is the RM 23.0 alternative. Several factors contributed to the elimination of the other alternatives and the selection of this option.

The middle river crossing, RM 17, and RM 19 alternatives were eliminated as less viable. A key factor in evaluating the various alternatives was that current Corps guidance limits the relocation to in-kind for the existing Highway 49. The RM 17 and 19 alternatives, rejoining the Auburn area at Newcastle, rather than east of Auburn as in the existing road, significantly change the existing flow of traffic from the Cool area to Auburn. Consequently, these alternatives did not meet the criteria for relocation and were eliminated. The RM 22.3 and 23.0 alternatives were retained. Table B-16 shows the cost estimates for these 2 alternatives. The RM 22.3 alternative significantly reduces travel time between Cool and Auburn. However, this betterment does not fill the replacement in-kind Federal criteria for road relocations. Consequently, the RM 23.0 relocation was selected for this project feature.

The Corps-selected alternative is preferred because it would be the minimum height relocation needed to allow crossing of the filled detention dam and would result in minimum impacts on existing traffic patterns.

The right-of-way for the selected relocation would be about 200 feet wide and require about 31 acres. The new alignment is entirely within the American River canyon and exists and rejoins the existing Highway 49 within the canyon. This relocation is approximately 9,300 feet in length and consists of four concrete bridges and a short length of connecting roadway. The road profile was kept above elevation 995, maximum pool elevation for the proposed project, at all locations.

The State of California, the Non-Federal sponsor responsible for the relocation, intends to conduct additional route selection studies and may choose during the detailed design phase to adopt another alignment as a betterment. The State will provide additional environmental documentation if they choose another alignment providing betterments to the existing highway.

TABLE B-16

HIGHWAY 49 RELOCATION ALTERNATIVES
(First Cost $1,000)[1]

| Item | High Level Bridge (RM 22.3) | Low Level Bridge (RM 23.0) |
|---|---|---|
| Lands | 7,600 | 1,100 |
| Bridge | 90,900 | 72,300 |
| Total | 98,500 | 73,400 |

[1]Costs updated October 1990 prices to October 1991 by the following ratios: 1) Lands - 8 percent; 2) All other - 4.1 percent.

d. Outlet Sluices. - Another structural feature of the dam, included in the selected plan, are gated outlet sluices. The purpose of such gates is for system safety and would be used only in the case of failure or imminent failure of the flood control system downstream from the flood detention dam at the Auburn site. Considering the large number of people protected by the flood control system, it is essential that every opportunity available be used to ensure the integrity of that system. The incorporation of emergency gates into the design of the dam's outlet structure offer such an opportunity, and are found on virtually every dam of this size designed and constructed by the Corps. The primary

benefit of temporary gate closure, under emergency conditions, would be to provide additional time to either make the necessary repairs or to evacuate people. Just a few extra hours under such circumstances could save hundreds of lives.

An example scenario will help to describe how the gates could be used during an emergency:

The most likely time for a levee emergency would be during the waning stages of a very large flood. At this time, lower American River levees would have been withstanding design or near-design floodflows for a day or two; Folsom Reservoir is nearly full, and unrestricted Auburn Dam discharges near a maximum. If a serious levee problem developed without gates at Auburn, there would be no way to temporarily reduce lower American River flows to enable emergency repairs or even to close a levee break. With gates, Auburn releases could be cut drastically and Folsom reoperated somewhat to reduce floodflows temporarily. The amount and length of the reduction depends on the size of the flood, the kind of storm and flood hydrograph, and the size of the flood control dam and its design.

The potential scenario is similar to the 1986 Yuba River levee failure at Linda. On the American River, a levee break could be visualized near H Street bridge (California State University at Sacramento). The American River has been at project flood stage of 42.8 feet for a day (115,000 cfs).

If we assume a 100-year flood and the selected plan dam size is the 200-year, 545,000 acre-feet, storage in this scenario is approaching a peak of 380,000 to 400,000 acre-feet and discharge would be around 80,000 cfs. Closing all the gates would cause storage to rise and surcharge until spillway overflow reached 50 to 60,000 cfs on a receding flood inflow hydrograph. Reservoir storage would then be around 590,000 acre-feet. The net effect would be to reduce Folsom Reservoir flood inflow temporarily by about 200,000 acre-feet. This would make it possible to cut Folsom releases in half (slowly so as not to cause added levee slumping) to around 55,000 cfs. The 200,000 acre-feet would enable operation at the reduced flow for about 30 hours, enough time to make an emergency levee repair, if the situation was not too bad, or to evacuate people.

At 55,000 cfs, the American River stage would be lowered by around 5 feet. Since natural ground on the landside of the levee is around 6 feet below flood stage in this vicinity, the flow reduction should be adequate to enable emergency repairs of a potential levee break.

With a 200-year sized flood in a 200-year dry dam (Plate 5 of Reservoir Control Appendix), a similar situation would have much less slack. The flood control dam would be nearly full,

520,000 acre-feet, still slowly filling, and discharging around 87,000 cfs. In this case, the reservoir could be surcharged to around 600,000 acre-feet (elevation 882 feet) before spillway overflows reach about 80,000 cfs. This may leave only 60,000 to 70,000 acre-feet of relief for Folsom Reservoir. Again, with gradual lowering of Folsom releases, this would allow only about 5 hours of flow reductions to 55,000 cfs. (But could be around 15 hours at 75,000 cfs.) Another way to gain time in this latter scenario is to surcharge some at Folsom Dam, which would yield about 5 hours more time for 2 feet of surcharge at 55,000 cfs compared to 115,000 cfs. Obviously, this second design flood scenario does not have the flexibility available with gates that a somewhat smaller flood would have.

These hypothetical examples show that the ability to control releases from the flood control dam with gates can add to the public safety margin below Folsom Dam in the event of an unexpected levee problem along the lower American River levees. This is particularly so at floodflows less than design. The additional inundation time in the canyon above the dam would be only the length of the flow reduction--probably a day or two.

There would be approximately 8 to 12 hours of lag time between when the emergency had been identified and flows would be reduced. This lag is composed of time to evaluate the situation, to make the decision to close the gates, to gradually reduce Folsom releases so as not to induce other levee problems, and for travel time from Folsom to the point of stress. This time would be spent determining the best method to repair the levee and in mobilizing repair forces and materials. Even if the attempt to prevent this hypothetical levee failure were unsuccessful, the flood volume temporarily stored behind the dam structure would be that much less volume which would flow through the levee break and flood developed areas, thus reducing flood damages. In addition, the time of reduced flows would increase the evacuation time from threatened flooded areas.

If two of the sluices were to be left ungated, the timeframe for emergency repair would be reduced by 2 to 4 hours. The amount of storage withheld from damaging areas would also be reduced by 10,000 to 20,000 acre-feet. The reason to leave any of the sluices ungated would be to alleviate the fears of many groups who feel that the emergency gates are in reality permanent water storage gates. A pair of ungated sluices would prevent water from being permanently stored behind the flood control structure.

The decision to close the emergency gates would involve several flood control agencies in the area. During a large flood, the State-Federal Flood Operation Center would be in operation. Under these flood circumstances, a representative from the Corps would also be on duty at the flood center. In 1994, the flood center is scheduled to be located in the new Water Operations

Center. The USBR CVP and State Water Project Operations Centers will also be located in the same building.

The actual decision to close the emergency gates would most likely be a consensus based on real-time evaluations of the flood emergency situation by officials of the DWR, Corps, and USBR (operators of Folsom Dam) with input from the National Weather Service, California/Nevada River Forecast Center, and local agencies. The consensus process would include consideration of all options available to fix or stabilize the problems, with emphasis on public safety. If the major agencies did not agree, the final decision would rest with the Corps' Sacramento District Engineer, since the Corps has responsibility for flood control space in Folsom.

There is no way to predict the probability that these types of emergency events will occur. However, should they occur, it would be very advantageous to have the emergency facilities proposed for the flood control dam available. They would help to reduce the impacts of these events or even to prevent a catastrophic occurrence.

e. Aggregate Borrow Sources. - Several alternative sources of aggregate for construction of the dam were examined. Each of these alternatives are discussed below.

(1) Middle Fork American River Bars. - Sand and gravel bars along the Middle Fork American River are a potential source of significant quantities of aggregate. These deposits lie along an approximate 7 mile reach of the river starting about 5 miles upstream of the proposed damsite at Mammoth Bar and ending at Cherokee Bar. The exposed gravel bars along the Middle Fork were estimated to cover an area of 180 acres. Table B-17 summarizes information related to each bar.

Due to annual flooding of the aggregate bars in the river, it is assumed that the bars will be accessible between 8 and 10 months of the year. Since most of the aggregate is underwater, it is likely that draglines would be used for excavation. Based upon required production rates, three to four large draglines working 12 hours per day would be needed. A maximum of two draglines could work each bar because of space limitations. The draglines would dump their buckets into a portable track-mounted primary processing unit. This unit would consist of a hopper, primary screen, jaw crusher, and conveyor. Aggregate would be screened to remove oversize material, crushed to 3-inch maximum size, and conveyed by a series of portable conveyors to the primary conveyor.

Most of the aggregate processing could be performed in plant located above Mammoth Bar. This allows storage of aggregate in areas distributed along the primary conveyor.

TABLE B-17

SUMMARY OF MIDDLE FORK AMERICAN RIVER
AGGREGATE BORROW SOURCE

| Location | Average Depth to Bedrock (feet) | Area (Sq-ft) | Volume (Cubic Yards) |
|---|---|---|---|
| Mammoth Bar | 31.4 | 971,250 | 1,129,500 |
| Texas Bar | 31.2 | 996,000 | 1,150,900 |
| Browns Bar | 30.4 | 599,000 | 674,400 |
| Kennebeck Bar | 31.5 | 719,000 | 839,000 |
| Hoosier Bar | 25.9 | 649,000 | 622,500 |
| Buckeye Bar | 27.6 | 1,104,000 | 1,128,000 |
| Maine Bar | 21.0 | 249,000 | 194,000 |
| Philadelphia Bar | 23.7 | 907,000 | 705,000 |
| Poverty Bar | 27.5 | 1,152,000 | 1,173,000 |
| Cherokee Bar | 18.0 | 1,484,000 | 989,000 |
| Channel Deposits | 6 | 4,357,000 | 968,000 |
| Weighted Average | 26.5[1] | TOTAL | 9,573,000 |

[1]Excluding depth of channel deposits

(2) Old Cool Quarry. - The existing Cool Quarry is located approximately 1-1/4 miles north of the town of Cool on the east side of Highway 49 in El Dorado County. This quarry is currently leased and operated by Spreckles Limestone and Aggregate. The operator estimates reserves of 12 million tons of marble and 100 million tons of metavolcanic rock. The currently permitted quarry has a 600 tons per hour processing capability and has enough available on site storage space to stockpile several million cubic yards. This site is considered to be one of the least environmentally damaging.

(3) Cool Quarry Amphibolite. - This site is located immediately west of the existing Cool Quarry. The proposed quarry site is adjacent to the large existing quarry about 2 miles east of Auburn. This site is a likely candidate for a new quarry operation in the vicinity of the damsite.

(4) North Fork American River Aggregates. - Several sand and gravel bars along the North Fork lie between the backwaters of Lake Clementine and Ponderosa bridge, a distance of about 4 miles. It is estimated that between 2 and 4 million cubic yards of aggregate could be available in these bars, Lake Clementine may have additional aggregated borrow sources. It appears that total quantities of materials in the lake would be insufficient as a serious aggregate source. In addition, extracting this relatively small amount from a significant underwater depth would be very expensive, create an enormous turbidity problem, and would be technically difficult to implement.

(5) Oregon Bar Pluton and River Mile 22.4 Quarry Site. - The Oregon Bar Pluton potential quarry site is located near the proposed damsite. However, the extensive shearing and deep disintegration of the rock, the Oregon Bar Pluton is not considered a viable source.

The potential quarry site at RM 22.4 is located in the downstream portion of the left abutment for the earlier proposed dam at RM 22.4. The rock appears suitable for aggregate and is located close to the damsite. However, environmental problems at this site are immense. The quarry would be in full view of homes built around Robie Point at the bridge of Auburn, a distance of about 2,500 feet directly access the river from the site.

(6) Bear River and Chevreaux Quarry. - These deposits along the Bear River, located on Highway 49, could provide large quantities of material. Aggregate would have to be trucked to the Auburn site.

(7) Mississippi Bar. - The bar located on the south shore of Lake Natomas is owned by the Government and was used to supply aggregate for Folsom Dam construction. Deposits could be trucked to the site or transported via railroad.

(8) Yuba River. - Deposits near Marysville consist of vast dredge piles. The quality of aggregate is well established and could be delivered to the Auburn site by either truck or railroad.

Of these nine alternative borrow sites, six were examined in more detail. These six are the Middle Fork American River sand and gravel deposits, Old Cool Quarry (Spreckles), Cool Quarry Amphibolite, Chevreaux property, Mississippi Bar, and Yuba River dredge fields. Detailed evaluations are found in Appendix R. As

a result of these detailed evaluations, the selected aggregate borrow source for the upper American River work is the Old Cool Quarry site. This site was chosen because of its proximity to the damsite, adequate supplies and stockpile areas are available, and environmental impacts are minimized since the source is a currently operating quarry.

f. Spoils. - Spoils are waste materials generated during excavation for various project features. When excavations are required to construct project features material removed is used to the extent possible in the construction of the features. However, there is always material generated which is not suitable for construction and must be wasted. While exact quantities of spoils and disposal locations cannot be finalized until construction occurs, estimates have been made of quantities and potential disposal locations.

The total amount of spoils can be divided into existing spoil, which was originally generated from construction operations by the USBR, and new or potential spoils which would be generated by construction activities at the Auburn Dam site in the early 1970's, approximately 8 million cubic yards of material had been generated. Most of this material had been disposed of in the upper cofferdam or in boat ramps. When the cofferdam failed in 1986, a large portion of this material was washed downstream and deposited. Much of this material needs to be disposed of in order to construct the flood control dam. The cofferdam debris consists of rock fragmented material.

Additional spoil would be generated during earthwork associated with the construction of the currently proposed dam. An estimated 5.5 million cubic yards of material consisting of material from clearing and grubbing operations, excavation of keyways, and potentially unstable hillside material.

Two banking areas have been identified that have sufficient capacity to accommodate both existing and potential future spoil material. These include (1) the existing keyways located adjacent to the upper cofferdam (3 million cubic yards) and (2) an area near the Salt Creek drainage (4.5 million cubic yards available). In the existing keyways, material would be placed and contoured to fit existing topography, and then revegetated. The Salt Creek site is located less than a mile upstream from the damsite and originally served as a major spoil bank during the earlier construction activities. Final placement would also involve contouring to coincide with adjacent topography and would be revegetated.

g. Natomas Area Protection. - As indicated, Natomas can be flooded due to levee failures at several locations from the American and Sacramento Rivers. The primary flooding threat is from levee overtopping and/or failure along the NEMDC. However,

during rare events (in excess of about 150 years), flooding would also be likely from failure of the NCC. So, using the management measures previously described for Natomas, features were assembled focusing on raising levees along the NEMDC and the cross canal or raising the NEMDC levees and constructing new levees across the Natomas basin at several locations. One such across-Natomas option consists of a levee along Del Paso Road. This option would protect only the currently developed southerly one-third of Natomas. Another alignment bisects Natomas with a cross levee along Elverta Road. This alignment would also protect the Sacramento Metropolitan Airport. There are other across-Natomas options. Following is a description and comparison of each option assuming a 200-year level of flood protection with flows in the American River of 115,000 cfs.

(1) Full Natomas Protection. - Primary features of a full-Natomas include the following:

- Raise the west NEMDC levee.
- Raise the south levee of the cross canal.
- Raise the west Pleasant Grove Creek Canal and modify a levee at Sankey Road.
- Raise the east levee of the NEMDC.
- Construct a gated pump station on the NEMDC just north of Dry Creek.
- Construct a new levee along the north side of Dry Creek.

To offset induced flooding impacts, the following hydraulic mitigation features were included in this alternative.

- Extend the existing south Dry Creek levee.
- Raise the south and north Arcade Creek levee.
- Construct a detention basin in north Natomas.

In addition, to offset the potential adverse backwater impacts along Dry Creek, the new levee on the north side of Dry Creek and the gated pumping station on the NEMDC would significantly reduce existing flood problems in the southwest areas of Rio Linda by providing well over a 100-year level of flood protection.

(2) Elverta Road Cross Levee. - This option primarily includes a new levee across Natomas generally along Elverta Road. The option provides protection to the Sacramento Metropolitan Airport and other significant currently planned developments. Primary features of the plan include the following:

- Raise the west levee of NEMDC.
- Construct about 7 miles of new levee across Natomas just north of Elverta Road.
- Construct an overflow weir in the Garden Highway levee just north of the terminus of the new cross levee.

Features to offset induced flooding would be similar to those for full Natomas protection except there would be no requirement for the detention basin in north Natomas. During a major event (i.e., 100 year or greater), the volume of floodwaters in the American and Sacramento Rivers is more than adequate to fill Natomas to overtopping the Garden Highway levees from the inside out in the southwest portion of Natomas. This would allow some floodwaters to flow back into the Sacramento River. Given the broad surface area of a flooded Natomas (allowing high wind-generated waves) and low potential for levee stability when flooded from the landside (as well as the waterside), it is likely that levees would fail, allowing flow from Natomas into Sacramento River when there is a differential in head of probably between 4 to 8 feet. Accordingly, since there is a significant increasing gradient in water surface elevations from south to north along Sacramento River, levees constructed across Natomas would cause the floodwater to be significantly deeper than it would have been had there been no cross levee. To compensate for the increased flood depths on lands north of the levee several options are available. One would be to acquire flowage easements in Natomas on all lands north of the cross levee. Another would be to include into the project some kind of weir and pumping facilities to facilitate evaluation of trapped (induced) floodwaters in north Natomas to Sacramento River. Either concept would be extremely costly. For simplicity, this option includes acquisition of flowage easements on about 22,000 acres.

(3) Del Paso Road Cross Levee (Developed Area Protection). - This option would protect only the currently developed southerly one-third of the Natomas basin. It would primarily include a Natomas cross levee along Del Paso Road. In addition, flood protection to the Sacramento Metropolitan Airport would be provided by construction of a separate ring levee. Of the three Natomas alternatives, this one would result in the least amount of protected land. Primary features of the plan include:

- Raise the west levee of NEMDC.

- Construct new levee across Natomas just north of Del Paso Road and a ring levee around the Sacramento Metropolitan Airport.

- Construct an overflow weir in the Garden Highway levee just north of the terminus of the new cross levee.

Features to offset induced flooding would be similar to the Elverta cross levee concept, except more land would be included in the flowage easement requirement for full Natomas protection and there would be no requirement to widen Fremont Weir.

(4) Comparison. - Table B-18 shows a comparison of major accomplishments, costs and benefits for the three representative Natomas options. As indicated, protecting all of Natomas is significantly more cost effective than protecting only a portion of the area. This is true even if requirements for flowage easement (hydraulic mitigation) is ignored, as shown in Table B-18.

Even though the full basin option is less costly, various interest groups question the rational of protecting all of Natomas. They claim that protecting all Natomas would trigger urbanization in the entire basin that would (1) result in further destruction of important environmental values and (2) place greater numbers of people at risk of major flooding. There is the belief that protecting only a portion of the basin would somehow prevent the impacts from occurring.

There is little evidence to indicate that a cross levee would preclude urbanization in north Natomas. Either of the cross-levee options would leave approximately six low spots along the Pleasant Grove Creek Canal and the NCC to be upgraded. The cost of upgrading these spots would be about $2 million. Reclamation District 1000 or other local interests could construct these minor improvements and thereby provide a minimum 100-year level of protection to the northern portion of Natomas. Should this occur, not only would excessive Federal and non-Federal funds have been spent, but many new residences and businesses in northern Natomas would be provided only a minimum level of increased flood protection.

h. Hydraulic Mitigation. - Flood control works on the American River can help alleviate--but cannot solve--flood problems in Natomas. Conversely, protecting Natomas cannot be accomplished without costly and complex levee and related modifications along the American and Sacramento Rivers. Accordingly, once the American River is controlled to a particular level of protection, Natomas can be provided similar levels of protection with relatively minimal levee modifications.

# TABLE B-18

## COMPARISON OF NATOMAS FLOOD-CONTROL-ONLY OPTIONS 1/ 200-YEAR PROTECTION

| Alternatives | Full Protection | South Area Protection | Developed Area Protection |
|---|---|---|---|
| **Accomplishments** | | | |
| Developed Acres Protected | 7,260 | 6,280 | 6,280 |
| Agricultural/Vacant Acres Protected | 47,620 | 27,120 | 6,020 |
| Highway Miles Protected | 25 | 19 | 10 |
| Area Left Unprotected (Acres) | 0 | 21,480 | 42,580 |
| **Features** | | | |
| Levees Raised (Miles) | 9 | 5 | 5 |
| New Levees (Miles)<br>Levee Fill (Million Cubic Yards)<br>Bridge Relocation | 4<br>0.6<br>Main Ave. @ NEMDC | 8<br>2.8<br>Main Ave. @ NEMDC | 14<br>7.0<br>Main Avenue @ NEMDC |
| Gated Pump Structure | NEMDC @ Dry Creek | NEMDC @ Dry Creek | NEMDC @ Dry Creek |
| Floodway Channel | Pleasant Grove Creek Canal @ Sankey Road | No | No |
| Flowage Easements (Acres) | 300 | 21,480 | 42,580 |
| **First Cost ($Millions) 2/** | | | |
| Levee and Related Improvements | 21 | 18 | 18 |
| Lands 3/<br>Construction<br>Flowage Easements 4/<br>Environmental Mitigation | <br>13<br>-<br>6 | <br>22<br>100<br>9 | <br>29<br>200<br>17 |
| Total<br>With Easements<br>Without Easements | <br>42<br>42 | <br>149<br>49 | <br>274<br>74 |
| **Annual Cost 5/ ($Millions)** | | | |
| With Easements | 4 | 13 | 24 |
| Without Easements | 4 | 5 | 7 |
| **Average Annual Benefits ($Millions 6/)** | | | |
| Benefits ($1,000) | 42 | 34 | 12 |
| **Net Annual Flood Control Benefits ($Millions)** | | | |
| With Easements | 38 | 21 | -12 |
| Without Easements | 38 | 29 | 5 |
| Advantages | • 100-year FEMA protection to all Natomas<br>• Support by local government and area residents<br>• Lowest cost and highest net economic benefits | • 100-year FEMA protection to area, 2/3 of Natomas<br>• Reduced chace of secondary adverse impacts | • 100-year FEMA protection to developed area<br>• Likely supported by environmental groups |
| Disadvantages | • Likely results in high adverse secondary impacts without adequate mitigation | • Little support by local area governments and local owners<br>• Would not prevent future developement in unprotected areas | • Little or no economic feasibility<br>• Little support by local area governments and land owners<br>• Would not prevent future developement in unprotected areas |

1/ Reconnaissance scope information for general comparison only.
2/ October 1990 price levels.
3/ Assume $6,000 dollars per acre. A detailed estimate would show varying real estate costs from highest in the south to lowest in North Natomas, with an average likely significantly in excess of $5,000.
4/ Assumes 75 percent of fee value.
5/ Based on an 8-7/8 percent discount rate and 100-year period of analysis.
6/ Includes location benefits which are greatest for the full basin plan.

Primary flood control measures are described here as those required to provide a specific level of protection. These include raising levees on NCC, Pleasant Grove Creek Canal, and NEMDC and a pump station on NEMDC. Secondary measures are those necessary to offset any adverse hydraulic impacts caused by the primary measures. For instance, raising a levee on one side of a channel may induce flooding on the other side of the channel. So, a hydraulic mitigation measure could be raising the levee on the affected side of the channel enough to offset the potential impact. Following are descriptions of the primary flood control measures and related secondary--or hydraulic mitigation--measures. Table B-19 summarizes the primary and secondary features, their size, cost, and damages prevented.

(1) Levee Modifications Along the NEMDC. - Levee modifications along both sides of the NEMDC are primary features to protect vast areas from flooding in Natomas, north Sacramento, and lower Dry and Arcade Creeks. The gated pump station and north Dry Creek levee would protect Natomas (from levee failure north of the pump station) and the Rio Linda area. Project flood elevation will be 6-8 feet lower than without-project conditions resulting from American River backwaters. Because of these modifications, flood depths could be greater in areas upstream along Dry and Arcade Creeks than before the modifications. Accordingly, secondary measures to mitigate for work along the NEMDC include:

- Extend the existing south Dry Creek levee 2,400 lineal feet east to Rio Linda Boulevard.
- Raise 2,400 lineal feet of levee on the north side of Arcade Creek just downstream from Marysville Boulevard about 3 feet.
- Raise 1,200 lineal feet of levee on the south side of Arcade Creek downstream from Marysville Boulevard about 1 foot.

The total estimated first and annual costs (1990 price levels) of these features are $4,500,000 and $400,000, respectively. The average annual "savings" in induced flood damages through the secondary feature is about $170,000.

(2) Pleasant Grove Creek Canal Levee and Sankey Road Modifications. - The primary features of (1) raising 500 lineal feet of the west levee of Pleasant Grove Creek Canal about 1 foot at two bridge crossings, (2) modifying a containment levee across the canal at Sankey Road, and (3) raising 3,000 lineal feet of East Levee Road about 4 feet from Sankey Road south preclude levee failure into north Natomas and resulting flooding from the NCC and the east-side streams. Again, during major flood events, these project features would result in a higher ponding of water upstream. To compensate for this impact, a 10,600-foot,

# TABLE B-19

## Natomas Hydraulic Mitigation Features

| Location and Description of Feature | Justification | Area Protected (Acres) | Approximate Annual Damage ($1000) | Proposed Improvement | | Costs 2/ | | Alternatives |
|---|---|---|---|---|---|---|---|---|
| | | | | Raising (ft) | Length (ft) | First ($Million) | Annual ($1000) | |
| **Natomas East Main Drain Primary Features** | | | | | | | | |
| **Total** | | | | | | 18 | 1600 | |
| NEMDC-Raise West Levee | Required to provide 100-yr FEMA protection & NED level of protection | 55,000 | 24,800 | 0.5 | 13,500 | 2 | 180 | Potential Natomas flooding<br>Lower the American River stages |
| NEMDC-Raise East Levee | Required to provide 100-yr FEMA protection & NED level of protection | 3,300 | 271 | 0.5 | 1,400 | 1 | 60 | Potential North Sacramento flooding<br>Lower the American River stages |
| NEMDC-Pump Station | Prevents enchroaching into 3 foot freeboard on west levee upper NEMDC | 1,640 | 25 | N/A | N/A | 5 | 440 | Flowage easement upper NEMDC<br>Additional 9 miles levee raising |
| NEMDC-Replace Main Ave. Bridge | Prevents enchroaching into 3 foot Rio Linda | 1/ | - | 2.0 | 500 | 7 | 670 | Periodic closure of bridge during high stage floods |
| Dry Creek-Construct North Levee | Prevents enchroaching into 3 foot freeboard on west levee upper NEMDC | 120 | 1 | 6.0 | 1,300 | 3 | 250 | Flowage easement on lands immediately north of Ascot Ave. |
| **Hydraulic Mitigation** | | | | | | | | |
| **Total** | | | | | | 4 | 400 | |
| Dry Creek-Extend South Levee | Hydraulic mitigation for induced flooding caused by containing less frequent floods | 1120 | 92 | 4.0 | 2,400 | 1 | 120 | Industrial/ residential area floods along Main Avenue |
| Arcade Creek-Extend North Levee | Hydraulic mitigation for induced flooding caused by containing less frequent | 540 | 44 | 3.0 | 2,400 | 2 | 180 | Flooding of residential areas in North Sacramento |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| upper NEMDC | | | | | | | | |
| **Hydraulic Mitigation** | | | | | | | | |
| **Total** | | | | | | 4 | 400 | |
| Dry Creek-Extend South Levee | Hydraulic mitigation for induced flooding caused by containing less frequent floods | 1120 | 92 | 4.0 | 2,400 | 1 | 120 | Industrial/ residential area floods along Main Avenue |
| Arcade Creek-Extend North Levee | Hydraulic mitigation for induced flooding caused by containing less frequent floods | 540 | 44 | 3.0 | 2,400 | 2 | 180 | Flooding of residential areas in North Sacramento |
| Arcade Creek-Raise South Levee | Hydraulic mitigation for induced flooding caused by containing less frequent floods | 270 | 22 | 1.0 | 1,200 | 1 | 100 | Flooding of residential areas in North Sacramento |
| **Pleasant Grove Creek Canal Primary Features** | | | | | | | | |
| **Total** | | | | | | 3 | 280 | |
| Pleasant Grove Levees-raise West Levee | Required to provide 100-yr FEMA protection & NED level of protection | 55,000 | 24,800 | 1.0 | 500 | 1 | 100 | Lower the Sacramento River Stages |
| Sankey Road - Modify east Levee Road | Prevents Pleasant Grove Creek water from entering Natomas | 2,220 | 2 | 4.0 | 3,000 | 2 | 180 | Lower the Sacramento River Stages |
| **Hydraulic Mitigation** | | | | | | | | |
| **Total** | | | | | | 1 | 115 | |
| Sankey Road-Training Channel to NEMDC | Hydraulic mitigation for expected increase in water surface north of Sankey Road | 5000 | 4 | -6.0 | 3,000 | 1 | 115 | Lower Sankey Road |
| **Natomas Cross Canal Primary Features** | | | | | | | | |
| **Total** | | | | | | 2 | 180 | |
| Cross Canal-Raise South Levee | Required to provide 100-yr FEMA protection & NED level of protection | 55,000 | 24,800 | 0.5 | 4,000 | 2 | 180 | Lower the Sacramento River Stages |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Total** | | | | | | 3 | 280 | |
| Pleasant Grove Levees-raise West Levee | Required to provide 100-yr FEMA protection & NED level of protection | 55,000 | 24,800 | 1.0 | 500 | 1 | 100 | Lower the Sacramento River Stages |
| Sankey Road - Modify east Levee Road | Prevents Pleasant Grove Creek water from entering Natomas | 2,220 | 2 | 4.0 | 3,000 | 2 | 180 | Lower the Sacramento River Stages |
| **Hydraulic Mitigation** | | | | | | | | |
| **Total** | | | | | | 1 | 115 | |
| Sankey Road-Training Channel to NEMDC | Hydraulic mitigation for expected increase in water surface north of Sankey Road | 5000 | 4 | -6.0 | 3,000 | 1 | 115 | Lower Sankey Road |
| **Natomas Cross Canal Primary Features** | | | | | | | | |
| **Total** | | | | | | 2 | 180 | |
| Cross Canal-Raise South Levee | Required to provide 100-yr FEMA protection & NED level of protection | 55,000 | 24,800 | 0.5 | 4,000 | 2 | 180 | Lower the Sacramento River Stages |
| **Hydraulic Mitigation** | | | | | | | | |
| **Total** | | | | | | 6 | 540 | |
| North Natomas Detention Basin-Move East Levee | Hydraulic mitigation for induced flooding resulting from raising Cross Canal levees | 4,000 | 4 | N/A<br>20 | 1,000<br>19,000 | 6 | 540 | Upstream storage/flowage easement Detention basin in Natomas |

1/ Required for levee raising.
2/ NED Plan.

3,000-cfs-capacity discharge channel from Sankey Road south to the Riego Road is included as a mitigation feature. The channel will act to reduce the upstream water stage to without-project conditions. The additional volume of floodwater flowing in the NEMDC would increase the ponding elevation upstream from the pump station. This increase still is much less than the water-surface elevations in the NEMDC without the project. The first and annual costs of the mitigation feature are $1,300,000 and $115,000, respectively. The average annual savings in induced flood damages is probably between $50,000 and $100,000.

(3) Levee Modifications Along The NCC. - The primary feature of raising 18,000 lineal feet of the south levee of the NCC about 0.5 foot would preclude flooding of Natomas primarily from the Sacramento River. During extremely rare flood events, this action would induce additional flooding in the Pleasant Grove area (increase depth by about 0.4 foot) and possibly cause flooding to lands on the other (north) side of the NCC. A number of possible hydraulic mitigation actions were considered. These include: (1) purchase flowage easements on about 8,000 acres in the Pleasant Grove area, (2) construct new storage upstream from Pleasant Grove on East Side Canal and Pleasant Grove Creeks, (3) construct a detention basin in north Natomas including containment levees and the flooded area within the levees, and (4) lengthen Fremont Weir. The least costly and most effective action chosen for the selected plan includes a detention basin in north Natomas (total storage of 3,000 acre-feet on a 300 acre area of land). About 11,600 feet of containment levees in the northeast corner of Natomas would be required. Also included would be six 8' x 8' concrete box culverts with sluices gates in the Pleasant Grove Canal levee. The estimated first and annual costs of the mitigation features are $5.6 million and $540,000, respectively. The average annual savings in induced flood damages are between $50,000 and $100,000. Despite the low benefit-cost ratio, it should be noted that there are social consequences associated with the flooding in the Pleasant Grove area. There are about 70 residential dwellings within the flood plain in addition to a cemetery and school. Also, during 1986, flooding a fire station was inundated at shallow depths. There has been significant public reaction related to the potential for induced flooding, even though it is only about 0.4 foot on areas already flooded up to depths of 5 feet.

## CHAPTER V - ALTERNATIVE PLANS AND COMPARISONS

16. General. - Four flood control measures along the main stem American River and three in Natomas were retained for development into alternative plans (see Chapter III). These measures are:

### Main Stem American River

- Increase flood control storage space in Folsom Reservoir.
- Increase downstream channel capacity with levee and channel modifications.
- Make structural modifications to Folsom Dam.
- Construct flood control storage facilities upstream from Folsom Reservoir.

### Natomas

- Construct levee improvements in and around Natomas.
- Construct gated structure and pumping station.
- Construct north Natomas detention basin.

Combinations of these measures were formulated into an array of alternatives to provide these levels of protection:

- 100-year (FEMA)
- 150-year
- 200-year
- 400-year

When this feasibility study was initiated, the State and its cost-sharing partners said they wanted the study to concentrate on plans to provide long-term flood protection. They considered flood protection to the 200-year level or greater to be essential for the Sacramento area because of the catastrophic loss of life and property that would result from levee failure during floods larger than the existing levee system can safely handle.

To ensure the development and evaluation of a full range of alternatives, plans were formulated to provide levels of protection less than 200 years, even though the lower levels do not meet the public safety objective established by the State and its cost-sharing partners. The minimum level of protection considered was 100 years (FEMA)--any lower level of protection would preclude removal of Sacramento's designation by FEMA as a flood-prone area. A 150-year level of protection was also evaluated--because it is about the greatest level of protection possible without development of flood control storage upstream from Folsom Reservoir.

As directed by the congressional authorization for this study, it was assumed that the USBR multipurpose Auburn Dam would not be constructed in the foreseeable future. However, because the American River basin has water resource needs in addition to flood control, initial planning included a flood control dam with "advance features," so the dam could be expanded later by non-Federal interests for water supply and power generation, as well as a flood control dam that could also provide other incidental benefits. Subsequent coordination and analysis showed that these alternatives were either economically infeasible and/or had no non-Federal sponsor willing to fund the features not related to flood control. Consequently, these alternatives were dropped from further analysis.

17. Initial Alternatives Identified. - Twenty-seven alternatives were initially formulated from the seven flood control measures carried forward. These alternatives are summarized in Table B-20 and briefly described in the sections below.

As shown in Table B-20, the alternatives are grouped by major project feature. All the alternatives include measures along both the main stem American River and in Natomas. However, it became clear during the formulation and evaluation of alternatives that any plan would require similar measures in Natomas, regardless of measures incorporated along the main stem American River or the level of flood protection provided. Thus, Natomas features are similar for all alternatives.

Described below are the various alternatives as they apply to the main stem American River. Also described are the Natomas area features common to all the alternatives.

a. Main Stem American River. - Flood control measures applicable to the main stem American River were considered individually and in various combinations in formulating the alternatives described below. The measures are grouped into three broad categories:

- Levee improvements
- Reoperation of Folsom Dam
- Flood control dam upstream from Folsom Reservoir

(1) Levee Improvements. - Various levee improvements and channel modifications could be made to increase the capacity of the lower American River to allow an increase in the current objective release (sustained flow) of 115,000 cfs from Folsom Dam. As shown on Plate 8, an increase in the objective release to about 145,000 cfs would be required to obtain a 100-year (FEMA) level of flood protection (equivalent to an 85-year level of protection

| ALTERNATIVE | | Folsom Flood Storage (ac-ft) | Folsom Objective Release (cfs) | Lower Folsom Spillway (feet) | Levee Raising (miles) | |
|---|---|---|---|---|---|---|
| Feature | Level of Protection | | | | | |
| **LEVEE IMPROVEMENT** | 1. 100-Yr (FEMA) | 400,000 | 145,000 | 0 | 21 | |
| | 150-Yr - 400-Yr | | | | | |
| **FOLSOM REOPERATION** -Modified Storage | 2. 100-Yr (FEMA) | 590,000 | 115,000 | 0 | 7 | |
| | 150-Yr - 400-Yr | | | | | |
| -Modified Spillway | 100-Yr (FEMA) - 400-Yr | | | | | |
| -Modified Storage and Spillway | 3. 100-Yr (FEMA) | 555,000 | 115,000 | 15 | 7 | |
| | 150-Yr - 400-Yr | | | | | |
| **LEVEE IMPROVEMENT/ FOLSOM REOPERATION** -Levee Improvement /Modified Storage | 4. 100-Yr (FEMA) | 530,000 | 130,000 | 0 | 13 | |
| | 150-Yr - 400-Yr | | | | | |
| -Levee Improvement /Modified Spillway | 5. 100-Yr (FEMA) | 400,000 | 143,000 | 15 | 21 | |
| | 150-Yr - 400-Yr | | | | | |
| -Levee Improvement /Modified Storage and Spillway | 6. 100-Yr (FEMA) | 470,000 | 130,000 | 15 | 13 | |
| | 7. 150-Yr | 650,000 | 180,000 | 15 | 27 | |
| | 200-Yr - 400-Yr | | | | | |
| **FLOOD CONTROL DAM** | 8. 100-Yr (FEMA) | 400,000 | 115,000 | 0 | 7 | |
| | 9. 150-Yr | 400,000 | 115,000 | 0 | 7 | |
| | 10. 200-Yr | 400,000 | 115,000 | 0 | 7 | |
| | 11. 400-Yr | 400,000 | 115,000 | 0 | 7 | |
| **FLOOD CONTROL DAM /LEVEE IMPROVEMENT** | 12. 100-Yr (FEMA) | 400,000 | 130,000 | 0 | 13 | |
| | 13. 150-Yr | 400,000 | 130,000 | 0 | 13 | |
| | 14. 200-Yr | 400,000 | 130,000 | 0 | 13 | |
| | 15. 200-Yr | 400,000 | 180,000 | 0 | 27 | |
| | 16. 400-Yr | 400,000 | 130,000 | 0 | 13 | |
| | 17. 400-Yr | 400,000 | 180,000 | 0 | 27 | |
| **FLOOD CONTROL DAM /FOLSOM REOPERATION** -Flood Control Dam /Modified Storage | 18. 100-Yr (FEMA) | 200,000 | 115,000 | 0 | 7 | |
| | 19. 150-Yr | 200,000 | 115,000 | 0 | 7 | |
| | 20. 200-Yr | 300,000 | 115,000 | 0 | 7 | |
| | 21. 200-Yr | 650,000 | 115,000 | 0 | 7 | |
| | 22. 400-Yr | 300,000 | 115,000 | 0 | 7 | |
| | 23. 400-Yr | 650,000 | 115,000 | 0 | 7 | |
| -Flood Control Dam /Modified Spillway | 100-Yr (FEMA) - 400-Yr | | | | | |
| -Flood Control Dam /Modified Storage and Spillway | 100-Yr (FEMA) - 400-Yr | | | | | |
| **FLOOD CONTROL DAM /LEVEE IMPROVEMENT /FOLSOM REOPERATION** -Flood Control Dam/Levee Improvement/Modified Storage | 24. 100-Yr (FEMA) | 470,000 | 130,000 | 0 | 13 | |
| | 25. 150-Yr | 470,000 | 130,000 | 0 | 13 | |
| | 26. 200-Yr | 550,000 | 130,000 | 0 | 13 | |
| | 27. 400-Yr | 550,000 | 130,000 | 0 | 13 | |
| -Flood Control Dam/Levee Improvement/Modified Spillway | 100-Yr (FEMA) - 400-Yr | | | | | |
| -Flood Control Dam/Levee Improvement/Modified Storage and Spillway | 100-Yr (FEMA) - 400-Yr | | | | | |

1/ October 1991 price levels and do not include creditable expenditures to date.
2/ 8 3/4% interest over 100-year project life.
3/ Flood control only.

TABLE B-20
SUMMARY OF INITIAL ALTERNATIVES FORMULATED

| Lower Folsom Spillway (feet) | Levee Raising (miles) | Bank and Levee Protection (miles) | Levee Stabilizing (miles) | New Upstream Flood Detention (ac-ft) | First Cost ($millions) [1] | Annual Cost ($millions) [2] |
|---|---|---|---|---|---|---|
| 0 | 21 | 10 | 8 | 0 | 176.6 | 17.3 |
| Not Achievable | | | | | | |
| 0 | 7 | 0 | 0 | 0 | 128.9 | 11.6 |
| Not Achievable | | | | | | |
| Not Achievable | | | | | | |
| 15 | 7 | 0 | 0 | 0 | 154.1 | 14.3 |
| Not Achievable | | | | | | |
| 0 | 13 | 10 | 1 | 0 | 198.5 | 18.9 |
| Not Achievable | | | | | | |
| 15 | 21 | 10 | 2 | 0 | 227.9 | 22.2 |
| Not Achievable | | | | | | |
| 15 | 13 | 10 | 1 | 0 | 225.1 | 21.7 |
| 15 | 27 | 10 | 12 | 0 | 495.9 | 46.6 |
| Not Achievable | | | | | | |
| 0 | 7 | 0 | 0 | 180,000 | 437.4 | 41.3 |
| 0 | 7 | 0 | 0 | 430,000 | 497.7 | 47.0 |
| 0 | 7 | 0 | 0 | 545,000 | 535.3 | 50.5 |
| 0 | 7 | 0 | 0 | 894,000 | 631.6 | 59.8 |
| 0 | 13 | 10 | 1 | 170,000 | 593.8 | 56.5 |
| 0 | 13 | 10 | 1 | 370,000 | 538.7 | 56.1 |
| 0 | 13 | 10 | 1 | 484,000 | 626.5 | 59.7 |
| 0 | 27 | 10 | 12 | 328,000 | 724.8 | 69.6 |
| 0 | 13 | 10 | 1 | 810,000 | 719.1 | 68.4 |
| 0 | 27 | 10 | 12 | 620,000 | 818.7 | 77.9 |
| 0 | 7 | 0 | 0 | 330,000 | 464.4 | 43.8 |
| 0 | 7 | 0 | 0 | 580,000 | 542.9 | 51.2 |
| 0 | 7 | 0 | 0 | 598,000 | 549.5 | 51.8 |
| 0 | 7 | 0 | 0 | 485,000 | 674.5 | 62.6 |
| 0 | 7 | 0 | 0 | 998,000 | 665.2 | 61.8 |
| 0 | 7 | 0 | 0 | 778,000 | 758.8 | 70.5 |
| Similar to Flood Control Dam | | | | | | |
| Similar to Dam/Modified Storage | | | | | | |
| 0 | 13 | 10 | 1 | 80,000 | 555.3 | 52.6 |
| 0 | 13 | 10 | 1 | 350,000 | 618.6 | 58.7 |
| 0 | 13 | 10 | 1 | 440,000 | 705.8 | 66.5 |
| 0 | 13 | 10 | 1 | 720,000 | 788.9 | 74.3 |
| Similar to Dam/Levee Improvements | | | | | | |
| Similar to Dam/Levee Improvements/Modified Storage | | | | | | |

| zing | New Upstream Flood Detention (ac-ft) | First Cost ($millions) [1] | Annual Cost ($millions) [2] | Annual Benefits ($millions) [3] | Net Benefits ($millions) |
|---|---|---|---|---|---|
| | 0 | 176.6 | 17.3 | 60 | 42.7 |
| ıle | | | | | |
| | 0 | 128.9 | 11.6 | 60 | 48.4 |
| ıle | | | | | |
| ıle | | | | | |
| | 0 | 154.1 | 14.3 | 60 | 45.7 |
| ıle | | | | | |
| | 0 | 198.5 | 18.9 | 60 | 41.1 |
| ıle | | | | | |
| | 0 | 227.9 | 22.2 | 60 | 37.8 |
| ıle | | | | | |
| | 0 | 225.1 | 21.7 | 60 | 38.3 |
| | 0 | 495.9 | 46.6 | 128 | 81.4 |
| ble | | | | | |
| | 180,000 | 437.4 | 41.3 | 60 | 18.7 |
| | 430,000 | 497.7 | 47.0 | 128 | 81.0 |
| | 545,000 | 535.3 | 50.5 | 166 | 115.5 |
| | 894,000 | 631.6 | 59.8 | 202 | 142.2 |
| | 170,000 | 593.8 | 56.5 | 60 | 3.5 |
| | 370,000 | 538.7 | 56.1 | 128 | 71.9 |
| | 484,000 | 626.5 | 59.7 | 166 | 106.3 |
| | 328,000 | 724.8 | 69.6 | 166 | 96.4 |
| | 810,000 | 719.1 | 68.4 | 202 | 133.6 |
| | 620,000 | 818.7 | 77.9 | 202 | 124.1 |
| | 330,000 | 464.4 | 43.8 | 60 | 16.2 |
| | 580,000 | 542.9 | 51.2 | 128 | 76.8 |
| | 598,000 | 549.5 | 51.8 | 166 | 114.2 |
| | 485,000 | 674.5 | 62.6 | 166 | 103.4 |
| | 998,000 | 665.2 | 61.8 | 202 | 140.2 |
| | 778,000 | 758.8 | 70.5 | 202 | 131.5 |
| ıntrol Dam | | | | | |
| fied Storage | | | | | |
| | 80,000 | 555.3 | 52.6 | 60 | 7.4 |
| | 350,000 | 618.6 | 58.7 | 128 | 69.3 |
| | 440,000 | 705.8 | 66.5 | 166 | 99.5 |
| | 720,000 | 788.9 | 74.3 | 202 | 127.7 |
| Improvements | | | | | |
| ments/Modified Storage | | | | | |

using Corps methodology). Levels of protection greater than about 100-year (Corps) are not achievable with levee improvements alone.

Table B-21 summarizes the extent of levee and channel modifications required to increase the channel capacity of the lower American River for higher objective releases. As shown, besides the bank and levee work along the river, the Sacramento Weir would need to be lengthened. In addition, levee work along the Yolo Bypass south of the Sacramento Bypass would be required.

Surcharge storage space was used for alternatives utilizing the existing spillway at Folsom. The reservoir was surcharged to a maximum elevation of 470 feet, 50,000 acre-feet of surcharge space, or 4 feet above gross pool. Surcharge storage may be utilized to obtain additional flood control effectiveness or safer operation of an existing project in some cases; however, it is not to be designated as part of the required flood control space.

(2) Folsom Reoperation. - Folsom reoperation alternatives involve increasing the flood control space in Folsom Reservoir and lowering the spillway at Folsom Dam. Three possible alternatives were identified, as described below.

(a) Modified Storage. - By itself, increasing the flood control space in Folsom Reservoir from the current 400,000 acre-feet could provide a maximum flood protection level of about 100-year (Corps). For a 100-year (FEMA) level of protection, the flood control space would have to be increased to 590,000 acre-feet. (See Plate 8.) This increase assumes that the objective release from Folsom Dam would be maintained at 115,000 cfs. It must also be stressed that in order to attain 100-year (FEMA) level of protection with 590,000 acre-feet of flood control space, surcharge space within the reservoir as well as incidental storage in existing upstream reservoirs must be used. Changes required by this alternative are limited to operation of Folsom Reservoir. No structural modifications would be required.

(b) Modified Spillway. - Lowering the spillway at Folsom Dam could increase the flood control efficiency of the dam if coupled with increases in the objective release or flood control storage space. However, just lowering the spillway (by 15 feet) would provide only about 70-year protection, just slightly greater than the current 63-year level. Because lowering the spillway could not by itself provide 100-year (FEMA) protection, no alternative was developed.

Surcharge storage was not utilized for any of the modified spillway alternatives. Structural modification of the existing spillway alters the flood control operation of the dam in the same manner as a new project would. Surcharge storage is a contingency for control of floods larger than the design flood and is not to be used in project design.

**TABLE B-21**

**SUMMARY OF LEVEE AND CHANNEL MODIFICATIONS TO INCREASE CHANNEL CAPACITY OF LOWER AMERICAN RIVER**

| | Objective Release (cfs) | | |
|---|---|---|---|
| | 130,000 | 145,000 | 180,000 |
| Lower American River (miles): | | | |
| Slurry wall | 0.7 | 0.9 | 4.1 |
| Toe drain | 0.6 | 2.7 | 7.8 |
| New levee | 0.9 | 1.0 | 1.0 |
| Levee raising | 0.0 | 2.7 | 11.4 |
| Riprap on bank | 1.5 | 1.5 | 1.5 |
| Riprap on levee | 5.3 | 5.3 | 5.3 |
| Riprap on bank and levee | 3.2 | 3.2 | 3.2 |
| Yolo Bypass | -- Extensive levee raising on both sides -- South of Sacramento Bypass | | |
| Sacramento Weir | Lengthen 500 feet | Lengthen 1,400 feet | Lengthen 3,600 feet |
| Other | -- -- Raise Union Pacific Railroad -- -- -- | | |
| | Relocate American River Parkway Access Road | | |
| | Replace Main Ave. Bridge | Replace Main Ave. Bridge and Norwood Ave. Bridge | Raise H Street bridge. Replace El Camino, Howe Ave., Main Ave., and Norwood Ave. bridges. Replace American River bike trail. Replace fencing. |

(c) Modified Storage and Spillway. - Increasing the flood control space in Folsom Reservoir and lowering the spillway at the dam could provide a 100-year (FEMA) level of protection. As shown on Plate 8, the storage space would be increased to 555,000 acre-feet and the spillway would be lowered by 15 feet. This would allow maintenance of the objective release from Folsom of 115,000 cfs during flood periods. Spillway modification would include:

- Removing five tainter gates measuring 42 feet wide by 50 feet high.
- Lowering the spillway crest by 15 feet.
- Installing five tainter gates measuring 42 feet wide by 65 feet high.
- Lengthening the stilling basin by 50 feet.

(3) Levee Improvements/Folsom Reoperation. - Levee improvements can be combined with increased flood control storage at Folsom, modification of the spillway, or both. Alternatives comprising the various combinations are described below.

(4) Levee Improvements/Modified Storage. - Alternatives combining American River levee improvements (to accommodate higher objective releases from Folsom Dam) and increased flood control storage in Folsom Reservoir could provide protection to about the 125-year level. To provide a 100-year (FEMA) level of protection, the objective release would be increased to 130,000 cfs and Folsom storage to 530,000 acre-feet. Table B-20 shows the levee and channel modifications that would be required.

(5) Levee Improvements/Modified Spillway. - A 100-year (FEMA) level of protection could be provided by increasing the objective release from Folsom Dam to 143,000 cfs and lowering the spillway 15 feet. As shown on Plate 8, the maximum level of flood protection from various combinations of such measures is about 100-year (Corps), assuming an objective release of 180,000 cfs. Accordingly, an alternative for just the 100-year (FEMA) level of protection was formulated.

(6) Levee Improvements/Modified Storage and Spillway. - Alternatives combining levee improvements and modified storage and spillway at Folsom were formulated for two levels of protection--100-year (FEMA) and 150-year. Alternatives for both levels assume lowering the spillway by 15 feet.

For the 100-year (FEMA) level of protection, combinations range from an objective release of about 115,000 cfs and storage of 555,000 acre-feet to a release just under 143,000 cfs and storage of 400,000 acre-feet. For display purposes, a combination

involving a release of 130,000 cfs and storage of 470,000 acre-feet was selected. Table B-20 shows the required levee and channel modifications.

Protection to the 150-year level would require increasing the Folsom objective release to 180,000 cfs and the flood control storage space to 650,000 acre-feet. The levee and channel modifications required to accommodate this release are shown in Table B-21.

The 150-year alternative would provide the highest level of flood protection possible without the development of additional flood control storage upstream from Folsom Reservoir. However, levee improvements to increase the channel capacity of the lower American River to 180,000 cfs within the current corridor may not even be feasible because of limitations of levee design. Because of these constraints and others for increasing the storage space in Folsom, no such alternatives were formulated to provide flood protection greater than the 150-year level.

(7) Flood Control Dam. - Development of flood detention facilities upstream from Folsom Reservoir could provide a full range of protection levels to Sacramento--from the 100-year (FEMA) to the 400-year (and greater). Plate 9 shows the flood storage space required at Folsom and at the new detention site (near Auburn) for various frequency floods, assuming an objective release from Folsom Dam of 115,000 cfs. Assuming flood control storage of 400,000 acre-feet in Folsom, detention requirements at the Auburn site would be:

| Protection Level | Detention Capacity (acre-feet) |
|---|---|
| 100-year (FEMA) | 180,000 |
| 150-year | 430,000 |
| 200-year | 545,000 |
| 400-year | 894,000 |

(8) Flood Control Dam/Levee Improvements. - Numerous alternatives are possible for combining development of an upstream flood control dam and levee improvements along the lower American River to permit increased releases from Folsom. Six possibilities are shown in Table B-20. These range from a flood detention capacity of 170,000 acre-feet and a Folsom release of 130,000 cfs for the 100-year (FEMA) level of protection to a detention capacity of 620,000 acre-feet and a release of 180,000 cfs for the 400-year level of protection.

(9) Flood Control Dam/Folsom Reoperation. - An upstream flood control dam can also be combined with different flood control storages at Folsom, a lower spillway at Folsom, or both. Representative alternatives are described below.

(a) Dam/Modified Storage. - Table B-20 shows six alternatives combining an upstream flood control dam and various flood storage requirements in Folsom. In four of the alternatives, some of the current flood storage requirement in Folsom would be shifted to the new detention site. In the other two, the Folsom requirement would be increased.

Two reductions were considered for Folsom flood storage - 200,000 acre-feet for alternatives providing 100-year (FEMA) and 150-year protection and 100,000 acre-feet for alternatives providing 200- and 400-year protection. Selection of these reductions was based on the estimated hydraulic optimization of the flood control operations of Folsom and a new detention facility. Plate 9 shows the relationships between reduced flood control storage in Folsom to 200,000 and 300,000 acre-feet and total flood storage (Folsom plus detention facility) for a full range of downstream flood protection levels. The hydraulic efficiency of the combined operation is discussed in more detail in the Reservoir Regulation Appendix.

(b) Dam/Modified Spillway. - No specific alternatives were developed to combine construction of an upstream flood control dam and lowering of the spillway at Folsom Dam. As discussed, lowering the spillway (while maintaining the existing objective release and flood control storage space) would only incrementally increase downstream flood protection from a 63-year level to about 70-year level. Alternatives combining these measures would be very similar to alternatives incorporating just the new upstream facility. Including the spillway modification would slightly reduce the detention requirement for the new upstream facility.

(c) Dam/Modified Storage and Spillway. - Alternatives using this combination of measures would be similar to the dam/modified storage alternatives. Incorporating the spillway modification could reduce somewhat the combined flood storage requirement for Folsom and the new facility because lowering the spillway would allow larger releases from Folsom to be made sooner during flood periods. But because the objective release of 115,000 cfs would be maintained, the benefit would be small.

(10) Flood Control Dam/Levee Improvements/Folsom Reoperation. - An upstream flood control dam and levee improvements along the lower American can be combined with modified flood storage in Folsom, spillway modification, or both.

(a) Dam/Levee Improvements/Modified Storage. - For each level of flood protection, numerous combinations are possible for incorporating an upstream flood control dam, levee improvements for higher objective releases from Folsom, and increased (or decreased) flood control storage in Folsom. Table B-20 shows an alternative for each level of protection.

An objective release of 130,000 cfs was chosen for each alternative because, from a technical perspective, it is the likely maximum dependable level of increase. Folsom flood storage would be increased to 470,000 acre-feet for the 100-year (FEMA) and 150-year levels of protection and 550,000 acre-feet for the 200- and 400-year levels. These sizes were selected because prior studies have shown that larger increases for these protection levels likely would not be feasible economically (on an incremental basis) or institutionally.

(b) Dam/Levee Improvements/Modified Spillway. - No specific alternatives were formulated for this combination because they would be similar to the dam/levee improvement alternatives - but more expensive.

(c) Dam/Levee Improvements/Modified Storage and Spillway. - Alternatives for this combination would be similar to the dam/levee improvement/modified storage alternatives.

b. Natomas. - All the alternatives described above for the main stem American River include additional features to provide protection to Natomas. Measures providing similar levels of flood control for the main stem and Natomas were combined into a single alternative. This is primarily because of the physical and socioeconomic interrelationships of each area to the other. As described in the Main Report, and in the Economic Appendix, Natomas can be evaluated as a last-added increment to a basin wide flood control project.

The Natomas features are economically feasible as a last-added increment. For numerous reasons including cost repayment assessments, community understanding, relative environmental and related impacts, it would be prudent planning to provide the same levels of flood protection to different areas of the community. The Natomas features highlighted below include measures to mitigate adverse environmental and hydraulic impacts. A more complete description of the environmental features is in the EIS/EIR. A brief description of the hydraulic mitigation features is in Chapter IV.

The features described below are for a 100-year (FEMA) level of protection, assuming an objective release from Folsom Dam of 115,000 cfs. Facilities required for higher levels of protection (assuming an objective release of 115,000 cfs) would be similar, but slightly larger. However, for alternatives including larger

increases in the objective release from Folsom Dam (regardless of the level of flood protection), features would be substantially more extensive, especially along the NEMDC and Dry and Arcade Creeks. The 100-year (FEMA) facilities are:

- Raise 13,000 lineal feet of the west levee along the NEMDC about 1 foot from El Camino Avenue to Main Avenue.
- Raise 7,000 lineal feet of the east levee along the NEMDC about 1 foot from Arcade Creek to Main Avenue.
- Replace the Main Avenue bridge.
- Construct a high-volume (700 cfs) pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek. (This would also provide flood protection to the western Rio Linda area by preventing backup of floodwaters in the NEMDC.)
- Construct about 4,600 lineal feet of levee a maximum of about 8 feet high along the north side of Dry Creek from the pump station at the NEMDC to high ground near West 2nd Street and Ascot Avenue. Provide floodgates at the Union Pacific Railroad. (This would also help provide flood protection to the western Rio Linda area.)
- Extend or raise the south levee along Dry Creek 2,400 lineal feet east to Rio Linda Boulevard.
- Raise 2,400 lineal feet of levee on the north side of Arcade Creek just downstream from Marysville Boulevard about 3 feet.
- Raise 1,200 lineal feet of levee on the south side of Arcade Creek downstream from Marysville Boulevard about 1 foot.
- Raise 6,000 lineal feet of the south levee along the NCC about 1 foot at three locations.
- Raise 500 lineal feet of the west levee along the Pleasant Grove Creek Canal about 1 foot at two bridge crossings and modify a containment levee across the canal at Sankey Road.
- Raise 3,000 lineal feet of East Levee Road about 4 feet from Sankey Road south.
- Construct a 3,000-cfs-capacity drainage channel south from Sankey Road for about 10,600 feet.

- Construct a 3,000 acre-foot detention basin in north Natomas covering about 300 acres.

18. Screening of Alternatives. - The 27 alternatives identified initially were compared to select the best among them to provide the four levels of protection. Key factors in the screening were the environmental impacts and the costs and benefits associated with each alternative.

a. Environmental Impacts. - The major features associated with the various alternatives would result in some adverse environmental impacts. The potential impacts are summarized below according to major project feature. They are described in more detail in the EIS/EIR.

(1) Levee Improvements. - This feature would involve (1) constructing levee improvements and related channel modifications along the lower American River and in the Yolo Bypass area and (2) releasing higher floodflows in the lower river from increased objective releases from Folsom. Likely impacts are:

- Decreased wildlife habitat along the lower portion of the American River Parkway as a result of modifications to the levees and construction activities.

- Decreased fishery habitat downstream from Folsom Dam due to higher objective releases. High net outflows from Folsom (on the order of 100,000 cfs and greater) disturb spawning gravels and other fishery habitat with increasing damage as flow rates increase. Sustained outflows in excess of 115,000 cfs would occur more often than under existing conditions.

- Decreased wildlife habitat (primarily in the American River Parkway) due to the higher objective releases. As with fishery habitat, higher outflows from Folsom can disturb existing wildlife habitat with damage increasing as flow rates increase. Higher outflows would occur more often than under existing conditions.

- Decreased recreational value of the American River Parkway primarily due to levee modifications.

The parkway supports more than 5 million visitor-use days annually. In 1972, the lower river became part of the State wild and scenic rivers system, and in 1981, it was given "recreational" status in the Federal wild and scenic rivers system. Increased flows in the river would require up to 1 mile of new levee and 11 miles of levee raising. In addition, riprap would be required along (1) 1.5 river miles of bank, (2) 5.3 miles of levee, and (3) 3.2 miles more of both bank and levee.

Construction activities and increasing the channel capacity of the lower river to 180,000 cfs would cause the loss of several hundred acres of wetlands, riparian forest, scrub-shrub, and upland habitats. Potential mitigation includes modifying adjacent lands in the parkway and managing them as wetlands. Increasing the channel capacity would also increase the rate of gravel loss from the lower river, which would affect salmon spawning. To mitigate this impact, a spawning gravel replacement program would be implemented. Other forms of mitigation are also possible.

Increasing the capacity to 180,000 cfs would create the most severe impacts. Lesser increases would have proportionally lower impacts.

(2) Reoperation of Folsom Reservoir. - Increasing the seasonal flood control storage space in Folsom Reservoir would result in several major physical changes, including:

- Greater annual fluctuation of the reservoir water-surface elevation, with a net decrease from existing conditions. The greatest change would be from September through April, when the reservoir would be drawndown for flood control. In average and below-normal water years, the water-surface elevation would be lower in all months.

- Increased flows in the lower American River from October through December necessary to evacuate the larger flood control space in Folsom.

- Reduced flows in the lower river from February through June to conserve as much spring snowmelt runoff as possible.

- Slight long-term reduction in Sacramento River flows from spring through fall. This reduction would result from operational changes of the CVP to help offset the reduced water supply potential at Folsom.

Each of these changes would result in numerous direct and indirect impacts on environmental and related resources. Some of the most significant impacts and possible ways to offset them are:

- Greater fluctuations in the reservoir water-surface elevation could adversely affect spawning of warmwater reservoir species. To compensate, brush piles and windrows could be provided at selected elevations of the reservoir to provide additional cover for fish during drawdown and refilling periods.

- Over time, reduced outflows from Folsom in the spring would affect the processes that influence the mixture of

habitat types in the American River Parkway. High-value riparian vegetation would slowly shift to more oak-grassland type habitat. Depending on the magnitude of Folsom release, changes in regeneration rates of riparian species would cause a loss of several hundred acres of riparian forest and other vegetation types. Riparian habitat types are very valuable because of their scarcity, so any riparian losses are considered significant. Mitigation could include vegetation planting to replace the lost habitat and a monitoring program to assess its success.

- Reduced storage in Folsom plus lower spring flows and higher fall flows would create increased-temperature problems in the lower American River that could adversely affect reproductive success and survival of fall-run Chinook salmon. Over 20 percent of the population could be lost. The fishery loss is 20 percent over and above any losses expected to occur in the future under the no-action plan as a result of meeting future water supply and power demands. Mitigation could involve replacing and enhancing spawning gravels along the lower river, but additional or supplemental measures might also be required. The U.S. Fish and Wildlife Service identified a potential need for an annual block of water of 60,000 acre-feet dedicated for release in the late fall to help compensate for the impact on the salmon. This measure may not be possible, however, because of physical limitations and constraints associated with reallocation of Folsom water supplies.

- Higher temperatures in the Sacramento River due to reoperation of other CVP reservoirs (required by reoperation of Folsom) would likely be slight but measurable. The changes would likely adversely affect anadromous fish habitat in the river.

- Cultural resources located within the maximum drawdown zone of reservoirs are subject to potentially damaging natural processes and human activities. Increasing the flood storage in Folsom would expose known and unknown cultural resources to more sustained and frequent impacts and uncover a larger area than under existing operating criteria. There are 32 prehistoric and 13 historic sites are located within the 395-466 foot elevation of Folsom Reservoir. Additional sites are located below the 395 foot elevation. Mitigation for impacts would include a program to inventory and evaluate all potential cultural resources in the drawdown zone and, where warranted, do systematic

recording, scientific data recovery, or preservation of the resources.

- Reduced storage in Folsom would have a small effect on downstream flows during the peak recreation season. However, reduced water levels in Folsom would significantly affect recreation use at the Folsom State Recreational Area, where up to 411,000 recreation use days would be lost annually. Increasing the flood control storage space by 250,000 acre-feet would have the greatest impact. Smaller increases would have proportionally smaller impacts.

Lowering the spillway at Folsom likely would have no significant adverse environmental impacts.

(3) Flood Control Dam. - The primary impacts related to an upstream flood control dam would result from construction activities and temporary inundation of the detention area during flood periods. Some oak forest/woodland, coniferous forest, chaparral, and ravine habitat types would be lost. Also, disturbance due to construction and periodic inundation of historic and prehistoric sites and artifacts in the detention area might be increased.

Flood detention capacities ranging from 175,000 to about 900,000 acre-feet were examined. Habitat losses from about 500 to over 2,000 acres would be expected. Oak woodlands, chaparral, and coniferous forests are not scarce habitat types in California, so these losses are not critical. Statewide, this vegetation type is common to about 3 million acres.

b. Economic Considerations. - The various alternatives would provide flood control and recreation benefits, and some alternatives would have economic impacts associated with reduced firm water supply and hydropower generation of the CVP. These benefits and impacts are briefly described below, and costs and comparisons presented.

(1) Flood Control Benefits. - Flood control benefits are associated with (a) inundation reduction, (b) location, (c) savings in flood-proofing costs, (d) bridge replacement, and (e) savings in flood insurance program operating costs. Average annual benefits range from about $60 million for the 100-year (FEMA) level of protection to about $202 million for the 400-year level.

(a) Inundation Reduction. - Inundation reduction benefits represent the difference between the projected equivalent average annual flood damages that would occur with and without a project. Average annual benefits range from about $52 million for

the 100-year (FEMA) level of protection to $163 million for the 400-year level.

(b) Location Benefits. - Location benefits result when flood control measures make flood plain lands available for a new economic use; for example, for residential instead of agricultural use. Since the land use analysis for Natomas indicates that there will be a significant difference in development under with- and without-project conditions, location benefits were estimated for the area. These benefits reflect the projected growth in Natomas under approved local plans until year 2010. Average annual location benefits range from about $8 million to about $30 million for the 100- (FEMA) and 400-year levels of protection, respectively.

(c) Savings in Flood-Proofing Costs. - The Flood Disaster Protection Act of 1973 (Public Law 93-234) requires that communities with flood-prone areas participate in the National Flood Insurance Program. Local agencies must adopt (and FEMA must certify) land use regulations that require the first floor of all new residential and nonresidential structures to be elevated to at least the elevation of the 100-year flood. The savings in flood-proofing costs are about $170,000.

(d) Bridge Replacement. - Bridge replacement benefits represent that portion of the annual cost of a bridge replaced as a project feature from the end of the existing bridge's "economic life" to the end of the project life. Up to five bridges would be replaced under various alternatives--Howe Avenue, Main Avenue, Norwood Avenue, El Camino Avenue, Highway 49, and Ponderosa Way. Bridge replacement benefits range from about $130,000 to $1.8 million.

(e) Savings in Flood Insurance Program Costs. - These savings reflect the reduction in costs associated with administration of the National Flood Insurance Program. The operating cost is currently $77 per policy, which would yield annual benefits of about $6.4 million for alternatives providing protection levels greater than 100-year (FEMA).

(2) Recreation Benefits. - Recreation benefits include a complex of pedestrian, bike, and equestrian trails associated with levee construction along the NEMDC in Natomas. The recreation facilities could provide about 335,000 use days annually with a benefit of about $1.5 million for the 200-year alternative.

(3) Benefit Comparison. - Table B-22 summarizes the average annual benefits for the four levels of flood protection.

(4) Other Economic Impacts. - Lower water levels in Folsom Reservoir from increasing the flood storage space would reduce the firm water supply yield and hydropower generation of

**TABLE B-22**

**SUMMARY OF AVERAGE ANNUAL BENEFITS 1/**
**($1,000)**

| Benefit Category | Level of Flood Protection | | | |
|---|---|---|---|---|
| | 100-Year (FEMA) | 150-Year | 200-Year | 400-Year |
| Flood Control | | | | |
| Inundation Reduction | 51,680 | 101,450 | 134,010 | 163,400 |
| Location | 8,000 | 20,000 | 24,000 | 30,000 |
| Savings in Flood-Proofing Costs | 170 | 170 | 170 | 170 |
| Bridge Replacement | 130 | 260 | 1,770 | 1,770 |
| Savings in Flood Insurance Program Costs | 0 | 6,400 | 6,400 | 6,400 |
| Subtotal | 59,980 | 128,280 | 166,350 | 201,740 |
| Recreation | 1,500 | 1,500 | 1,500 | 1,500 |
| Total | 61,480 | 129,780 | 167,850 | 203,240 |

1/ October 1991 price levels at 8-3/4% discount rate.

the CVP. Also, costs to provide water from Folsom to several CVP water customers near the reservoir would be increased.

The reduction in water supply yield and hydropower generation represents a significant monetary loss. For example, based on year 2020 demand levels, the estimated water supply yield to the CVP would be decreased between 8,000 and 33,000 acre-feet, depending on the increase in flood control space. Assuming the value of this reduction is equal to the cost of developing a replacement supply (about $300 per acre-foot), the annual loss would be between $2.4 million and $10 million. Also, power generation would be reduced between 8 and 40 gigawatthours per year and project-dependable capacity between 3 and 6 megawatts. Assuming a replacement value of 100 mills per kilowatthour, the annual loss would be between $9 million and $46 million.

Six agencies--the City of Roseville, San Juan Suburban Water District, Folsom Prison, City of Folsom, Placer County, and El Dorado Irrigational District--obtain their water directly from Folsom Reservoir. These agencies would not lose any of their water supply, but El Dorado Irrigation District and San Juan Suburban Water District might experience some pump inefficiencies during critically dry years. Pumping would be required more often, resulting in increased annual costs of up to $62,500.

(5) Costs and Comparisons. - Table B-20 shows estimated first and annual costs, average annual benefits, and net benefits for the 27 alternative plans. As shown, each plan has positive net economic benefits (benefits exceed costs).

Two general conclusions can be made about the various plans on the basis of economic considerations.

- Plans providing higher levels of flood protection cost more, but they also provide the greater net economic benefits.

- Plans providing the 100-year (FEMA) level of protection incorporate a range of features, including new upstream storage in some plans. However, plans incorporating levee improvements and/or Folsom reoperation are the more cost-effective ones for this relatively low level of protection.

The least expensive way to provide the 100-year (FEMA) level of protection would be to increase the flood control storage in Folsom Reservoir to 590,000 acre-feet (alternative 2) at an annual cost of $11.6 million. The next least expensive plan would incorporate lowering the spillway at Folsom Dam (alternative 3), with an annual cost of $14.3 million. Lowering the spillway would reduce the flood control storage requirement to 555,000 acre-feet, but the cost for the spillway work would be greater than the

resource replacement cost associated with the reduced storage requirement.

The next least costly alternative has an annual cost of $17.3 million. Alternative 1 provides for just levee improvements, to allow increasing the objective release from Folsom to 145,000 cfs. Like alternative 1, alternative 5 provides for levee improvements. It also includes lowering the spillway at Folsom, which would cut the objective release required in alternative 1 to 143,000 cfs, a reduction of just 2,000 cfs. However, the cost associated with the spillway work would be significantly greater than the slight reduction in levee costs associated with the 2,000 cfs reduction in objective release. Alternative 5 has an annual cost of $22.2 million.

c. Selection of Final Alternatives. - On the basis of environmental and economic comparisons, 6 of the 27 alternatives were carried forward for more detailed analysis. Three of the six alternatives would provide 100-year (FEMA) protection. The other three would provide 150-year, 200-year, or 400-year protection.

Alternatives for the 100-year (FEMA) level of protection incorporate levee improvements, reoperation of Folsom, or both. Construction of a flood control dam upstream from Folsom was ruled out because of the high costs.

Of the 100-year (FEMA) alternatives based on levee improvements, Folsom reoperation, or both, no single alternative stood out as being both environmentally and economically superior. Each alternative would have some adverse environmental impacts, but the resources affected and the magnitude of the impacts would vary depending on the alternative. Also, cost alone was not a sufficient criterion because it would not account for environmental values related to avoidance of particular impacts.

The 100-year levee improvement alternative (1) was carried forward because it avoids impacts associated with increasing the flood control space in Folsom Reservoir. The modified storage alternative (2) was kept because it is the least costly alternative for the 100-year level of protection. (Selection of this alternative assumed that the mitigation measures contemplated would be adequate.) The levee improvement/modified storage and spillway alternative (6) was carried forward because it would minimize environmental impacts related to increases in Folsom flood control storage and in the downstream channel capacity.

Alternative 7 would provide 150-year protection with levee improvements along the lower American River and reoperation of Folsom. This plan was carried forward because it would provide the highest level of protection possible without development of an upstream flood control dam and thus would avoid environmental impacts to the upper American River canyon.

The 150-year alternatives incorporating an upstream dam have costs generally comparable to alternative 7 costs and would have various environmental impacts, depending on the specific features of each plan. Considering both costs and impacts, avoidance of impacts to the upper canyon was considered a major factor in the screening.

For both the 200- and 400-year levels of protection, alternatives incorporating only a flood control dam at the Auburn site (alternatives 10 and 11) were carried forward. These alternatives are the most cost-effective and least environmentally damaging means of providing these levels of protection. These alternatives avoid impacts associated with lower American River flows or reoperation of Folsom Reservoir.

The other 200- and 400-year alternatives combine an upstream detention dam with either levee improvements along the lower American River, reoperation of Folsom Reservoir, or both. All the combinations are less suitable than the dam-only alternatives based on environmental or economic considerations or both.

Alternatives 14-17 combine the upstream dam with levee improvements. These alternatives would affect environmental resources at two sites instead of one, and they are more costly than just an upstream dam.

Alternatives 20-23 combine the upstream dam with modified flood control storage in Folsom Reservoir. Alternatives 20 and 22 would "transfer" 100,000 acre-feet of Folsom flood control storage to the upstream site. The USBR estimated that this transfer would increase Folsom Reservoir's firm water supply yield by about 1,250 acre-feet a year and hydropower generation of 9 gigawatthours a year. The annual economic benefit would be about $1.3 million (based on values of $300 per acre-foot and 100 mills per kilowatthour). However, the cost of providing additional capacity of 100,000 acre-feet at the upstream site was slightly higher than the benefits associated with the reduction at Folsom. Also, no cost-sharing sponsors were identified to participate in the transfer.

Instead of transferring some Folsom flood control space to the upstream site, alternatives 21 and 23 would increase the space. These alternatives would result in increased environmental impacts along the lower American River, but they would have no significant reduction in impacts in the upper canyon. These alternatives are also more costly than the dam-only plans.

Alternatives combining an upstream dam and lowering the spillway at Folsom were dropped because the cost of the spillway work would be greater than the cost saving of a slightly smaller dam. Alternatives of an upstream dam plus modified storage and spillway at Folsom are similar to the dam/modified storage plans.

The hydraulic efficiency advantages from lowering the spillway are not sufficient to offset the costs or impacts associated with modifying Folsom's flood control space.

Alternatives combining an upstream dam with levee improvements along the lower American River and Folsom reoperation also are less suitable than the dam-only plans based on environmental and economic considerations.

Alternatives 26 and 27 comprise an upstream dam, levee improvements, and modified storage at Folsom. Because more environmental resources would be affected by the combination of changes required, impacts would be significant. Also, the increased costs of doing both Folsom storage modifications and levee improvements make these alternatives among the most costly.

Lowering the spillway at Folsom--either with or without modifying the storage at Folsom--is not effective. The cost of the spillway modification would be greater than any savings associated with storage or levee modifications.

Table B-23 is a summary comparison of the original 27 alternatives. It briefly explains why the alternatives were either retained for further evaluation or dropped from consideration.

19. Alternatives Considered in Detail. - Six action alternatives were carried forward in the plan formulation process. In addition to these six, a no-action alternative is required for comparison. The alternatives are:

- No Action
- 100-Year (FEMA) Levees
- 100-Year (FEMA) Storage
- 100-Year (FEMA) Levees/Storage and Spillway
- 150-Year
- 200-Year
- 400-Year

Each action alternative was formulated to provide a consistent level of flood protection along the lower American River and in Natomas. However, some residual flood problems will remain as a result of existing drainage inadequacies within the various flood plains. Estimated flood plains remaining with implementation of a flood control project are shown on Plate 6 in the Economic Appendix. Resolution of these problems is not a part of this investigation.

Following are brief descriptions of the various plans.

## TABLE B-23

## SUMMARY RESULTS OF SCREENING OF INITIAL ALTERNATIVES [1]

| Alternative | | Level of Protection | Status | Reasons for Retaining, Deleting, or Not Formulating Alternative |
|---|---|---|---|---|
| Major Feature | Folsom/Channel Spillway/Dam [2] | | | |
| **Levee Improvement** | | | | |
| 1 Levee Improvement | 400/145/0/0 | 100-year (FEMA) | Retained | Avoids impacts of Folsom reoperation and upstream facilities |
| **Folsom Reoperation** | | | | |
| 2 Modified Storage | 590/115/0/0 | 100-year (FEMA) | Retained | Least costly of 100-Yr (FEMA) alternatives |
| Modified Spillway | 590/115/0/0 | 100-yr (FEMA)-400-yr | Deleted | Cannot achieve objectives |
| 3 Modified Storage and Spillway | 555/115/15/0 | 100-year (FEMA) | Deleted | Spillway lowering not cost effective for storage reduction |
| **Levee Improvement/Folsom Reoperation** | | | | |
| Levee Improvement/Modified Storage | 530/130/0/0 | 100-year (FEMA) | Deleted | Higher costs and relatively higher impacts compared to other alternatives |
| 5 Levee Improvement/Modified Spillway | 400/143/15/0 | 100-year (FEMA) | Deleted | Spillway lowering not cost effective for channel capacity reduction |
| 6 Levee Improvement/Modified Storage and Spillway | 470/130/15/0 | 100-year (FEMA) | Retained | Moderate impacts related to channel flows and Folsom storage modification |
| 7 Levee Improvement/Modified Storage and Spillway | 650/180/15/0 | 150-year | Retained | Maximum level of protection without upstream storage |
| **Flood Control Dam** | | | | |
| 8 Flood Control Dam | 400/115/0/180 | 100-year (FEMA) | Deleted | High cost alternative to provide this level of protection |
| 9 Flood Control Dam | 400/115/0/430 | 150-year | Deleted | Other alternatives provided similar protection without impacting upper canyon |
| 10 Flood Control Dam | 400/115/0/545 | 200-year | Retained | Alternative with highest N.E.D. |
| 11 Flood Control Dam | 400/115/0/894 | 400-year | Retained | Very cost effective alternative while satisfying non-Federal sponsor's flood projection objective. |
| **Flood Control Dam/Levee Improvements** | | | | |
| 12 Flood Control Dam/Levee Improvement | 400/130/0/170 | 100-year (FEMA) | Deleted | Low cost effectiveness and relatively high environmental impact |
| 13 Flood Control Dam/Levee Improvement | 400/130/0/370 | 150-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| 14 Flood Control Dam/Levee Improvement | 400/130/0/484 | 200-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| 15 Flood Control Dam/Levee Improvement | 400/180/0/328 | 200-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| 16 Flood Control Dam/Levee Improvement | 400/130/0/810 | 400-year | Deleted | Low cost effectiveness and relatively high environmental impact |

| | | | | |
|---|---|---|---|---|
| | | | | non-federal sponsor's flood protection objectives. |
| **Flood Control Dam/Levee Improvements** | | | | |
| 12 Flood Control Dam/Levee Improvement | 400/130/0/170 | 100-year (FEMA) | Deleted | Low cost effectiveness and relatively high environmental impact |
| 13 Flood Control Dam/Levee Improvement | 400/130/0/370 | 150-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| 14 Flood Control Dam/Levee Improvement | 400/130/0/484 | 200-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| 15 Flood Control Dam/Levee Improvement | 400/180/0/328 | 200-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| 16 Flood Control Dam/Levee Improvement | 400/130/0/810 | 400-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| 17 Flood Control Dam/Levee Improvement | 400/180/0/620 | 400-year | Deleted | Low cost effectiveness and relatively high environmental impact |
| **Flood Control Dam/Folsom Reoperation** | | | | |
| 18 Flood Control Dam/Modified Storage | 200/115/0/330 | 100-year (FEMA) | Deleted | Higher cost and no cost sharing sponsor for storage transfer |
| 19 Flood Control Dam/Modified Storage | 200/115/0/580 | 150-year | Deleted | Low cost effectiveness |
| 20 Flood Control Dam/Modified Storage | 300/115/0/598 | 200-year | Deleted | Slightly more costly than alternatives without Folsom space reduction. No cost sharing sponsor for transfer of storage |
| 21 Flood Control Dam/Modified Storage | 650/115/0/485 | 200-year | Deleted | Low cost effectiveness and relatively higher environmental impacts |
| 22 Flood Control Dam/Modified Storage | 300/115/0/998 | 400-year | Deleted | Slightly more costly than alternatives without Folsom space reduction |
| 23 Flood Control Dam/Modified Storage | 650/115/0/778 | 400-year | Deleted | Slightly more costly than alternative without Folsom space reduction |
| Flood Control Dam Modified Spillway | See Reasons | 100-yr (FEMA)-400-yr | Deleted | Similar to flood control dam with slightly higher costs and no reduction in environmental impacts |
| Flood Control Dam Modified Storage and Spillway | See Reasons | 100-yr (FEMA)-400-yr | Deleted | Similar to flood control dam/modified storage, but more costly, and without any reduction in environmental impacts |
| **Flood Control Dam/Levee Improvements/Folsom Reoperation** | | | | |
| 24 Flood Control Dam/Levee Improvement/Modified Storage | 470/130/0/80 | 100-year (FEMA) | Deleted | Low cost effectiveness without environmental benefits |
| 25 Flood Control Dam/Levee Improvement/Modified Storage | 470/130/0/350 | 150-year | Deleted | Low cost effectiveness without environmental benefits |
| 26 Flood Control Dam/Levee Improvement/Modified Storage | 550/130/0/440 | 200-year | Deleted | Low cost effectiveness without environmental benefits |
| 27 Flood Control Dam/Levee Improvement/Modified Storage | 550/130/0/720 | 400-year | Deleted | Low cost effectiveness without environmental benefits |
| Flood Control Dam/Levee Improvement/Modified Spillway | See Reasons | 100-yr (FEMA)-400-yr | Deleted | Low cost effectiveness without environmental benefits |

| | | | | |
|---|---|---|---|---|
| Storage | | | | environmental impacts |
| 22 Flood Control Dam/Modified Storage | 300/115/0/998 | 400-year | Deleted | Slightly more costly than alternatives without Folsom space reduction |
| 23 Flood Control Dam/Modified Storage | 650/115/0/778 | 400-year | Deleted | Slightly more costly than alternative without Folsom space reduction |
| Flood Control Dam Modified Spillway | See Reasons | 100-yr (FEMA)-400-yr | Deleted | Similar to flood control dam with slightly higher costs and no reduction in environmental impacts |
| Flood Control Dam Modified Storage and Spillway | See Reasons | 100-yr (FEMA)-400-yr | Deleted | Similar to flood control dam/modified storage, but more costly, and without any reduction in environmental impacts |
| **Flood Control Dam/Levee Improvements/Folsom Reoperation** | | | | |
| 24 Flood Control Dam/Levee Improvement/Modified Storage | 470/130/0/80 | 100-year (FEMA) | Deleted | Low cost effectiveness without environmental benefits |
| 25 Flood Control Dam/Levee Improvement/Modified Storage | 470/130/0/350 | 150-year | Deleted | Low cost effectiveness without environmental benefits |
| 26 Flood Control Dam/Levee Improvement/Modified Storage | 550/130/0/440 | 200-year | Deleted | Low cost effectiveness without environmental benefits |
| 27 Flood Control Dam/Levee Improvement/Modified Storage | 550/130/0/720 | 400-year | Deleted | Low cost effectiveness without environmental benefits |
| Flood Control Dam/Levee Improvement/Modified Spillway | See Reasons | 100-yr (FEMA)-400-yr | Deleted | Low cost effectiveness without environmental benefits |
| Flood Control Dam/Levee Improvement/Modified Storage and Spillway | See Reasons | 100-yr (FEMA)-400-yr | Deleted | Low cost effectiveness without environmental benefits |

1/ All alternatives include levee, channel, and related construction in Natomas.
2/ Folsom flood control storage space (1,000 acre-feet)/objective release (1,000 cfs)/Folsom spillway lowering (feet), and flood control dam detention capacity (1,000 acre-feet).

a. No Action. - Under this alternative, the Federal Government would take no action toward implementing a specific flood control plan. Any future developments (or major expansion of existing developments) would have to be flood proofed to the 100-year (FEMA) level. It was assumed that urban growth along the main stem American River would continue generally as described in current local plans. For Natomas, the City and County of Sacramento and Sutter County would also require developers to flood proof future developments. However, because the flood depths would be so great, this requirement would severely limit future growth in that area.

Future population trends, land use, and other conditions previously described would occur. Major flooding also would be expected. The average annual equivalent flood damages are expected to reach about $191 million in the study area. Significant environment related impacts could be expected from this major flooding. These include impacts associated with (1) developing natural resources required for reconstruction, (2) flooding of hazardous and toxic waste sites, (3) disposal of debris generated by a flood and its related damages, (4) the American River Parkway, and (5) socioeconomic factors such as increased flooding risk and economic disruption. In addition, other water resource needs and opportunities would go unmet.

b. Recreation Features. - Each action alternative includes a recreation element. The Federal Water Project Recreation Act of 1965 provides for recreation to be considered as a full project purpose at Federal water resources projects, provided a non-Federal sponsor participates in the study and construction of recreation facilities and assumes all operation and maintenance responsibilities of the completed project. The development of recreation facilities would be restricted to project lands, with additional lands purchased if required for access, parking, or provision of sanitary or other health and safety facilities.

Many State and local agencies with potential for participating in recreation development as part of this investigation expressed interest in the recreation features of the study. However, only the Sacramento County Department of Parks and Recreation and the City of Sacramento Department of Parks and Community Services indicated a willingness to cost share in the development and construction of recreation facilities. No interest was expressed at this time for addressing recreation development in the upper American River canyon.

The City, County, and Corps identified several potential areas of recreation development, including (1) hiking, bike, and equestrian trails along the NEMDC with connectors along Dry and Arcade Creeks, (2) trail development along the Sacramento River levees (Garden Highway and Pocket areas), and (3) development of intensive public day-use areas in Natomas with river access sites

and passive-use wildlife habitat enhancement areas near the mouth of the NEMDC. The trail development is included in the project alternatives. Because Natomas flood control measures do not include work on the existing Sacramento River levees, the Garden Highway and Pocket area trails were not considered in this study. Similarly, day-use facilities have not been included because of restrictions requiring that any such facilities must be developed on project lands.

Recreation measures included in all the action alternatives are:

- Construct paved pedestrian/bike trails and parallel equestrian trails along portions of the NEMDC and Dry and Arcade Creeks, with necessary access facilities.

- For safety, reroute 1.1 miles of existing bike trail to avoid a surface crossing of Del Paso Blvd.

These recreation developments are expected to provide about 335,000 user days annually.

c. 100-Year (FEMA) Levees. - This alternative would allow much of the area along the main stem American River and in Natomas to be removed from the 100-year (FEMA) flood plain designation. The primary flood control features are levee and channel work along the lower American River and in Natomas. Plate 8 is a general layout of the alternative. The plan includes the measures outlined below.

(1) Main Stem American River. - Levee and channel modifications necessary to increase the objective release from Folsom Dam from 115,000 to 145,000 cfs include:

Slurry Wall: 0.9 miles
Toe Drain: 2.7 miles

- New Levee: 1 mile
- Levee Raising: 2.7 miles
- Riprap on Bank: 1.5 miles
- Riprap on Levees: 5.3 miles
- Riprap on Levees and Bank: 3.2 miles

(2) Downstream from American River. - The increased objective release and certain levee and selected construction in Natomas would require the following in the Yolo Bypass area:

- Sacramento Bypass: Widen the bypass about 1,400 feet by realigning the north 1.8-mile-long levee to a height of 26 feet.

- Sacramento Weir: Lengthen the weir about 1,400 feet and the nearby highway and railroad bridges.

(3) Natomas. - Table B-24 shows the flood control work required in Natomas. Recreation features have previously been outlined in an earlier section.

(4) Impacts and Mitigation. - Likely major adverse impacts and potential mitigation features are shown in Table B-25.

d. 100-Year (FEMA) Storage. - This alternative would increase the seasonal flood control storage space in Folsom Reservoir to 590,000 acre-feet and require levee and related modifications downstream from the American River and in Natomas. Plate 9 is a general layout of the plan.

(1) Downstream from American River. - There are no modifications required downstream from the American River in this plan.

(2) Natomas. - Table B-26 shows Natomas flood control features. Recreation has been previously described.

(3) Impacts and Mitigation. - Potential impacts and mitigation features are shown in Table B-27.

e. 100-year (FEMA) Levees/Storage and Spillway. - Primary features include (1) increasing the seasonal flood control space in Folsom Reservoir, (2) constructing levee and related modifications downstream from Folsom Dam to allow increased objective releases, and (3) constructing levee and related improvements in Natomas. Plate 12 is a general layout of the plan.

(1) Main Stem American River. - The primary feature is increasing Folsom Reservoir storage space from 400,000 to 470,000 acre-feet. The spillway at Folsom Dam would be lowered by 15 feet, requiring installation of five new tainter gates 42 feet wide by 65 feet high and lengthening the stilling basin 50 feet. The objective release from Folsom Dam would be increased from 115,000 to 130,000 cfs, and levee and related features would be constructed along the lower American River to accommodate the higher flow. Major channel construction features include:

- Slurry Wall: 0.7 mile
- Toe Drain: 0.6 mile
- New Levee: 0.9 mile
- Riprap on Bank: 1.5 miles
- Riprap on Levees: 5.3 miles
- Riprap on Levees and Bank: 3.2 miles

TABLE B-24

NATOMAS FEATURES FOR 100-YEAR (FEMA) LEVEE ALTERNATIVE

| FEATURE | LOCATION | LENGTH | HEIGHT | RELOCATION/OTHER |
|---|---|---|---|---|
| **NEMDC:** | | | | |
| East Levee | •American R.to Arcade Creek | 1 mi. | 1.9 ft. | El Camino Ave. Bridge Norwood Ave. Bridge |
| | •Arcade to Dry Cr. | 2.6 mi. | 2.7 ft. | Union Pacific RR |
| West Levee | •El Camino Rd. to Main Ave. | 3.1 mi. | 3.5 ft. | Main Ave. Bridge |
| | •Main Ave. to NEMDC Pump Station | 0.7 mi. | 1 ft. | Levee Road |
| | •Riego Rd. to Sankey Rd. | 0.6 mi. | 1.1 ft. | Levee Rd./Ramp Sankey Rd. |
| Channel | •Riego Rd. to Sankey Rd. | 10,600 ft. | 80 ft. wide | |
| NEMDC Gated/Pump Structure | •NEMDC upstream from Dry Cr. | - | - | 700 cfs pump station |
| **ARCADE CREEK:** | | | | |
| North Levee | •Raise various locations | 1.8 mi. | 4.1 ft. | Norwood Ave. Bridge/1,000 ft. of fence |
| South Levee | •Raise various locations | 0.6 mi. | 2.4 ft. | 1,300 ft. of fence/600 ft. of powerline |
| **DRY CREEK:** | | | | - |
| North Levee | •Raise various locations | - | - | RR Floodgates at Sankey Rd. Ramp Ascott Ave./200 ft. of fence |
| | •New levee | 0.9 mi. | 9.2 ft. | |
| South Levee | •Raise various locations | 0.5 mi. | 1.4 ft. | - |
| | •Extend levee | 0.4 mi. | 4.8 ft. | - |
| **PLEASANT GROVE CREEK CANAL LEVEES:** | •Raise various locations | 0.1 mi. | 1.7 ft. | Levee Rd./Ramp Howsley Rd./1,000 ft. power and telephone line |
| **NATOMAS CROSS CANAL LEVEES:** | •Raise various locations | 3.3 mi. | 1.2 ft. | - |
| **NORTH NATOMAS DETENTION BASIN** | •Northeast Corner of Natomas adjacent to Pleasant Grove Creek Canal | 300 acres with 3,000 acre-foot capacity | - | - |

## TABLE B-25

## 100-YEAR (FEMA) LEVEE ALTERNATIVE - IMPACTS AND MITIGATION SUMMARY 1/

| Item | Impact | Mitigation |
|---|---|---|
| **American River** | | |
| Decreased wildlife habitat along lower American River Parkway 2/ | 462 acres | Riparian planting on 979 acres and monitoring program |
| Loss of cultural resources due to levee construction activities | 3/ | Data recovery and preservation |
| Anadromous fisheries and spawning habitat impacts due to bank stabilization work | Loss of spawning habitat | Limited construction to non-spawning times of year of anadromous fish where affected 4/ |
| **Natomas** | | |
| Loss of wildlife habitat primarily along NEMDC (levee reconstruction) | 290 acres | Acquisition and management of 280 acres on a mitigation site in Natomas |
| Loss of wildlife habitat along recreation trail | 25 acres | Tree planting along recreation trail |
| Loss of cultural resources in levee construction area | 3/ | Data recovery and preservation |
| Growth inducing impacts in flood plain | 7913 acres 5/ | Non-Federal sponsor implements a long-term mitigation program |
| Adverse anadromous fish impacts in NEMDC from construction and operation activities | | Limit construction to non-spawning times of year of anadromous fish where affected, install fish screens on the pump |

1/ Reference EIS/EIR for more detail.
2/ Includes loss of valley elderberry shrubs.
3/ Number of sites will be determined during advanced engineering and design studies.
4/ No mitigation measures identified for loss of spawning. See mitigation discussion in EIS for reoperation impact mitigation measures. Significant additional analysis required to determine viability of mitigation to effectively offset impact.
5/ Impacts influence a wide variety of resources, primarily in Natomas. See EIS for more information.

**TABLE B-26**

**NATOMAS FEATURES FOR 100-YEAR (FEMA) STORAGE ALTERNATIVE**

| FEATURE | LOCATION | LENGTH | HEIGHT | RELOCATION/OTHER |
|---|---|---|---|---|
| **NEMDC:** | | | | |
| East Levee | •American R. to Arcade Creek | - | - | - |
| | •Arcade to Dry Cr. | 1.3 mi. | 1.0 ft. | - |
| West Levee | •El Camino Rd. to Main St. | 2.5 mi. | 2.0 ft. | Main Ave. Bridge |
| | •Main St. to NEMDC Pump Station | - | - | - |
| | •Riego Rd. to Sankey Rd. | 0.6 mi. | 1.1 ft. | Levee Rd./Ramp Sankey Rd. |
| Channel | •Riego Rd. to Sankey Rd. | 10,600 ft. | 50 ft. wide | - |
| NEMDC Gated/Pump Structure | •NEMDC upstream from Dry Cr. | - | - | 700 cfs pump station |
| **ARCADE CREEK:** | | | | |
| North Levee | •Raise various locations | 0.4 mi. | 3.1 ft. | 1,000 ft. of fence |
| South Levee | •Raise various locations | 0.2 mi. | 1.3 ft. | 1,300 ft. of fence/ 600 ft. powerline |
| **DRY CREEK:** | | | | |
| North Levee | •Raise various locations | - | - | RR Floodgates |
| | •New levee | 0.9 mi. | 8.1 ft. | Ramp Ascott/ 200 ft. of fence |
| South Levee | •Raise various locations | 0.1 mi. | 0.5 ft. | - |
| | •Extend levee | 0.3 mi. | 3.1 ft. | - |
| **PLEASANT GROVE CREEK CANAL LEVEES:** | •Raise various locations | 0.1 mi. | 1.6 ft. | Levee Rd./Ramp Howsley/1,000 ft. powerline & telephone |
| **NATOMAS CROSS CANAL LEVEES:** | •Raise various locations | 3.3 mi. | 1.1 ft. | - |
| NORTH NATOMAS DETENTION BASIN | •Northeast corner of Natomas adjacent to Pleasant Grove Creek canal | 300 acres with 3,000 acre-foot capacity | | - |

## TABLE B-27

## 100-YEAR (FEMA) STORAGE ALTERNATIVE IMPACTS AND MITIGATION SUMMARY 1/

| Item | Impact | Mitigation |
|---|---|---|
| **American River** | | |
| Reduced water supply yield of CVP | 20,000 ac-ft/yr ($6 mil/year) | Reimburse for water supply loss |
| Reduced hydropower generation to CVP | 24 GWh/year ($7.4 million/ year) | Reimburse for power supply loss |
| Reduced dependable capacity | 3 to 5 megawatts | Reimburse for power supply loss |
| Increased pumping to SJSWD and EID | $42,300 per year | Reimburse for water supply loss |
| Increased exposure of historic and pre-historic sites at Folsom Reservoir | 47 + sites | Data recovery and preservation |
| Reduced recreation use at Folsom and along lower American River | 292,000 use days | - |
| Decreased riparian and related vegetation along lower American River (lower spring flows) | 143 acres | 303 acres riparian planting and maintenance program |
| Impacts to fish resources due to the reoperation of Folsom Reservoir | 19% loss | See EIS Mitigation Discussion |
| **Natomas** | | |
| Loss of wildlife habitat due to levee construction, bridge replacement, and other construction activities | 290 acres | Habitat replacement on 280 acres at mitigation site in Natomas |
| Loss of wildlife habitat along recreation trail | 25 acres | Tree planting along recreation trail |
| Loss of cultural resources in levee construction area | 2/ | Data recovery and preservation |
| Growth inducing impacts in flood plain | 7,913 acres 3/ | Non-Federal sponsor implements a long-term mitigation program |
| Adverse anadromous fish impacts in NEMDC from construction and operation activities | - | Limit construction to non-spawning times of year of anadromous fish where affected, install fish screens on the pump |

1/ Reference EIS/EIR for more detail.
2/ Number of sites will be determined during future planning studies.
3/ Impacts influence a wide variety of resources, primarily in Natomas. See EIS for more information.

(2) Downstream from American River. - Requirements downstream from the American River are:

- Sacramento Bypass: Widen bypass about 500 feet by reconstructing 1.8 miles of the north levee to a height of 26.0 feet.

- Sacramento Weir: Lengthen the weir about 500 feet and nearby highway and railroad bridges.

(3) Natomas. - Table B-28 shows Natomas flood control features. Recreation has been previously discussed.

(4) Impacts and Mitigation. - Likely major adverse impacts and potential mitigation features are shown in Table B-29.

f. 150-Year Protection. - This alternative includes levee improvements along the lower American River and in Natomas, an increase in the flood control storage space in Folsom Reservoir, and lowering the spillway at Folsom Dam. Plate 13 is a general layout of the plan.

(1) Main Stem American River. - Primary features along the lower American River consist of (1) increasing the flood control storage space in Folsom Reservoir from 400,000 to 650,000 acre-feet, (2) increasing the objective release to the lower American River from 115,000 to 180,000 cfs, (3) lowering the spillway at Folsom Dam by 15 feet, and (4) modifying levees and channels downstream from Folsom Dam to safely pass the increased flows.

Figure 3 shows typical examples of levee and bank protection methods. Requirements along the lower American River include:

- Slurry Wall: 4.1 miles
- Toe Drain: 7.8 miles
- New Levee: 1 mile
- Levee Raising: 11.4 miles
- Riprap on Bank: 1.5 miles
- Riprap on Levees: 5.3 miles
- Riprap on Levees and Bank: 3.2 miles

(2) Downstream from American River. - The following measures are required downstream from the American River:

- Sacramento Bypass: Widen the bypass about 3,600 feet by reconstructing 1.8 miles of the north levee to a height of 26 feet.

- Sacramento Weir: Lengthen the weir about 3,600 feet and nearby highway and railroad bridges.

TABLE B-28

NATOMAS FEATURES FOR 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

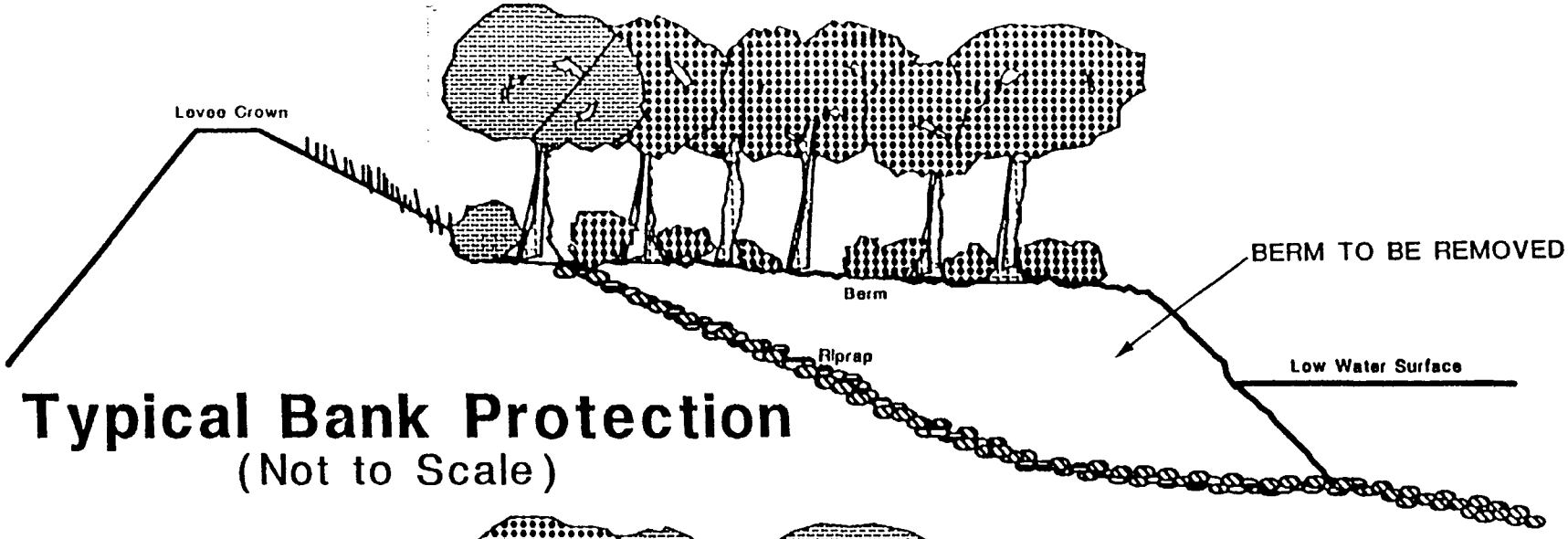
| FEATURE | LOCATION | LENGTH | HEIGHT | RELOCATION/OTHER |
|---|---|---|---|---|
| **NEMDC:** | | | | |
| East Levee | •American R. to Arcade Creek<br>•Arcade to Dry Cr. | -<br>2.5 mi. | -<br>1.9 mi. | -<br>- |
| West Levee | •El Camino Rd. to Main St.<br>•Main St. to NEMDC pump station<br>•Riego Rd. to Sankey Rd. | 3.0 mi.<br>-<br>0.6 mi. | 2.7 ft.<br>-<br>1.1 ft. | Main Ave. Bridge<br>-<br>Levee Rd./Ramp Sankey Rd. |
| Channel | •Riego Rd. to Sankey Rd. | 10,600 ft. | 50 ft. wide | - |
| NEMDC Gated/Pump Structure | •NEMDC upstream from Dry Cr. | - | - | 700 cfs pump station |
| **ARCADE CREEK:** | | | | |
| North Levee | •Raise various locations | 1.7 mi. | 3.9 ft. | 1,000 ft. of fence |
| South Levee | •Raise various locations | 0.5 mi. | 2.1 ft. | 1,300 ft. of fence/ 600 ft. of powerline |
| **DRY CREEK:** | | | | |
| North Levee | •Raise various locations<br>•New levee | -<br>0.9 mi. | -<br>8.5 ft. | Ramp Ascott Ave./ 200 ft. of fence<br>RR Floodgates |
| South Levee | •Raise various locations<br>•Extend levee | 0.3 mi.<br>0.4 mi. | 0.9 ft.<br>3.5 ft. | -<br>- |
| **PLEASANT GROVE CREEK CANAL LEVEES:** | •Raise various locations | 0.1 mi. | 1.6 ft. | Levee Rd./Ramp Howsley Rd./1,000 ft. power and telephone line |
| **NATOMAS CROSS CANAL** | •Raise various locations | 3.3 mi. | 1.1 ft. | - |
| North Natomas Detention Basin | •Northeast corner of Natomas adjacent to Pleasant Grove Creek Canal | 300 acres with 3,000 acre-foot capacity | | - |

## TABLE B-29

## 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE IMPACTS AND MITIGATION SUMMARY 1/

| Item | Impact | Mitigation |
|---|---|---|
| **American River** | | |
| Reduced water supply yield of CVP | 8,000 ac-ft/yr ($2.4 mil/yr) | Reimburse for water supply loss |
| Reduced hydropower generation to CVP | 8 GWh/yr ($0.8 mil/yr) | Reimburse for power supply loss |
| Reduced dependable capacity | 3 to 5 megawatts | Reimburse for power supply loss |
| Increased pumping to SJSWD and EID | $42,300 per year | Reimburse for water supply loss |
| Increased exposure of historic and pre-historic sites at Folsom Reservoir and due to levee construction activities | 47 + sites 2/ | Data recovery and preservation |
| Reduced recreation use at Folsom and along lower American River | 2/ | - |
| Decreased wildlife habitat along lower American River Parkway (levee construction) 3/ | Less than 454 acres | Riparian planting on approximately 1,200 acres and monitoring program on lands to be identified should this alternative be selected |
| Anadromous fisheries and spawning habitat impacts due to bank stabilization work | Loss of spawning habitat | Limit construction to non-spawning time of year of anadromous fish where affected 3/ |
| Fishery losses due to change in temperature and seasonal flows resulting from Folsom reoperation | 17% reduction in fish resources | 4/ |
| **Natomas** | | |
| Loss of wildlife habitat primarily along NEMDC (levee construction) | 290 acres | Habitat replacement on 280 acres at a mitigation site in Natomas |
| Loss of wildlife habitat along recreation trail | 25 acres | Tree planting along recreation trail |
| Loss of cultural resources in levee construction area | 2/ | Data recovery and preservation |
| Growth inducing impacts in flood plain | 7,913 acres 3/ | Non-Federal sponsor implements a long-term mitigation program |
| Adverse anadromous fish impacts in NEMDC from construction and operation | - | Limit construction to non-spawning times of year anadromous fish where affected, install fish screens on the pump |

1/ Reference EIS/EIR for more detail.
2/ Number of sites to be determined in future studies.
3/ Includes loss of valley elderberry shrubs.
4/ No mitigation measures identified for loss of spawning. See mitigation discussion in EIS for reoperation impact mitigation measures. Significant additional analysis required to determine viability of mitigation to effectively offset impacts.
5/ Impacts influence a wide variety of resources, primarily in Natomas. See EIS for more information.



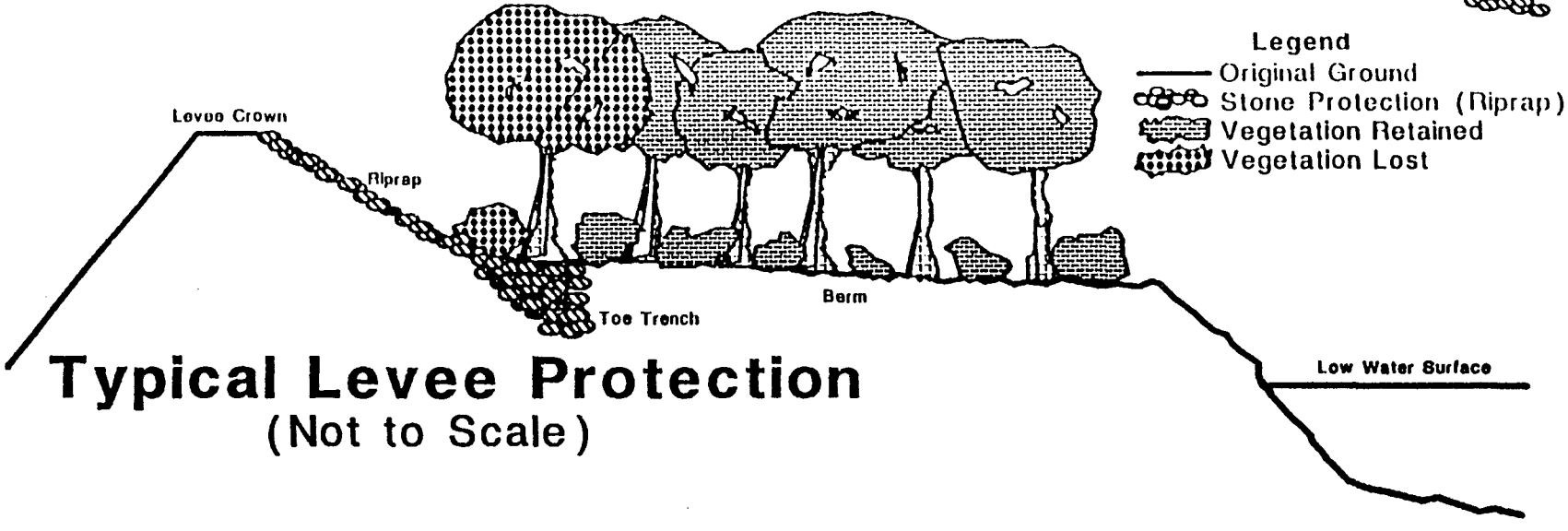




Figure 3 Typical Examples of Bank and Levee Protection Considered in Alternatives Requiring Flow Increases in Lower American River

(3) Natomas. - Natomas flood control features are shown in Table B-30. Recreation has been discussed previously.

(4) Impacts and Mitigation. - Potential mitigation features are shown in Table B-31.

g. 200-Year Protection. - Major elements of this alternative include a flood control dam upstream from Folsom Reservoir, weir and levee improvements downstream from the American River, and levee and channel modifications in Natomas. Plate 14 is a general layout of the alternative.

(1) Main Stem American River. -

- Construct a roller-compacted concrete dam 425 feet high on the North Fork American River at RM 20.1.
- Create a detention reservoir to accommodate a peak storage of 545,000 acre-feet.
- Relocate Highway 49 and Ponderosa Way.

(2) Downstream from American River. - No modifications are needed downstream of the American River.

(3) Natomas. - Flood control features for Natomas are shown in Table B-32. Recreation features have been previously described.

(4) Impacts and Mitigation. - Potential impacts and mitigation features are shown in Table B-33.

h. 400-Year Protection. - The alternative providing 400-year protection has the same elements as the 200-year plan, but some of the facilities would be larger. Plate 13 is a general layout of the 400-year alternative.

(1) Main Stem American River. -

- Construct a roller-compacted concrete dam 498 feet high on the North Fork American River at RM 20.1.
- Create a detention reservoir to accommodate a peak storage of 894,000 acre-feet.
- Relocate Highway 49 and Ponderosa Way.

(2) Downstream from American River. - No modifications are required downstream from the American River.

**TABLE B-30**

**NATOMAS FEATURES FOR 150-YEAR ALTERNATIVE**

| FEATURE | LOCATION | LENGTH | HEIGHT | RELOCATION/OTHER |
|---|---|---|---|---|
| **NEMDC:** | | | | |
| East Levee | •American R. to Arcade Creek<br>•Arcade to Dry Cr. | 1.1 mi.<br>2.6 mi. | 1.9 ft.<br>3.4 ft. | El Camino Ave. Bridge<br>Union Pacific RR. |
| West Levee | •El Camino Rd. to Main St.<br>•Main St. to NEMDC Pump station<br>•Riego Rd. to Sankey Rd. | 3.2 mi.<br>0.7 mi.<br>0.6 mi. | 4.2 ft.<br>1.0 ft.<br>1.1 ft. | Main Ave. Bridge<br>Levee Rd.<br>Levee Rd./Ramp Sankey Rd. |
| Channel | •Riego Rd. to Sankey Rd. | 10,600 ft. | 80 ft. wide | - |
| NEMDC Gated/Pump Structure | •NEMDC upstream from Dry Cr. | - | - | 700 cfs pump station |
| **ARCADE CREEK:** | | | | |
| North Levee | •Raise various locations | 1.9 mi. | 4.3 ft. | 1,000 ft. of fence/Norwood Avenue Bridge |
| South Levee | •Raise various locations | 0.7 mi. | 2.6 ft. | 1,300 ft. of fence/600 ft. powerline |
| **DRY CREEK:** | | | | |
| North Levee | •Raise various locations<br>•New levee | -<br>0.9 mi. | -<br>9.9 ft. | Ramp Ascott/200 ft. of fence<br>RR Floodgates |
| South Levee | •Raise various locations<br>•Extend levee | 0.6 mi.<br>0.4 mi. | 1.9 ft.<br>6.0 ft. | -<br>- |
| **PLEASANT GROVE CREEK CANAL LEVEES:** | •Raise various locations | 0.1 mi. | 1.7 ft. | Levee Rd./ Ramp Howsley/1,000 ft. powerline & telephone |
| **NATOMAS CROSS CANAL LEVEES:** | •Raise various locations | 3.3 mi. | 1.3 ft. | - |
| North Natomas Detention Basin | •Northeast corner of Natomas adjacent to Pleasant Grove Creek Canal | 300 acres with 3,000 acre-foot capacity | | - |

## TABLE B-31

## 150-YEAR ALTERNATIVE - IMPACTS AND MITIGATION SUMMARY 1/

| Item | Impact | Mitigation |
|---|---|---|
| **American River** | | |
| Reduced water supply yield of CVP | 33,000 ac-ft/yr ($9.9 mil/yr) | Reimburse for water supply loss |
| Reduced hydropower to CVP | 41 GWh/yr ($3.5 mil/yr) | Reimburse for power supply loss |
| Reduced dependable capacity | 6 megawatts | Reimburse for power supply |
| Increased pumping supply to SJSWD and EID | $62,500 per year | Reimburse for water supply loss |
| Increased exposure of historic and pre-historic sites at Folsom Reservoir and due to levee construction activities | 60 + sites 2/ | Data recovery and preservation |
| Reduced recreation use at Folsom and along lower American River | 411,000 use days | - |
| Decreased riparian and related vegetation along lower American River (lower spring flows) 3/ | 679 acres | Riparian planting on 450 acres and maintenance program |
| Anadromous fisheries and spawning habitat impacts due to bank stabilization work | Loss of spawning habitat | Limit construction to non-spawning times of year of anadromous fish where affected 4/ |
| Fishery losses due to changes in temperature and seasonal flows resulting from Folsom reoperation | 21% reduction in fish resources | 4/ |
| **Natomas** | | |
| Loss of wildlife habitat primarily along NEMDC (levee construction) | 290 acres | Acquisition and management of 280 acres in Natomas |
| Loss of wildlife habitat along recreation trail | 25 acres | Tree planting along recreation trail |
| Loss of cultural resources in levee construction area | 2/ | Data recovery and preservation |
| Growth-inducing impacts in flood plain | 7,913 acres 5/ | Non-Federal sponsor implements a long- term mitigation program |
| Adverse fish impacts in NEMDC from the construction and operation activities | | Limit construction to non-spawning times of year of anadromous fish where affected, install fish screens on the pump |

1/ Reference EIS/EIR for more detail.
2/ Number of sites affected will be determined during future studies.
3/ Includes loss of valley elderberry shrubs.
4/ No mitigation measures identified for loss of spawning. See mitigation discussion in EIS for reoperation impact mitigation measures. Significant additional analysis required to determine viability of mitigation to effectively offset impact.
5/ Impacts influence a wide variety of resources, primarily in Natomas. See EIS for more information.

TABLE B-32

NATOMAS FEATURES FOR 200-YEAR ALTERNATIVE

| FEATURE | LOCATION | LENGTH | MAXIMUM HEIGHT | RELOCATION/OTHER |
|---|---|---|---|---|
| **NEMDC:** | | | | |
| East Levee | •American R. to Arcade Creek<br>•Arcade to Dry Cr. | -<br>1.4 mi. | -<br>1.0 ft. | -<br>- |
| West Levee | •El Camino Ave. to Main Ave.<br>•Main Ave. to NEMDC Pump Station<br>•Riego Rd. to Sankey Rd. | 2.6 mi.<br>-<br>0.6 mi. | 2.0 ft.<br>-<br>1.1 ft. | Main Ave. Bridge<br>-<br>Levee Rd./Ramp Sankey Rd. |
| Channel | •Riego Rd. to Sankey Rd. | 10,600 ft. | 100 ft. wide | |
| NEMDC Gated/Pump Structure | •NEMDC upstream from Dry Cr. | - | - | 700 cfs pump station |
| **ARCADE CREEK:** | | | | |
| North Levee | •Raise various locations | 0.5 mi. | 3.1 ft. | 1,000 ft. of fence |
| South Levee | •Raise various locations | 0.2 mi. | 1.3 ft. | 1,300 ft. of fence/ 600 ft. of powerline |
| **DRY CREEK:** | | | | |
| New North Levee | •Raise various locations | 0.9 mi. | 8.3 ft. | Ramp Ascott Ave./ 200 ft. of fence RR Floodgates |
| South Levee | •Raise various locations<br>•Extend levee | 0.2 mi.<br>0.5 mi. | 0.7 ft.<br>4.8 ft. | -<br>- |
| **PLEASANT GROVE CREEK CANAL LEVEES:** | •Raise various locations | 0.1 mi. | 1.8 ft. | Levee Rd./Ramp Howsley Rd./1,000 ft. power and telephone line |
| **NATOMAS CROSS CANAL LEVEES:** | •Raise various locations | 3.3 mi. | 1.6 ft. | |
| North Natomas Detention Basin | •Northeast corner of Natomas adjacent to Pleasant Grove Creek Canal | 300 acres with 3,000 acre-foot capacity | | - |

## TABLE B-33

## 200-YEAR PLAN - IMPACTS AND MITIGATION SUMMARY 1/

| Item | Impact | Mitigation |
|---|---|---|
| **American River** | | |
| Direct impacts from Highway 49 and Ponderosa bridge replacements, dam construction, aggregate transportation and processing, and periodic inundation impacts 2/ | Losses of oak forest/woodland, coniferous forest chaparral, and riverine habitat (1,927 acres) | Acquire and manage about 5,385 acres (2,685 acres for general vegetation and wildlife; 2,700 acres for endangered species) of private lands along South Fork American River. Implement adaptive management plan for the detention dam area 3/ |
| Increased exposure of historic pre-historic and paleontological sites in the detention area including Cool Quarry | 4/ | Data recovery and preservation |
| **Natomas** | | |
| Loss of wildlife habitat due to levee construction, bridge replacement and other construction activities | 290 acres | Habitat replacement on 280 acres in Natomas area |
| Loss of wildlife habitat along recreation trail | 25 acres | Tree planting along recreation trail. |
| Loss of cultural resources due to levee construction | 4/ | Data recovery and preservation |
| Growth-inducing impacts in flood plain | 7,913 acres 5/ | Non-Federal sponsor implements a long-term mitigation program |
| Adverse anadromous fish impacts in NEMDC from construction and operation activities | - | Limit constructicn to non-spawning times of year of anadromous fish where affected, install fish screens on the pump |

1/ Reference EIS/EIR for more detail.
2/ Includes impacts to valley elderberry shrubs.
3/ Mitigation for impacts to the valley elderberry beetle will include planting valley elderberry shrubs on additional lands to be acquired along the South Fork American River.
4/ Number of sites affected will be determined during future studies.
5/ Impacts influence a wide variety of resources, primarily in Natomas. See EIS for more information.

(3) Natomas. - Flood control features for Natomas are shown in Table B-34. Recreation features have been previously described.

(4) Impacts and Mitigation. - Potential impacts and mitigation features are shown in Table B-35.

20. Summary Display. - Table B-36, compares preliminary estimates of costs and benefits of the seven alternatives. It also includes a summary description of likely advantages and disadvantages of each plan. Of special importance is the potential for non-Federal participation in construction costs. The plans providing 200 year or greater flood protection are superior to plans providing lower levels of protection because the lower levels of protection leave much of the community at significant flood risk, are less economically feasible, and do not have a potential non-Federal sponsor.

TABLE B-34

NATOMAS FEATURES FOR 400-YEAR ALTERNATIVE

| FEATURE | LOCATION | LENGTH | MAXIMUM HEIGHT | RELOCATION/OTHER |
|---|---|---|---|---|
| **NEMDC:** | | | | |
| East Levee | •American R. to Arcade Creek<br>•Arcade to Dry Cr. | -<br>1.4 mi. | -<br>1.8 ft. | -<br>- |
| West Levee | •El Camino Rd. to Main Ave.<br>•Main Ave. to NEMDC Pump Station<br>•Riego Rd. to Sankey Rd. | 2.6 mi.<br>-<br>0.6 mi. | 2.8 ft.<br>-<br>1.1 ft. | Main Ave. Bridge<br>-<br>Levee Rd./Ramp Sankey Rd. |
| Channel | •Riego Rd. to Sankey Rd. | 10,600 ft. | 150 ft. wide | |
| NEMDC Gated/Pump Structure | •NEMDC upstream from Dry Cr. | - | - | 700 cfs pump station |
| **ARCADE CREEK:** | | | | |
| North Levee | •Various locations | 0.5 mi. | 3.3 ft. | 1,000 ft. of fence |
| South Levee | •Various locations | 0.2 mi. | 1.5 ft. | 1,300 ft. of fence/600 ft. powerline |
| **DRY CREEK:** | | | | |
| New North Levee | •Various locations | 0.9 mi. | 8.5 ft. | Ramp Ascott /200 ft. of fence railroad floodgates |
| South Levee | •Raise various locations<br>•Extend levee | 0.2 mi.<br>0.5 mi. | 0.9 ft.<br>5.0 ft. | -<br>- |
| **PLEASANT GROVE CREEK CANAL LEVEES:** | •Various locations | 0.1 mi. | 2.0 ft. | Levee Rd./ Ramp Howsley/1,000 ft. powerline & telephone |
| **NATOMAS CROSS CANAL LEVEES:** | •Various locations | 3.3 mi. | 1.8 ft. | - |
| North Natoms Detention Basin | •Northeast corner of Natomas adjacent to Pleasant Grove Creek Canal | 300 acres with 3,000 acre-foot capacity | | - |

## TABLE B-35

## 400-YEAR ALTERNATIVE - IMPACTS AND MITIGATION SUMMARY 1/

| Item | Impact | Mitigation |
|---|---|---|
| **American River** | | |
| Direct impacts from Highway 49 and Ponderosa bridge replacements, dam construction, aggregate transportation and processing, and periodic inundation impacts 2/ | Loss of oak forest/woodland, coniferous forest chapparral, and riverine habitat (954 acres) | Acquire and manage about 4,030 acres (1,330 acres for general vegetation and wildlife; 2,700 acres for endangered species) of private lands along South Fork American River. Implement adaptive management plan for the detention dam area 3/ |
| Increased exposure of historic, pre-historic and paleontological sites in the detention area | 4/ | Data recovery and preservation |
| **Natomas** | | |
| Loss of wildlife habitat due to levee construction bridge replacements and other construction activities | 290 acres | Acquisition and management of 280 acres in Natomas area |
| Loss of wildlife habitat along recreation trail | 25 acres | Tree planting along recreation trail |
| Loss of cultural resources in levee construction area | 4/ | Data recovery and preservation |
| Growth-inducing impacts in flood plain | 7,931 acres 5/ | Non-Federal sponsor implements a long-term mitigation program |
| Adverse anadromous fish impacts in NEMDC from construction and operation activities | - | Limit construction to non-spawning times of year of anadromous fish where affected, install fish seasons |

1/ Reference EIS/EIR for more detail.
2/ Includes impacts to valley elderberry shrubs.
3/ Mitigation for impacts to the valley elderberry beetle will include planting valley elderberry shrubs on lands.
4/ Number of sites affected will be determined during feasibility studies.
5/ Impacts influence a wide variety of resources, primarily in Natomas. See EIS for more information.

# TABLE B-36

## SUMMARY OF ALTERNATIVES

| COMPONENT | NO ACTION ALTERNATIVE | 200-YEAR ALTERNATIVE (SELECTED PLAN) | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| FOLSOM FLOOD CONTROL STORAGE (ACRE-FEET) | 400,000[1] | 400,000[1] | 400,000[1] | 650,000 | 400,000[1] | 590,000 | 470,000 |
| LOWER FOLSOM DAM SPILLWAY: NEW GATES: | NO | NO | NO | 15 FT. | NO | NO | 15 FT. |
| FOLSOM RELEASE AND AMERICAN RIVER CAPACITY: (CFS) | 115,000[1] | 115,000[1] | 115,000[1] | 180,000 | 145,000 | 115,000[1] | 130,000 |
| RAISE/REPLACE BRIDGE AT: | Not Applicable | Hwy 49<br>Ponderosa Way<br>Main Ave. | Hwy 49<br>Ponderosa Way<br>Main Ave. | Numerous Bridges in Lower American River and Natomas | Similar to 150-year alternative | Main Avenue | Similar to 150-year alternative |
| RAISE YOLO BYPASS LEVEES | NO | NO | NO | YES | YES | NO | YES |
| LEVEE, CHANNEL AND RELATED IMPROVEMENTS IN NATOMAS: | NO | YES | YES | YES | YES | YES | YES |
| DETENTION BASIN IN PLEASANT GROVE: | NO | YES | YES | YES | YES | YES | YES |
| IMPROVEMENTS ALONG AMERICAN RIVER:<br>SLURRY WALL<br>TOE DRAIN<br>NEW LEVEE<br>LEVEE RAISING<br>BANK RIPRAP<br>LEVEE RIPRAP<br>BANK/LEVEE RIPRAP | NOT APPLICABLE | NOT APPLICABLE | NOT APPLICABLE | 4.1 MILES<br>7.8 MILES<br>1.0 MILE<br>11.4 MILES<br>1.5 MILES<br>5.3 MILES<br>3.2 MILES | 0.9 MILE<br>2.7 MILES<br>1.0 MILE<br>2.7 MILES<br>1.5 MILES<br>5.3 MILES<br>3.2 MILES | NOT APPLICABLE | 0.7 MILE<br>0.6 MILE<br>0.9 MILE<br>0 MILES<br>1.5 MILES<br>5.3 MILES<br>3.2 MILES |
| BUILD DAM AT AUBURN:<br>STORAGE CAPACITY (ACRE-FEET)<br>FLOOD POOL ELEV. (FT)<br>MAX. POOL AREA (ACRES)<br>STREAM LENGTH INUNDATED (MILES) | NO | YES<br>545,000<br>868.5<br>4,000<br>35.8 | YES<br>894,000<br>945<br>5,450<br>39.3 | NO | NO | NO | NO |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| IMPROVEMENTS ALONG AMERICAN RIVER:<br>SLURRY WALL<br>TOE DRAIN<br>NEW LEVEE<br>LEVEE RAISING<br>BANK RIPRAP<br>LEVEE RIPRAP<br>BANK/LEVEE RIPRAP | NOT APPLICABLE | NOT APPLICABLE | NOT APPLICABLE | 4.1 MILES<br>7.8 MILES<br>1.0 MILE<br>11.4 MILES<br>1.5 MILES<br>5.3 MILES<br>3.2 MILES | 0.9 MILE<br>2.7 MILES<br>1.0 MILE<br>2.7 MILES<br>1.5 MILES<br>5.3 MILES<br>3.2 MILES | NOT APPLICABLE | 0.7 MILE<br>0.6 MILE<br>0.9 MILE<br>0 MILES<br>1.5 MILES<br>5.3 MILES<br>3.2 MILES |
| BUILD DAM AT AUBURN:<br>STORAGE CAPACITY (ACRE-FEET)<br>FLOOD POOL ELEV. (FT)<br>MAX. POOL AREA (ACRES)<br>STREAM LENGTH INUNDATED (MILES) | NO | YES<br>545,000<br>868.5<br>4,000<br>35.8 | YES<br>894,000<br>945<br>5,450<br>39.3 | NO | NO | NO | NO |
| RECREATION TRAILS IN NATOMAS | NO | YES | YES | YES | YES | YES | YES |
| FIRST COST ($ MILLIONS)[2] | 0 | 535.3[3] | 631.6 | 495.9 | 176.6 | 128.9 | 225.1 |
| ANNUAL COST ($ MILLIONS)[4] | 0 | 50.5 | 59.8 | 46.6 | 17.3 | 11.6 | 21.7 |
| ANNUAL BENEFITS ($ MILLIONS)[4] | 0 | 166 | 202 | 128 | 60 | 60 | 60 |
| NET BENEFITS ($ MILLIONS)[4] | 0 | 115.5 | 142.2 | 81.4 | 42.7 | 48.4 | 38.3 |
| ADVANTAGES | • No initial impact on environmental resources. | • High level of flood protection.<br>• High net economic benefits.<br>• No impact to existing CVP benefits.<br>• Likely non-Federal sponsor. | • High level of flood protection.<br>• Highest net economic benefits.<br>• No impact to existing CVP benefits. | • Moderately high level of flood protection. | • Meets minimum requirements for flood insurance program.<br>• No impact to existing CVP benefits. | • Meets minimum requirements for flood insurance program. | • Meets minimum requirements for flood insurance program. |
| DISADVANTAGES[5] | • High remaining risk of flooding to Sacramento and vicinity.<br>• FEMA restrictions continue to apply. | • Loss of habitat in Natomas.<br>• Intermittent loss of habitat in detention area. | • Loss of habitat in Natomas.<br>• Intermittent loss of habitat in detention area. | • Significant remaining flood threat.<br>• No known non-Federal sponsor.<br>• Severe impact on existing CVP system benefits.<br>• Severe environmental impacts to lower American River.<br>• Significant impact on Folsom Reservoir recreation.<br>• Loss of habitat | • Higher public health and safety threat than No-Action alternative.<br>• No known non-Federal sponsor.<br>• Significant environmental impacts to lower American River and Natomas.<br>• Impact on Folsom Reservoir recreation.<br>• Loss of habitat in Natomas.<br>• Increase of | • Higher public health and safety threat than No-Action alternative.<br>• No known non-Federal sponsor.<br>• Significant environmental impacts to lower American River.<br>• Impact on Folsom Reservoir recreation.<br>• Reduction in existing CVP system benefits | • Higher public health and safety threat than No-Action alternative.<br>• No known non-Federal sponsor.<br>• Reduction in existing CVP system benefits.<br>• Impact on Folsom Reservoir recreation.<br>• Environmental and recreation impacts to lower American River |

| NET BENEFITS ($ MILLIONS)[4] | 0 | 115.5 | 142.2 | 81.4 | 42.7 | 48.4 | 38.3 |
|---|---|---|---|---|---|---|---|
| ADVANTAGES | • No initial impact on environmental resources. | • High level of flood protection.<br>• High net economic benefits.<br>• No impact to existing CVP benefits.<br>• Likely non-Federal sponsor. | • High level of flood protection.<br>• Highest net economic benefits.<br>• No impact to existing CVP benefits. | • Moderately high level of flood protection. | • Meets minimum requirements for flood insurance program.<br>• No impact to existing CVP benefits. | • Meets minimum requirements for flood insurance program. | • Meets minimum requirements for flood insurance program. |
| DISADVANTAGES[5] | • High remaining risk of flooding to Sacramento and vicinity.<br>• FEMA restrictions continue to apply. | • Loss of habitat in Natomas.<br>• Intermittent loss of habitat in detention area. | • Loss of habitat in Natomas.<br>• Intermittent loss of habitat in detention area. | • Significant remaining flood threat.<br>• No known non-Federal sponsor.<br>• Severe impact on existing CVP system benefits.<br>• Severe environmental impacts to lower American River.<br>• Significant impact on Folsom Reservoir recreation.<br>• Loss of habitat in Natomas.<br>• Increase of flows and velocities within levee system. | • Higher public health and safety threat than No-Action alternative.<br>• No known non-Federal sponsor.<br>• Significant environmental impacts to lower American River and Natomas.<br>• Impact on Folsom Reservoir recreation.<br>• Loss of habitat in Natomas.<br>• Increase of flows and velocities within levee system. | • Higher public health and safety threat than No-Action alternative.<br>• No known non-Federal sponsor.<br>• Significant environmental impacts to lower American River.<br>• Impact on Folsom Reservoir recreation.<br>• Reduction in existing CVP system benefits.<br>• Loss of habitat in Natomas. | • Higher public health and safety threat than No-Action alternative.<br>• No known non-Federal sponsor.<br>• Reduction in existing CVP system benefits.<br>• Impact on Folsom Reservoir recreation.<br>• Environmental and recreation impacts to lower American River.<br>• Loss of habitat in Natomas.<br>• Increase of flows and velocities within levee system. |

3

1. Existing conditions
2. Excludes creditable expenditures to date by USBR at Auburn Dam Site. Includes present worth of water supply and hydropower replacement costs.
3. Cost estimate of selected plan exceeds this cost due to a more detailed design with modified features.
4. 100-year period of analysis at 8-3/4% interest rate.
5. For comparison; includes unmitigated impacts. Actual plans include mitigation features.

## CHAPTER VI - PLAN SELECTION PROCESS

21. Plan Selection Criteria. - As previously identified, four general criteria were used in formulating and evaluating alternatives. These four criteria, established under Federal Principles and Guidelines, are completeness, effectiveness, efficiency, and acceptability. Within the framework established by these four general criteria, it was found that important factors leading to the recommendation of a selected plan could be summarized into four categories. These four categories are (1) economic efficiency, (2) environmental impacts, (3) public health and safety, and (4) acceptability. Factors presented in each of these four categories all fall within one or more of the general criteria of completeness, effectiveness, efficiency, and acceptability. Below, pertinent information leading to the recommendation of a selected plan is described in these four categories to demonstrate that the plan chosen for recommended implementation not only meets the Federal selection criteria but also non-Federal goals and objectives.

a. Efficiency. - Efficiency is the degree to which an alternative satisfies NED criteria, as measured by the net economic benefits produced by the various alternatives. Net economic benefits represent the difference between average annual benefits achieved by a given alternative (principally in the form of inundation damage reduction) and the average annual costs of that alternative. Net economic benefits for each alternative are shown in Table B-36. The alternative with the highest net benefits is (by definition) the NED plan. The net benefits are higher for the alternatives providing high levels of protection because of (1) the relatively low level of protection provided by the existing flood control system along the American River, (2) the relatively high level of development in the American River flood plain (value of existing structures is about $22 billion in the 100-year flood plain and $37 billion in the 400-year flood plain), and (3) the topography of the American River basin, which accentuates potential flood damages along the lower American and provides excellent opportunities for additional flood storage capacity upstream.

The alternative plan with the greatest net economic benefits (NED plan) is required to be the plan recommended for Federal action unless an exception is granted by the Assistant Secretary of the Army for Civil Works (ASA (CW)). The 400-year (NED) plan has the highest net economic benefits. Plans either larger or smaller than the NED plan can be selected if there are overriding and compelling reasons for doing so. Recommendation of a project smaller (less costly) than the NED plan will usually be considered favorably for an exception to the NED requirements based on local affordability considerations. Affordability is a valid reason for selecting a smaller plan. Assuming an exception were granted, the

smaller plan would be cost shared in the same manner the NED plan and would become a Federally supportable plan.

b. Environmental Impacts. - The environmental impacts of each of the alternatives are evaluated in the EIS/EIR. This evaluation, which focuses on direct impacts, indirect impacts, and impacts related to residual flooding, is summarized below. Included for reference is Table B-37 which provides a summary of direct impacts for each impact category.

(1) Direct Impacts. - Increasing the channel capacity of the lower American River combined with increases in the seasonal flood storage at Folsom Reservoir as proposed under the 150-year alternative and two of the 100-year (FEMA) alternatives would result in a permanent loss of hundreds of acres of riparian and wetland habitat, including open water, freshwater marsh, shaded riverine aquatic, riparian shrub scrub, and riparian forest cover types (see Table B-37). These cover types and the areas associated with them support a greater diversity of wildlife than any other terrestrial habitat. Dramatic statewide losses of freshwater marsh and riparian forest, in particular, over the past century makes these cover types especially significant locally and regionally. The lost vegetation would include elderberry bushes which provide habitat for the endangered valley elderberry longhorn beetle (see Table B-37). In order to compensate for the loss of wildlife values associated with this habitat, up to 1,439 acres in the American River Parkway (roughly 30 percent of the parkway) would have to be acquired and intensively managed as a wetland/upland complex. Impacts to the valley elderberry longhorn beetle would be avoided by removing identified elderberry bushes to sites outside of the construction zone.

Bank armoring, levee enlargement, and removal of riparian vegetation would significantly reduce the quality of both water-dependant and water-enhanced recreation in the lower American River (see Table B-37). This reach of the river is part of a State and Federal "wild and scenic" classification which normally prohibits activities such as Federal construction, assistance, or licensing of water projects adversely affecting the characteristics qualifying the river for the national system. Such adverse impacts in this case would be unavoidable.

Increases in seasonal flood storage at Folsom Reservoir as proposed under the 150-year and two of the 100-year (FEMA) alternatives would cause the reservoir to be operated at lower levels during the flood season. Accordingly, water which would otherwise be stored for power generation, agricultural irrigation, municipal and industrial use, recreation, or environmental resource management would have to be released. The principal casualties of this operation would be the temperature-sensitive

Table . Summary of Direct Impacts of the Selected Plan and Project Alternatives - Land Use

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Major flooding and temporary ponding would occur during flood events greater than 63-year frequency. | -Flooding and ponding limited to flood events greater than 200-year frequency. | -Flooding and ponding limited to flood events greater than 400-year frequency | -Flooding and ponding limited to flood events greater than 150-year frequency | -Flooding and ponding limited to flood events greater than 100-year frequency | -Same as 100-year (FEMA) levee alternative | -Same as 100-Year (FEMA) levee alternative |
| | -No impact | -Removal of existing access points east and west of the Main Ave. bridge replacement due to construction of approach ramps. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Potential long-term disruption of existing activities at 125 acre borrow site due to removal of top soils. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Elimination of the only access point to existing residences located north of Ascot Ave. due to construction of the north Dry Creek levee. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -All residential development stopped due to FEMA regulations. | -Development of area not hindered since level of flood control exceeds FEMA standards. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| LOWER AMERICAN RIVER | Flooding and ponding could occur in the event of a flood greater than 63-year frequency. | Flooding and ponding limited to flood events greater than 200-year frequency | Flooding and ponding limited to flood events greater than 400-year frequency | Flooding and ponding limited to flood events greater than 150-year frequency | Flooding and ponding limited to flood events greater than 100-year (FEMA) frequency. | Same as 100-Year (FEMA) levee alternative | Same as 100-Year (FEMA) levee alternative |
| UPPER AMERICAN RIVER | No impact | Elimination of existing recreation access routes due to new Hwy 49 alignment and erosion which is caused by inundation in the dam detention area. | Same as selected plan | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Hazardous and Toxic Waste

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | Waters from flood events greater than 63-year frequency would seep into approximately 62 HTW sites in the flood plain. | Waters from flood events greater than 200-year frequency would seep into approximately 62 HTW sites in the flood plain. | Waters from flood events greater than 400-year frequency would seep into approximately 62 HTW sites in the flood plain. | Waters from flood events greater than 150-year frequency would seep into approximately 62 HTW sites in the flood plain. | Waters from flood events greater than 100-year (FEMA) frequency would seep into approximately 62 HTW sites in the flood plain. | Same as selected plan | Same as selected plan |
| LOWER AMERICAN RIVER | Waters from flood events greater than 63-year frequency would seep into approximately 1,200 HTW sites in the flood plain | Waters from flood events greater than 200-year frequency would seep into approximately 1,200 HTW sites in the flood plain | Waters from flood events greater than 400-year frequency would seep into approximately 1,200 HTW sites in the flood plain | Waters from flood events greater than 150-year frequency would seep into approximately 1,200 HTW sites in the flood plain | Waters from flood events greater than 100-year (FEMA) frequency would seep into approximately 1,200 HTW sites in the flood plain | Same as 100-year (FEMA) levee alternative | Same as 100-year (FEMA) levee alternative |
| UPPER AMERICAN RIVER | No impact | No impact | No impact | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Agriculture and Farmland

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Minimal growth would result in the loss of approximately 58 acres by 2010. Estimate assumes a no-growth scenario due to FEMA regulations.<br>-Virtually all of Natomas would be inundated during flood events greater than 63-year frequency. Crop damage would likely result. | -No direct impact[1]<br>-Similar to no-action alternative except impacts would be reduced to flood events greater than 200-year frequency. | -No direct impact[1]<br>-Similar to no-action alternative except impacts would be reduced to flood events greater than 400-year frequency. | -No direct impact[1]<br>-Similar to no-action alternative except impacts would be reduced to flood events greater than 150-year frequency. | -No direct impact[1]<br>-Similar to no-action alternative except impacts would be reduced to flood events greater than 100-year frequency | -No direct impact[1]<br>-Same as 100-year (FEMA) levee alternative | -No direct impact[1]<br>-Same as 100-year (FEMA) levee alternative |
| LOWER AMERICAN RIVER | -Periodic inundation due to flood events greater than 63-year frequency would result in crop damage.<br>-No impact | -Similar to no-action alternative except impact would be reduced to flood events greater than 200-year frequency.<br>-No impact | -Similar to no-action alternative except impact would be reduced to flood events greater than 400-year frequency.<br>-No impact | -Similar to no-action alternative except impact would be reduced to flood events greater than 150-year frequency.<br>-Lengthening the Sacramento Weir will affect approximately 785 acres north of the Sacramento Bypass. | -Similar to no-action alternative except impact would be reduced to flood events greater than 100-year (FEMA) frequency.<br>-Similar to 150-year alternative; approximately 315 acres affected. | -Same as 100-year (FEMA) levee alternative<br>-No impact | -Same as 100-year (FEMA) levee alternative<br>-Similar to 150-year alternative; approximately 110 acres affected. |
| UPPER AMERICAN RIVER | -Some urban development would occur due to low amount of agricultural land. Some minor loss would occur.<br>-No impact | -Same as no-action alternative<br>-Relocation of Hwy 49 would affect some grazing land. | -Same as no-action alternative<br>-Same as selected plan | -Same as no-action alternative<br>-No impact | -Same as no-action alternative<br>-No impact | -Same as no-action alternative<br>-No impact | -Same as no-action alternative<br>-No impact |

1. Growth inducing indirect impacts would cause significant losses to farmlands under the alternative plans. These losses would be greater than those direct impacts identified for the no-action alternative.

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Water Quality and Drainage

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Flood events greater than 63-year freq. may cause storm drains to overflow; pollutants such as oils, grease, heavy metals, and pesticides could be discharged into the Sacramento and American Rivers. | -Similar to no-action alternative except impacts would occur during flood events greater than 200-year frequency | -Similar to no-action alternative except impacts would occur during flood events greater than 400-year frequency | -Similar to no-action alternative except impacts would occur during flood events greater than 150-year frequency | -Similar to no-action alternative except impacts would occur during flood events greater than 100-year (FEMA) frequency | -Same as 100-Year (FEMA) levee alternative | -Same as 100-Year (FEMA) levee alternative |
| | -No impact | -Levee construction could cause erosion and sedimentation into drainage canals and streams | -Similar to selected plan; higher levee elevations would slightly increase impact potential | -Similar to 400-year alternative. Highest levee elevation of all alternatives leads to greatest impact potential | -Similar to 400-year alternative | -Similar to selected plan | -Similar to 400-year alternative |
| | -No impact | -Potential construction materials spills would impact water quality. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| LOWER AMERICAN RIVER | -Flood events greater than 63-year freq. may cause sewage treatment plants to overflow and discharge effluents into the Sacramento and American Rivers; ground pollutants may also be discharged into the rivers. | -Similar to no-action alternative except impacts would occur during flood events greater than 200-year freq. | -Similar to no-action alternative except impacts would occur during flood events greater than 400-year freq. | -Similar to no-action alternative except impacts would occur during flood events greater than 150-year freq. | -Similar to no-action alternative except impacts would occur during flood events greater than 100-year (FEMA) freq. | -Same as 100-Year (FEMA) levee alternative | -Same as 100-Year (FEMA) levee alternative |
| | -No impact | -No impact | -No impact | -Seasonal water temp. effect from Folsom reoperation. Adverse impacts to aquatic biota in reservoir and channel | -Higher flow releases would affect the quality of aquatic habitats | -Similar to 150-year alternative | -Same as 150-year alternative |
| | -No impact | -No impact | -No impact | -Potential construction material spills would impact water quality | -Same as 150-year alternative | -Same as 150-year alternative | -Same as 150-year alternative |

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|---|---|---|---|---|---|---|---|
| UPPER AMERICAN RIVER | No impact | -Increase in waste material and disposal requirements due to higher aggregate production<br>-Aggregate conveyor transport system would cause topsoil erosion leading to sediment-ation in river<br>-Spoil disposal at dam site<br>-In worst-case estimate, 38,400 tons of sediment would be generated by construction<br>-Concentrations of dissolved calcium, sulphate, chloride, iron, manganese, and asbestos, may increase during const.<br>-Potential construction material spills would degrade water quality | -Same as selected plan<br>-Same as selected plan<br>-Same as selected plan<br>-Similar to selected plan; impacts slightly greater<br>-Same as selected plan<br>-Same as selected plan | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Fish

| | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Short-term disruptions to riparian zones capable of affecting fish and aquatic insect populations would occur from flood events greater than 63-year frequency.<br>-No impact | -Short-term disruptions to riparian zones capable of affecting fish and aquatic insect populations would occur from flood events greater than 200-year frequency.<br>-Changes in water quality due to levee construction and related activities would temporarily lower fish habitat quality. | -Short-term disruptions to riparian zones capable of affecting fish and aquatic insect populations would occur from flood events greater than 400-year frequency.<br>-Same as selected plan | -Short-term disruptions to riparian zones capable of affecting fish and aquatic insect populations would occur from flood events greater than 150-year frequency.<br>-Same as selected plan | -Short-term disruptions to riparian zones capable of affecting fish and aquatic insect populations would occur from flood events greater than 100-year (FEMA) frequency.<br>-Same as selected plan | -Same as 100-year (FEMA) levee alternative<br>-Same as selected plan | -Same as 100-year (FEMA) levee alternative<br>-Same as selected plan |
| LOWER AMERICAN RIVER | Increase of in-basin water demand, Delta water quality releases, and increases in water exports will lead to a decline in fish resources of Folsom Reservoir and lower American River. These reduced flows will primarily impact naturally spawning Chinook Salmon and American Shad. Degraded water quality at the hatchery is expected to affect production with a 10% decline. | Same as no-action alternative | Same as no-action alternative | In addition to the effects of the no-action alternative, bank stabilization work and riprap placement would impact fisheries and cause loss of spawning habitat. A 21% reduction in fish resources due to changes in temperature and seasonal flows resulting from Folsom reoperation. | -Bank stabilization impacts, loss of spawning habitat, and no-action alternative effects would be the same as 150-year alternative. Folsom reoperation not included in this alternative; no impact | -No riprapping or bank stabilization measures in this alternative; impacts due to Folsom reoperation and no-action alternative effects only. Impacts less than 150-year alternative | -Bank stabilization impacts, spawning losses, no-action alternative effects, and Folsom reoperation impacts similar to 150-year alternative |

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| UPPER AMERICAN RIVER | Potential for disruptions from flooding to riparian zones and fish and insect population would continue. Increased water diversions, public use, and increased development would continue to adversely impact instream habitat and fish population. | Sedimentation and sloughing during flood events may affect fish resources. | Same as selected plan | Same as no-action alternative | Same as no-action alternative | Same as no-action alternative | Same as no-action alternative |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Vegetation and Wildlife

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Flood events outside the growing season greater than 63-year frequency would cause temporary riparian damage along with temporary wildlife displacement.<br>-No impact | -Flood events outside the growing season greater than 200-year frequency would cause temporary riparian damage along with temporary wildlife displacement.<br>-Construction activities would cause 18 acres of wetland habitat and 272 acres of upland habitat to be lost. | -Flood events outside the growing season greater than 400-year frequency would cause temporary riparian damage along with temporary wildlife displacement.<br>-Same as selected plan | -Flood events outside the growing season greater than 150-year frequency would cause temporary riparian damage along with temporary wildlife displacement<br>-Same as selected plan | -Flood events outside the growing season greater than 100-year (FEMA) frequency would cause temporary riparian damage along with temporary wildlife displacement.<br>-Same as selected plan | -Same as 100-year (FEMA) levee alternative<br>-Same as selected plan | -Same as 100-year (FEMA) levee alternative<br>-Same as selected plan |
| LOWER AMERICAN RIVER | Temporary wildlife displacement could occur from flood events greater than 63-year frequency. In addition, vegetation will continue to change as it has since the construction of Folsom Dam; estimated loss is 1,480 acres. | Same effects as no-action alternative except wildlife displacement could occur from flood events greater than 200-year frequency. | Same effects as no-action alternative except wildlife displacement could occur from flood events greater than 400-year frequency. | Same effects as no-action alternative except wildlife displacement could occur from flood events greater than 150-year frequency. In addition, vegetation cover impacts due to construction activities include the loss of 679 acres of wetland habitat. | Same effects as no-action alternative except wildlife displacement could occur from flood events greater than 100-year (FEMA) frequency. In addition, vegetation cover impacts due to construction activities include the loss of 462 acres of wetland habitat | Same effects as 100-year (FEMA) levee alternative except vegetation cover impacts due to construction activities include the loss of 143 acres of wetland habitat. | Same effects as the 100-year (FEMA) levee alternative except vegetation cover impacts due to construction activities include the loss of 454 acres of wetland habitat. |

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| UPPER AMERICAN RIVER | Potential disruption to vegetation and wildlife from flood events greater than 63-year frequency | Vegetation and associated wildlife would be impacted by dam construction, relocation of Hwy 49 and Ponderosa Way bridge, inundation and associated sloughing events. An estimated 1,200 acres would be impacted. In addition, potential disruption to vegetation and wildlife could occur from flood events greater than 200-year frequency. | Same as selected plan except approximately acres would be impacted. | Same as no-action alternative | Same as no-action alternative | Same as no-action alternative | Same as no-action alternative |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Endangered Species

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | No impact | -20 acres of habitat for Swainson's Hawk would be permanently lost due to construction activities<br>-626 acres of habitat for Swainson's Hawk would be temporarily disturbed due to construction activities<br>-Impacts to Giant Garter Snake habitat due to relocation of 3,000 linear ft. of toe drain now located along Sankey Road.<br>-Possible construction related impacts to irregular historic Winter Chinook Salmon runs. | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan |
| LOWER AMERICAN RIVER | No impact | No impact | No impact | -Levee construction and changes in river's hydrology due to storage and flow modification would affect elderberry plants, possibly impacting the Valley Elderberry Longhorn Beetle<br>-Changes to Folsom reservoir could affect the fish population which, in turn, could affect the food supply of the Bald Eagle | -Similar to 150-year alternative; impact from levee construction only<br>-No impact | -Similar to 150-year alternative; impact from storage and flow modification only<br>-Similar to 150-year alternative; impact from storage only | -Similar to 150-year alternative<br>-Similar to 150-year alternative; lower impact due to less flow alteration |

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| UPPER AMERICAN RIVER | Elderberry plants along canyon bottom potentially impacted by natural flooding. | Possible impacts related to presence of elderberry plants in upper canyon area. | Similar to selected plan | Same as no-action alternative | Same as no-action alternative | Same as no-action alternative | Same as no-action alternative |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Cultural Resources

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | Potential damage to prehistoric and historic sites from flood events greater than 63-year freq. and agricultural practices | Damage to prehistoric sites would occur in Dry Creek, Arcade Creek, and Sacramento River areas from const. | Same as selected plan | Similar to selected plan; additional impacts near Sacramento River and Garden Hwy likely. | Same as 150-year alternative | Same as selected plan | Same as selected plan |
| LOWER AMERICAN RIVER | -Current operation of Folsom Reservoir causes changes in water levels that could expose and damage cultural resources within the fluctuation zone | -Same as no-action alternative | -Same as no-action alternative | -32 prehist. and 13 hist. sites within the 395-466 ft. elev. of Folsom Reservoir. Additional sites below 395 ft. elev. Sites affected to a greater degree by reservoir fluctuation, erosion, and vandalism due to changes in operation. | -Same as no-action alternative | -Similar to 150-year alternative; 25 prehistoric and 10 historic sites within the 404-416 ft. elevation would be affected. | -Similar to 150-year alternative; 23 prehistoric and 9 historic sites within the 419-466 ft. elevation. |
| | -No impact | -No impact | -No impact | -Possible damage to prehistoric, historic, or submerged resources due to construction activities | -Similar to 150-year alternative; total area affected would be smaller. | -No impact | -Similar to 150-year alternative; total area affected would be smaller. |
| | -No impact | -No impact | -No impact | -Lengthening Sacramento Weir 3600 ft. would impact a Natl. Register eligible property by altering historical and architectural integrity | -Similar to 150-year alternative; lengthening is 1400 ft. | -No impact | -Similar to 150-year alternative; lengthening is 500 ft. |

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| UPPER AMERICAN RIVER | -Damage to historic and prehistoric sites would continue from slides, vandalism, ORV activity, burning and flooding | -163 historic and 17 prehistoric sites at risk from construction. More sites may be found during construction. | -Similar to selected plan; 268 known historic and 23 known prehistoric sites at risk. | -Same as no-action alternative | -Same as no-action alternative | -Same as no-action alternative | -Same as no-action alternative |
| | -Potential damage to sites due to vandalism, looting, fire, and erosion. | -Hwy 49 relocation may destroy known sites. | -Same as selected plan | -No impact | -No impact | -No impact | -No impact |
| | -Resources may be disturbed from high river flows during a large storm event | -Dam operation may uncover and damage historic and prehistoric sites due to wave action and bank slumping. | -Similar to selected plan; greater impact due to larger dam size. | -Same as no-action alternative | -Same as no-action alternative | -Same as no-action alternative | -Same as no-action alternative |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Transportation/Traffic

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA)LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Flood events greater than 63-year frequency may damage roadways and transportation facilities rendering them inoperable for a long period of time | -Similar to no-action alternative except impacts would be reduced to flood events greater than 200-year frequency | -Similar to no-action alternative except impacts would be reduced to flood events greater than 400-year frequency | -Similar to no-action alternative except impacts would be reduced to flood events greater than 150-year frequency | -Similar to no-action alternative except impacts would be reduced to flood events greater than 100-year frequency. | -Same as 100-Year (FEMA) levee alternative | -Same as 100-Year (FEMA) levee alternative |
| | -No impact | -Extensive construction-related vehicle activity reduces the life of roadways not designed for heavy-vehicle use | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Construction vehicles on public roadways would cause capacity problems with existing traffic activity. Increases in delays at major intersections and at major arterials. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Construction vehicle parking and site access would require adequate roadway width and turning radius. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Narrow levee road width, inadequate turn radius, and impaired line of sight between Sutnip road and NEMDC pump site would result in safety impacts | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Main Avenue Bridge construction would detour traffic via Norwood ave., I-80, and Northgate Boulevard | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |

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|---|---|---|---|---|---|---|---|
| LOWER AMERICAN RIVER | Flood events greater than 63-year frequency may damage roadways and transportation facilities | Similar to no-action alternative except impacts would be reduced to flood events greater than 200-year frequency. | Similar to no-action alternative except impacts would be reduced to flood events greater than 400-year frequency. | Similar to no-action alternative except impacts would be reduced to flood events greater than 150-year frequency. | Similar to no-action alternative except impacts would be reduced to flood events greater than 100-year (FEMA) frequency. | Same as 100-Year (FEMA) levee alternative | Same as 100-Year (FEMA) levee alternative |
| UPPER AMERICAN RIVER | No impact | -Extensive construction-related vehicle activity reduces the life of roadways not designed for heavy-vehicle use.<br>-Construction vehicles on public roadways would cause capacity problems with existing traffic activity. Increases in delays at major intersections and along major arterials.<br>-Construction vehicle parking and site access would require adequate roadway width and turning radius. | Same as selected plan | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Air Quality

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | No impact | Construction would produce a substantial increase in PM(10) and ozone precurser emissions. | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan |
| LOWER AMERICAN RIVER | No impact | Construction would produce a substantial increase in PM(10) and ozone precurser emissions. | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan |
| UPPER AMERICAN RIVER | No impact | Construction would produce a substantial increase in PM(10) and ozone precurser emissions. | Same as selected plan | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Noise

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | No impact | -Construction activities at the NEMDC, east and west levees, NEMDC pump station, Sankey road, Dry and Arcade Creeks, and the 125 acre borrow site would produce substantial noise.<br>-Construction and related traffic would generate increased noise levels. | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan |
| LOWER AMERICAN RIVER | No impact | No impact | No impact | -Specific location, design, and noise generation for the American River pump station near Mayhew Drain is unknown.<br>-Construction of levees at various locations along the lower American River would generate substantial noise. | Same as 150-year alternative | No impact | Same as 150-year alternative |
| UPPER AMERICAN RIVER | No impact | -Increased aggregate production at Old Cool Quarry combined with operation of a conveyor system and construction activities at the dam site would increase ambient noise levels in adjacent areas.<br>-Construction and related traffic along travel routes would generate increased noise levels. | Same as selected plan | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Recreation

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Public or private activities such as hunting and wildlife observation would be impacted by periodic flooding and ponding<br>-High flows could damage Parkway facilities resulting in high cost repairs and maintenance to existing recreation facilities | -Levee improvements would cause direct impacts to public or private activities such as hunting and wildlife observation<br>-Damage to recreation facilities from high flows would be prevented due to additional detention capabilities | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan | Same as selected plan |
| LOWER AMERICAN RIVER | -No impact | -No impact | -No impact | -Reduced quality of recreation due to loss of vegetation. Possible impact to Wild and Scenic Rivers designation. | -Same as 150-year alternative | -No impact | -Similar to 150-year alternative |
| | -No impact | -No impact | -No impact | -Impact to water recreation due to altered flow patterns of Folsom reoperation | -No impact | -Similar to 150-year alternative | -Similar to 150-year alternative |
| | -Increased demand on existing recreation facilities | -Provides 9.5 miles of additional trails connecting to American River Parkway | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |

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|---|---|---|---|---|---|---|---|
| UPPER AMERICAN RIVER | No impact | -Sanitation facilities and access roads within inundation zone would be damaged.<br>-River rafting, Tevis Cup, and Western States Endurance Run would temporarily be rerouted<br>-Long term flood control operations could adversely affect floating boat docks and gas facilities on Lake Clementine<br>-A person or vessel could be trapped in the hydraulic action of North Fork Dam at Lake Clementine in the event of a flood<br>-Construction of a new Ponderosa Way Bridge would impede public access to the North Fork | Same as selected plan | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Socioeconomics

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Flood events greater than 63-year frequency would have high potential for loss of life.<br>-Structures damaged more than 50% of their value by flood waters are not able to rebuild in the flood plain.<br>-Damages from flood events greater than 63-year frequency generate significant quantities of debris requiring disposal.<br>-Allows maintaining availability of open space areas in urban setting for social value.<br>-Significant economic disruption resulting from flood events greater than 63-year frequency. | -Flood events greater than 200-year frequency have potential for loss of life.<br>-Flood events greater than 200-year frequency would cause extensive damage to structures which would lead to depletion of additional environmental resources for reconstruction.<br>-Same as no-action alternative except flood debris generation occurs for flood events greater than 200-year frequency.<br>-Likely elimination of open space areas.<br>-Significant economic disruption resulting from flood events greater than 200-year frequency. | -Flood events greater than 400-year frequency have potential for loss of life.<br>-Same as selected plan except damages occur for flood events greater than 400-year frequency.<br>-Same as no-action alternative except flood debris generation occurs for flood events greater than 400-year frequency.<br>-Same as selected plan<br>-Significant economic disruption resulting from flood events greater than 400-year frequency. | -Flood events greater than 150-year frequency have potential for loss of life.<br>-Same as selected plan except damages occur for flood events greater than 150-year frequency<br>-Same as no-action alternative except flood debris generation occurs for flood events greater than 150-year frequency.<br>-Same as selected plan<br>-Significant economic disruption resulting from flood events greater than 400-year frequency. | -Flood events greater than 100-year (FEMA) frequency have higher potential for loss of life than no-action alternative<br>-Same as selected plan except damages occur for flood events greater than 100-year (FEMA) frequency.<br>-Same as no-action alternative except flood debris generation occurs for flood events greater than 100-year (FEMA) frequency.<br>-Same as selected plan<br>-Significant economic disruption resulting from flood events greater than 100-year (FEMA) frequency. | Same as 100-year (FEMA) levee alternative | Same as 100-year (FEMA) levee alternative |

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|---|---|---|---|---|---|---|---|
| LOWER AMERICAN RIVER | -Flood events greater than 63-year frequency would have high potential for loss of life.<br>-Structures damaged more than 50% of their value by flood waters are not able to rebuild in the flood plain.<br>-Social and economic value impacts to the American River Parkway from flood events greater than 63-year frequency. | -Flood events greater than 200-year frequency would have high potential for loss of life<br>-Same as no-action alternative<br>-Same as no-action alternative except impacts occur for flood events greater than 200-year frequency. | -Flood events greater than 400-year frequency would have high potential for loss of life.<br>-Same as no-action alternative<br>-Same as no-action alternative except impacts occur for flood events greater than 400-year frequency. | -Flood events greater than 150-year frequency would have high potential for loss of life.<br>-Same as no-action alternative<br>-Same as no-action alternative except impacts occur for flood events greater than 150-year frequency. | -Flood events greater than 100-year (FEMA) frequency would have high potential for loss of life.<br>-Same as no-action alternative<br>-Same as no-action alternative except impacts occur for flood events greater than 100-year (FEMA) frequency. | Same as 100-year (FEMA) levee alternative | Same as 100-year (FEMA) levee alternative |
| UPPER AMERICAN RIVER | No impact | -Construction vehicles would increase traffic congestion and accident potential along roads potentially resulting in more calls for emergency services.<br>-Realignment of Hwy 49 would require detours during construction and would result in traffic congestion and higher accident potential. The demand for emergency services could increase.<br>-Impacts to social values associated with the natural state of the American River canyon. | Same as selected plan | No impact | No impact | No impact | No impact |

Table B-37. Summary of Direct Impacts of the Selected Plan and Project Alternatives - Visual Resources

| LOCATION | NO ACTION | SELECTED PLAN | 400-YEAR ALTERNATIVE | 150-YEAR ALTERNATIVE | 100-YEAR (FEMA) LEVEE ALTERNATIVE | 100-YEAR (FEMA) STORAGE ALTERNATIVE | 100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE |
|---|---|---|---|---|---|---|---|
| NATOMAS | -Urbanization would be slowed or halted in some areas preserving the natural landscape. | -No impact | -No impact | -No impact | -No impact | -No impact | -No impact |
| | -Flood events greater than 63-year frequency would leave debris strewn throughout the flood plain. | -Similar to no-action alternative except impacts would be reduced to flood events greater than 200-year frequency. | -Similar to no-action alternative except impacts would be reduced to flood events greater than 400-year frequency. | -Similar to no-action alternative except impacts would be reduced to flood events greater than 150-year frequency. | -Similar to no-action alternative except impacts would be reduced to flood events greater than 100-year (FEMA) frequency. | -Same as 100-Year (FEMA) Levee alternative | -Same as 100-Year (FEMA) Levee alternative |
| | -No impact | -Operation of heavy-duty equipment in close proximity to residential areas and disturbance of established vegetation during construction. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Construction of levees along north and south Dry Creek would block open space views from existing residences. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Excavation of material from the Garden Highway borrow site would produce visual impacts. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Elevating the NEMDC pump station several feet above the height of finished levees would impact views from homes located on West 6th Street. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |
| | -No impact | -Construction of a high bridge at Main Ave./NEMDC would produce visual impacts. | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan | -Same as selected plan |

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|---|---|---|---|---|---|---|---|
| LOWER AMERICAN RIVER | -Flood events greater than 63-year frequency would leave debris strewn throughout the floodplain. | -Similar to no-action alternative except impacts would be reduced to flood events greater than 200-year frequency | -Similar to no-action alternative except impacts would be reduced to flood events greater than 400-year frequency. | -Similar to no-action alternative except impacts would be reduced to flood events greater than 150-year frequency. | -Similar to no-action alternative except impacts would be reduced to flood events greater than 100-year (FEMA) frequency. | -Same as 100-Year (FEMA) levee alternative | -Same as 100-Year (FEMA) levee alternative |
| | -Urbanization would be slowed or halted in some areas preserving the natural landscape. | -No impact | -No impact | -No impact | -No impact | -No impact | -No impact |
| | -No impact | -No impact | -No impact | -Levee appearance would shift from semi-natural to manmade; reflective nature of riprap dominant. Parkway would have a stark appearance due to plant loss. | -Similar to 150-year alternative | -No impact | -Similar to 150-year alternative |
| | -No impact | -No impact | -No impact | -Construction activities along lower American River and at Folsom Reservoir would result in significant short-term impacts to visual resources. | -Construction along the lower American River would affect local views. | -Same as 150-year alternative | -Same as 150-year alternative |
| | -No impact | -No impact | -No impact | -Low water surface elevations at Folsom Reservoir would expose a larger area of reservoir bottom during the winter and dry years than is currently exposed. An increase of dust storms resulting from high winds would obstruct view of reservoir. | -No impact | -Same as 150-year alternative | -Same as 150-year alternative |

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|---|---|---|---|---|---|---|---|
| UPPER AMERICAN RIVER | No impact | -Completed dam would present minimal visual disruptions due to limited public vantage points. However the manmade form and reflective surface would provide moderate contrast to the bare rock and construction areas. The dam would become more prominent as vegetation growth occurs on adjacent sites.<br>-Conveyor system would need a 20 ft. wide 5 mi. long right-of-way<br>-Construction of a new bridge for Hwy 49 relocation would require grading cuts along the wall of the canyon resulting in significant visual impacts. The bridge itself would alter existing views.<br>-Infrequent views of debris clutter in the detention area and river, landslides and stripped vegetation or other damage following a flood event greater than 200-year frequency | -Same as selected plan<br>-Same as selected plan<br>-Same as selected plan<br>-Similar to selected plan; impacts would occur during a flood event with greater than 400-year frequency. | No impact | No impact | No impact | No impact |

elements of the fishery inhabiting the reservoir and the lower reaches of the American River. With increased flood storage, water level fluctuations in the reservoir would worsen, thereby, threatening existing warm water fish spawning in the reservoir during April through June. Reductions in the pool of cold water available for release from the reservoir would also result in downstream water temperature increases and Imperil Chinook salmon production in the lower American River (see Table B-37).

Finally, the added space for flood control at Folsom could trigger adjustments in overall CVP operations which would adversely affect two Federally listed endangered species, the winter-run Chinook salmon and the Delta smelt (see Table B-37).

Impacts to water and power resources, under the above scenario, would be compensated through purchase of supplies developed from alternative sources. Impacts to fisheries would be reduced by plantings in the reservoir and placement of spawning gravels in the lower American River. These impacts could be further reduced by making reservoir operations more temperature-sensitive at the expense of water, power and recreational uses. Impacts to recreation would be unavoidable. Impacts to endangered species could be avoided by maintaining pre-project CVP operations and meeting anticipated demands for water and power from sources outside the CVP.

In contrast to impacting the regionally significant resources of the lower American River including the fishery, riparian vegetation, recreational, water supply, and hydropower, the impacts associated with constructing a flood control dam at Auburn would be confined to the 4,000 acre detention area. This area is a relatively unpopulated area, with fish, vegetation, and wildlife habitats that are much more abundant on a statewide basis. The sand and gravel needed for the dam would be obtained from the Old Cool Quarry which is currently operating in the Middle Fork canyon approximately 5 miles upstream from the damsite. Despite the volume of material involved, aggregate could be mined from the quarry and transported to the damsite without any significant loss of habitat. Because of the preparatory work accomplished in connection with the multipurpose project, many of the construction roads needed for the flood control dam have already been created and the damsite itself has been substantially degraded. Spoils generated by foundation excavation would be banked in the keyway of the existing multipurpose dam foundation and at the foot of an uncompleted boatramp adjacent to the keyway, thereby providing some environmental restoration values.

Operation of the flood control dam would have little affect on aquatic resources in the upper American River area. However, dam operations would adversely affect wildlife species, including the valley elderberry longhorn beetle, and upland vegetation occupying the inundation zone (see Tables B-37). Investigations

resulted in a determination that 1,927 acres of oak woodland, chaparral, and conifer forrest cover types will be lost due to the combined effects of inundation and soil slippage in the inundation zone (Appendix Q). Compensation for the loss of general wildlife values associated with this habitat would require acquisition and preservation of approximately 2,685 acres of riverine habitat along the South Fork of the American River. Impacts to the valley elderberry longhorn beetle would be mitigated by the acquisition of an additional 2,700 acreas and the planting of elderberry bushes.

Periodic flooding would not have any adverse impact on whitewater rafting in the canyon area since high flows would occur only during winter storms. Flooding could cause erosion damage to existing roads and trails in the inundation zone, thereby disrupting recreational use of the canyon area (see Table B-37). However,these impacts would occur in the off-season, leaving the agency responsible for maintenance and operation of the dam adequate time to repair the damage before any recreational activity is substantially affected. Similarly, while replacement of Highway 49 would restrict recreational access to the canyon, this impact could be avoided if the existing roadway is maintained as a local access facility. Construction and operation of the flood control dam would result in unavoidable impacts on the aesthetic quality of the canyon area.

(2) Indirect Impacts. - Under all of the alternatives, the metropolitan Sacramento area, including the Natomas basin would be protected from flooding at least to a level sufficient to permit FEMA to issue new Flood Insurance Rate Maps removing most of the area from the 100-year flood plain. Based on existing local land use plans, this protection would enable regional growth to occur in Natomas and in the remaining vacant areas in the Meadowview and Pocket sections of the City where high base flood elevations might otherwise constrain development. A change in land use from open space and agriculture to urban uses in these areas would produce significant impacts on housing, population, traffic, air pollution, sewage generation, and other public services. Urbanization would cause the loss of significant amounts of agricultural land, much of which is designated prime or unique farmland in the Natomas basin. Cultural resources, wetlands, and fish and wildlife habitats in the area would also be adversely affected. In particular, development in Natomas and Meadowview would imperil two resident State-listed species, the California giant garter snake and the Swainson's hawk. Under the State Endangered Species Act, the State is constrained from participating in the project unless the local land use agencies controlling development in Natomas provide assurances that they will exercise their authority in such a manner as to avoid jeopardy to these species.

Both of the dam alternatives would require relocation of Highway 49. Based on the in-kind/in-place replacement, this relocation would not significantly alter existing commute or other local traffic patterns and would thus have little effect on regional growth in the foothills. However, relocation of the highway is a State responsibility which must be discharged in accordance with existing State procedures. These procedures require completion of a route adoption study and approval of the proposed relocation by the California Transportation Commission (CTC). It is possible, therefore, that the relocation ultimately adopted by the State may differ from the one identified by the Corps and may produce a more substantial effect on regional growth in the foothills.

(3) Residual Flood Damages. - Residual flood damages are a measure of the risk of uncontrolled flooding associated with each of the alternatives and the severity of the impacts should an uncontrolled flood occur in the Sacramento area. These impacts include: (1) contamination due to flood-induced releases of hazardous and toxic waste materials, (2) loss of vegetation and special status wildlife, (3) loss of American River Parkway resources, (4) loss of upper American River canyon resources, (5) generation of significant quantities of landfill related to the disposal of flood-related debris, (6) loss of open space in Natomas, (7) consumption of the environmental resources needed to replace damaged structures, (8) risk aversion, and (9) economic disruption.

(a) Toxic and Hazardous Waste Contamination. - Flooding has caused significant releases of toxic and hazardous substances into the environment. Types of hazardous materials which have caused significant problems include above-ground tanks and drums, which may contain heating oil, fuel oil, liquid propane, kerosene, and agricultural chemicals. Floods in agricultural areas are particularly susceptible in this regard since a wide variety of petroleum products, herbicides, pesticides, solvents, and fertilizers are often stored on site in unsecured and unanchored containers. Commercially available hazardous products in homes, retail stores, landfills, and illegal dump sites can also cause problems. Without extensive changes in the way these substances are used and stored, future natural disasters are likely to continue to cause significant problems in this regard.

(b) Loss of Vegetation and Special Status Wildlife. - There is very little indication that plant and animal populations within the flood plain would be severely impacted by flooding. However, some special status wildlife species could be impacted by inundation. An extensive flood could possibly expatriate species from the Sacramento area (depending upon their tolerance to inundation). These species include: the giant garter snake, the ringtail, the valley elderberry longhorn beetle,

diffuse rush, delta tule pea, Sanford's saggitaria, bird's beak, Downingia, hege-hyssop, California hibiscus, toad rush and valley oak. In alternatives providing lower levels of protection there is greater risk that significant flooding would occur that could eliminate these species from the Sacramento area.

(c) Loss of American River Parkway Resources. - The American River Parkway, as an environmental resource has associated with it high recreational, aesthetic, and existence values. Under the alternatives which provide less than 200-year protection there is significant risk that these environmental values would be adversely impacted by frequent flooding. The higher level of protection alternatives reduce this risk considerably, thereby preserving these environmental values.

(d) Loss of Upper American River Canyon Resources. - Similar to the American River Parkway, the upper American River canyon, as an environmental resource, has associated with it high recreational, aesthetic, and existence values. The alternatives providing levels of protection in excess of 200 years would adversely impact these values due to the construction of a flood control dam in the canyon. However, offsetting this is the fact that this flood control dam would not incur permanent inundation. Thus, the environmental values of recreational, aesthetic, and existence would remain mostly unchanged.

(e) Flood Debris Generation. - It is quite likely that subsequent to a major flood, significant quantities of flood related debris would be generated. The Sacramento area flood of 1986 was examined to determine an estimate of the amount of debris generated as a result of that flood. This figure has been estimated at 9,478 tons. It should be noted that flooding which occurred in the Sacramento area in 1986 was very limited in scope. No major levee failures occurred and only a small area of land was affected. The amount of debris that could be generated by a 200-year flood or greater would be many times greater. Since most of this debris would end up being hauled to local landfills, a large flood would significantly impact space at landfills within the area.

(f) Loss of Open Space in Natomas. - The availability of open space within an urban setting is generally perceived as a significant social value. Implementation of any of the alternatives (except no action) allows future development in Natomas. The future of any open space land under any of the alternatives will be subject to local land use policy decisions. Potential flooding, and its associated impacts to any remaining open space however, will be greatest under the alternatives providing less than 200-year levels of protection.

(g) Consumption of Environmental Resources. - There would be impacts associated with developing additional natural resources needed for reconstruction of the flood plain subsequent to a flood. Little information is available estimating the types and quantities of building materials needed for reconstruction after a major inundation. Since most flood damage occurs as the result of ponding, very little concrete replacement is likely. However, gypsum board, wood, carpeting, and insulation would very likely sustain significant damage. Alternatives with 200-year levels of protection or greater would impact environmental resources much less than alternatives having lower than 200-year levels of protection.

(h) Risk Aversion. - Many people place a premium on the avoidance of risk. In the case of flooding, this risk averse behavior means that flood victims will usually perceive themselves as having sustained losses significantly in excess of the property and possessions they lost. This added value is attributed to such things as fear (of death, injury, loss of loved ones), mental anguish, trauma, general disruption, and so on. There is also evidence that if a flood involves the possibility of contamination by flood disturbed hazardous waste, the premium placed on the avoidance of risk is significantly higher. The alternatives providing at least 200-year levels of protection offer the greatest security against risk because these alternatives offer the greatest levels of protection.

(i) Economic Disruption. - Flood inundation within the flood plain would have significant impacts on the day to day business activities of the Sacramento area. Many businesses would be forced to close, at least temporarily, during the inundation and cleanup periods. Halt in productivity, in any business, can be devastating. In addition, Sacramento, being the State capitol, carries on significant government activities. Significant flooding would temporarily stop government operations. Alternatives providing 200-year levels of protection or greater ensure against these types of impacts.

A rough comparison of these differences may be obtained by examining the extent to which, over the assumed 100-year life of the project, each of the alternatives would reduce the flood inundation damages likely to occur under the "without" project (or no action) condition. Annual damages under this baseline condition would be $191 million. The 400-year alternative would reduce this figure by $163 million. The 200-year alternative would produce a $134 million reduction. The 150-year alternative would reduce the projected damages by $101 million annually. Finally, the 100-year (FEMA) alternatives would produce a $52 million reduction. If these figures are indicative of environmental impacts avoided, the impacts produced by the 100-year (FEMA) alternative during the life of the project would be

significantly greater than the impacts produced by all of the other alternatives.

c. Public Health and Safety. - By 1992, it is estimated that over 366,000 people will reside within the 100-year flood plain of the American River. Significant portions of this flood plain could flood to a level of 5 feet or more in the event of a levee failure. Depending on the size and circumstances of the failure, flooding could be swift and extensive, placing a heavy strain on the evacuation capabilities of the responsible local agencies. Even with a relatively long warning time (7-9 hours) prior to the break, a major flood event affecting the entire flood plain could cause many fatalities. If the warning time is relatively short (less than 1 hour), the loss of life could reach catastrophic proportions.

Two areas of the City of Sacramento are of particular concern: Natomas, which is currently inhabited by about 35,000 residents, and the Pocket area which contains about 40,000 residents. Depending on the magnitude of the storm, flood depths in these areas could reach 15 feet. Since both areas suffer from a lack of adequate exit routes to facilitate rapid evacuation, flooding would not only cause extensive property damage, but would pose a serious and immediate threat to public safety. The potential for flooding in these areas is magnified by their dependence on high earthen levees for protection. High levees essentially function as long dams without normal dam safety features such as emergency spillways, outlet facilities, and seismic design criteria. Storm waters moving at erosive velocities for miles along the slope of the levees need only encounter a single weak spot in the system to cause a breach and produce an uncontrolled, life-threatening flood. The performance of the American River levee system during the 1986 flood provides a good example of the inherent risks associated with levees. During the 1986 flood, the lower American River flows peaked for short durations at about 134,000 cfs. Near the Business 80 crossing, significant erosion damage occurred. Water velocities at this location were estimated at only about 4 feet per second (fps). Alternatives which incorporate objective releases of 180,000 cfs are capable of generating velocities well in excess of 4 fps at different locations along the river. For example, at "H" Street, hydraulic models indicate water velocities would be in excess of 10 fps with a 180,000 cfs objective release. Similarly, at the Guy West pedestrian bridge velocities could reach in excess of 9 fps. Velocities of at least 10 fps are expected at Sunrise bridge. While erosion protection would be incorporated into levee designs to prevent failures it must be remembered that should some natural disaster (an earthquake, for example) occur which compromised the structural integrity of the erosion protection along the levee these velocities would be very destructive. Levees cannot be feasibly designed to the same criteria as dam facilities. The State Department of Water Resources has long

recognized this risk. In its "Bulletin 199 - California Flood Management: An Evaluation of Flood Damage Prevention Programs; September 1980," the Department states "Levees are the basic method of providing local flood protection in the United State . . . they are also the method with the greatest potential risk of failure."

The ability of the existing system to safely contain high flows is constrained by the relatively narrow width of the floodway. Widening the floodway is infeasible due to the proximity of existing development. Thus, the only way to increase the design capacity of the lower American River channel is to increase the height of these levees as proposed under the 150-year alternative and two of the three 100-year (FEMA) alternatives. This approach, however, results in higher velocities and exacerbates the inherent risks of the system.

The risk of flooding in Sacramento is further heightened by the uncertainties associated with forecasting flood events in the American River. Since the hydrologic record for this watershed is relatively short (about 85 years), additional significant flood events can cause major adjustments in estimates of flood frequencies. For example, in the early 1950's Folsom Dam was designed to provide protection from the largest rainstorm of record within the region (the 1937 storm). This "Reservoir Design Flood" (RDF) was estimated to be about a 250-year storm based on what was then a 40-50 year record. In 1961, following a detailed evaluation of the 1955 storm which exceeded the RDF and established a record for northern California, the protection afforded by Folsom Reservoir was downgraded based on a new flood-frequency curve prepared by the Corps. The new curve indicated that the American River flood plain was protected to about a 120-year level. Nevertheless, the 1986 storm, later estimated to be about a 70-year event, nearly resulted in significant uncontrolled flooding. In the aftermath of this storm, the frequency curve was updated to reflect the last 25 years of record. This latest curve indicates that the flood plain is protected only to about a 63-year level, roughly half the protection thought to exist prior to 1986.

Uncertainties in flood forecasting also impact on the viability of the 100- and 150-year protection level alternatives. The 100- and 150-year alternatives require the use of Folsom Reservoir surcharge storage space. Surcharge storage space is normally provided in a reservoir as a safety factor to account for a large variety of uncertainties. By elimination of the "safety" storage, there is increased risk associated with the operation of these alternatives. Current technology is not capable of eliminating the many uncertainties that go into flood control reservoir operations that would eliminate the risk associated with the use of surcharge overtopping Folsom Dam in the event of unforeseen circumstances.

Against this background of uncertainty regarding the magnitude of the storms which may be generated in the American River basin, the alternatives which would create high levels of flood protection based on new storage at Auburn would provide a far greater margin of safety than the alternatives which rely on increasing the capacity of the existing system. The dam alternatives are designed to handle big storms. They also provide a reliable structural hedge against unexpectedly large events in the form of surcharge storage space, and thus reduce the extent to which flood plain occupants must rely on levee freeboard in the event of storms which exceed the design capacity of the system.

Finally, as noted above, under existing local and Federal flood plain management regulations, all of the alternatives would provide a sufficient level of protection to permit development to proceed in Natomas and elsewhere in the 100-year flood plain. This development would significantly increase the number of people and the amount of property exposed to flooding and would increase the losses produced by an uncontrolled event. It is possible in this context that the 100-year (FEMA) alternatives could actually be less safe than the no-action alternative since the incremental reduction in risk achieved by the FEMA alternatives could be offset by an increase in the severity of a flood event due to the additional people and property at risk in the deepest portions of the flood plain. The 150-year alternative would achieve more of a balance between reduced risk and increased severity of flooding. However, the 200- and 400-year alternatives by substantially reducing the risk of flooding would achieve the greatest net gains in public safety.

The tabulation below shows an estimate of the relative potential for loss of life within the 100-year flood plain for the various levels of flood protection provided by the alternatives over the project life (100 years). The no-action alternative is the base condition. For comparative purposes, the public health and safety factor is defined as the potential for loss of life during a major flood. Loss of life is dependent on many considerations, including the (1) flood plain population at risk (individuals who cannot or will not vacate the flood plain in an emergency), (2) flood-warning time, (3) potential depth of flooding, and (4) the probability of the flood event.

| Alternative | Potential Loss of Life (Change from Base Condition)[1] | Public Health and Safety Rating |
|---|---|---|
| No Action | Base Condition | Low |
| Three 100-year (FEMA) | 30-40% Increase | None |
| 150-year | 10-15% Increase | Low |
| 200-year | 15-20% Decrease | High |
| 400-year | 40-50% Decrease | Very High |

[1]Over the project life of 100 years.

d. Acceptability. - Non-Federal participation in the project is essential because the non-Federal sponsor must share in the cost of construction and provide long-term maintenance and operation. Without this participation, it would not be possible to proceed with the project. In this case, the State and SAFCA have taken the position that they will not support any project providing less than a 200-year level of protection to the people and property currently occupying the American River flood plain.

This position is based on the public safety considerations discussed above. It recognizes that the areas lying within the flood plain are subject to a significant risk of uncontrolled flows with the potential for a catastrophic loss of life and property. Under these circumstances, the non-Federal sponsors have concluded that the "average" level of protection afforded by the 100-year standard is inadequate. They note that long-term flood protection planning along the American River for most of the last 40 years has been based on protecting against the standard project flood (SPF). This standard was developed by the Corps in the late 1940's and early 50's and was used to ensure that Federal flood control projects involving unusually high-valued urban property and significant risks to human life achieve a uniformly high level of flood protection. The SPF has been defined as " a hypothetical flood representing the critical flood runoff volume and peak discharge that may be expected from the most severe combination of meteorologic and hydrologic conditions that is considered reasonably characteristic for the hydrologic region involved." As a general rule, the SPF is considered to be an event likely to occur about once every 200 to 300 years.

In the aftermath of the most serious flood event in Sacramento's recent history, the non-Federal sponsors have reaffirmed the appropriateness of achieving a high (SPF) level of protection for Sacramento. Since 200-year protection represents the low range of the SPF standard, the non-Federal sponsors have sought to protect the community at least to that level. On this

basis, the 100- (FEMA) and 150-year alternatives are considered unacceptable.

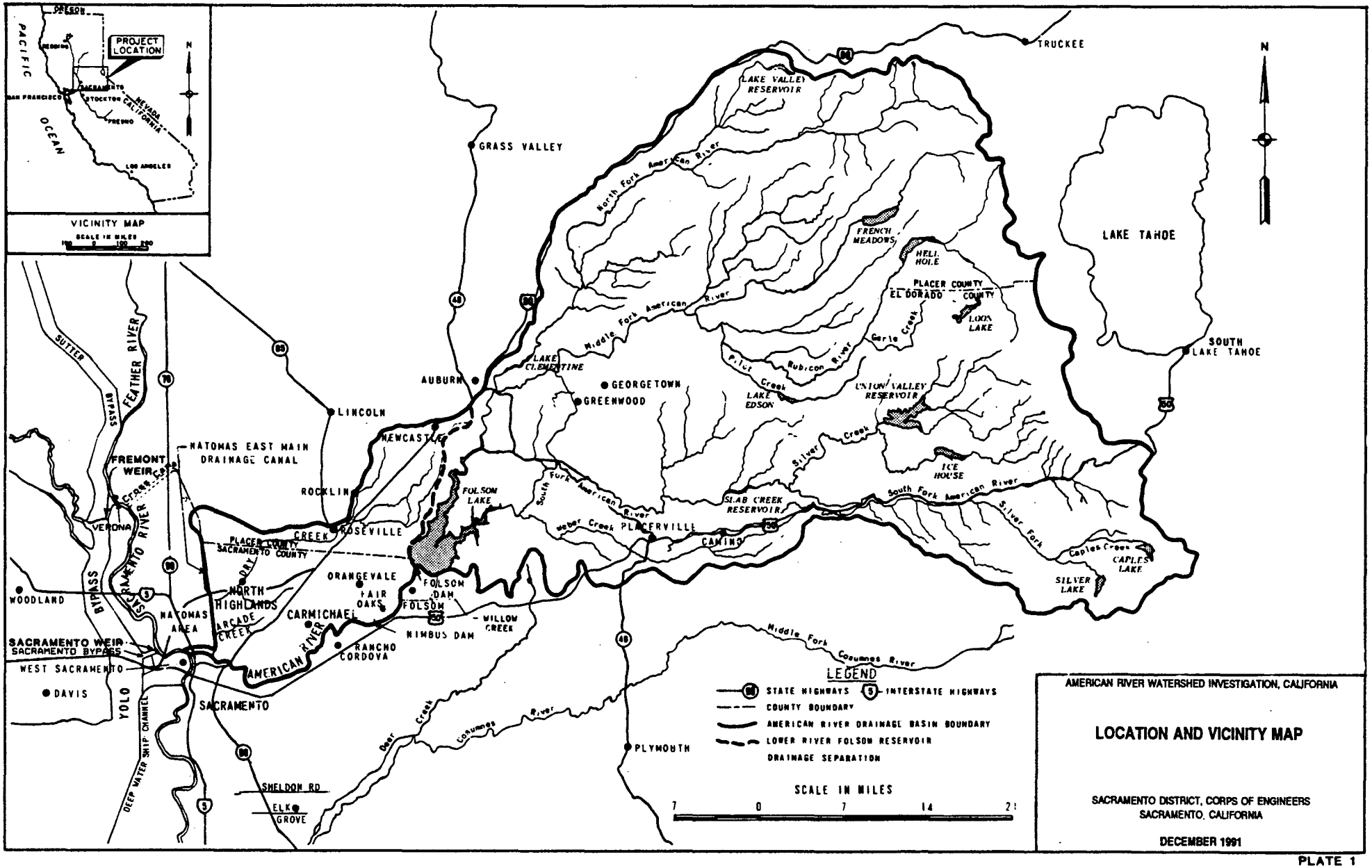
As between the 200- and 400-year alternatives, the 200-year plan has achieved more widespread local acceptance for two reasons. First, the 200-year alternative is less costly by about $100 million. Assuming final costs in the range of $700 to $800 million for the 400-year alternative, the smaller project would represent an 12-13 percent cost saving. Second, the dam proposed under the 400-year alternative is perceived by some members of the environmental community as a facility that would be more easily convertible to multipurpose use than the smaller 200-year dam. The concern is that the 400-year structure would be large enough to accommodate a permanent pool for water storage while still providing the minimum 200-year level of flood protection to which the non-Federal sponsors are committed. Thus, the non-Federal sponsor feels that the larger project is not sufficiently neutral with respect to development of the natural resources in the canyon area. In deference to these views and in consideration of the cost savings which could be realized with a smaller project, the non-Federal sponsors have recommended that the Corps consider selection of the 200-year alternative for submittal to Congress.

22. Plan Selection. - Final plan selection was based on all of the above criteria. Table B-38 compares the relative capability of each alternative to satisfy each of the selection factors. Both qualitative and numerical ratings were made, and the major advantages and disadvantages of each alternative are shown to help explain the ratings. In the numerical rating system, a scale of zero to five was used. In this system, a zero ranked lowest and a five ranked highest. The numerical ratings given each alternative under each evaluation category were then summed to provide an overall numerical ranking of the alternative.

The 400-year plan in the draft feasibility report was rated highest overall based upon the four evaluation criteria (economic efficiency, public health and safety, and environmental categories). For the reasons outlined above, the Reclamation Board and SAFCA, after the close of the comment period on the draft report, identified the 200-year plan as the locally preferred plan. On the basis of this State recommendation, the 200-year alternative was identified as the selected plan for submittal to Congress. The non-Federal sponsor recognizes that an exception will need to be granted by the ASA (CW) to deviate from the NED plan.

## TABLE B-38
## PLAN SELECTION COMPARISON OF ALTERNATIVES

| Alternative | No Action | 100-year (FEMA) Levees | 100-year (FEMA) Storage | 100-year (FEMA) Levees/Storage | 150-year | 200-year | 400-year (NED) |
|---|---|---|---|---|---|---|---|
| Relative Rating | | | | | | | |
| Efficiency | None 0 | Low 2 | Low 2 | Low 2 | Mod. 3 | High 4 | Very High 5 |
| Public Health & Safety | Low 1 | None 0 | None 0 | None 0 | Low 2 | High 4 | Very High 5 |
| Acceptability | None 0 | None 0 | Low 0 | None 0 | None 0 | High 5 | High 2 |
| Evironmental Conditions | Moderate 3 | Low 2 | Low 2 | Low 2 | Low 2 | Mod. 3 | High 4 |
| Total | 4 | 4 | 4 | 4 | 7 | 16 | 16 |
| Advantages | - No initial adverse environmental impacts<br>- No reduction in CVP benefits | - FEMA level of flood protection<br>- No reduction in CVP benefits | - FEMA level of flood protection | - Fema level of flood protection | - Relatively high level of flood protection | - High level of flood protection<br>- No reduction in CVP benefits | - Very high level of flood protection<br>- Highest net economic benefits<br>- No reduction in CVP benefits |
| Disadvantages | - High remaining flood risk<br>- Likely high adverse environmental impacts following flood | - Moderate remaining flood risk<br>- Increase in flows and velocities in levee system<br>- Allows potential for advese indirect environmental impacts in Natomas | - Moderate remaining flood risk<br>- Reduction in water resource benefits in CVP<br>- Allows potential for adverse indirect environmental impacts in Natomas | - Moderate remaining flood risk<br>- Increase in flows and velocities in levee system<br>- Reduction in water resource benefits in CVP<br>- Allows potential for adverse indirect environmental impacts in Natomas | - Significant increase in flows and velocities in levee system<br>- Reduction in water resource benefits in CVP<br>- Allows potential for adverse indirect environmental impacts | - Allows potential for adverse indirect environmental impacts in Natomas | - Allows potential for adverse indirect environmental impacts in Natomas |



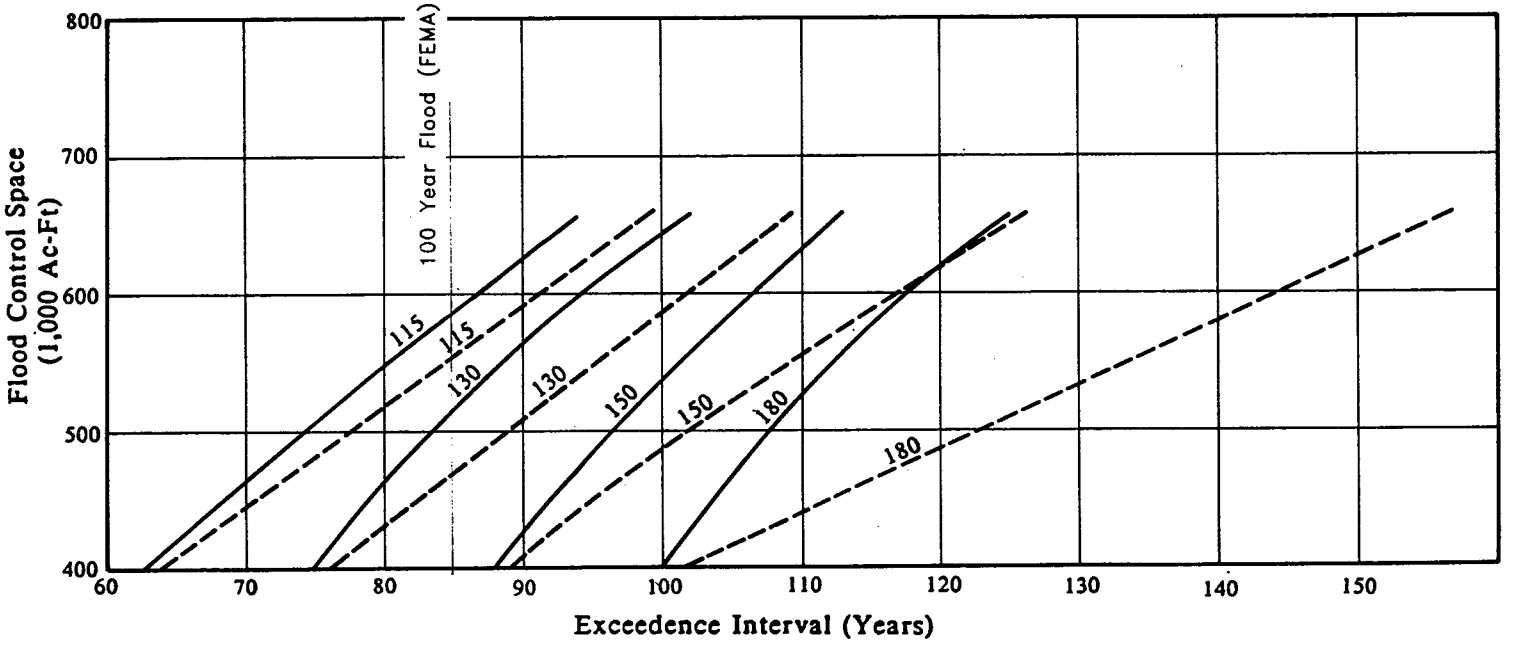

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

## LOCATION AND VICINITY MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE 1




LEGEND:

115 Channel Capacity (1,000 cfs)
—— Existing Spillway (Maximum Pool Elevation 470.0)
– – – Spillway lowered 15 feet (Maximum Pool Elevation 466.0)

NOTE:

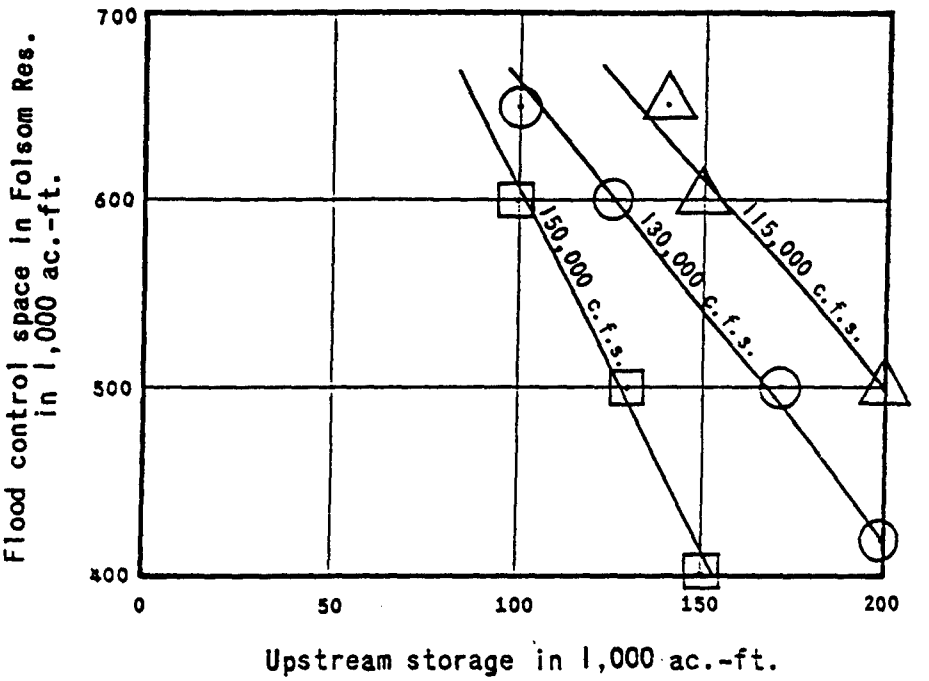
80,000 Ac-Ft initial encroachment into flood space;
4 hr. delay on releases above starting release of 20,000 cfs;
Outflow ≈ inflow lagged 4 hrs. until channel capacity is reached;
Maximum rate of change of release is 7,500 cfs/hr.;
- 47,000 Ac-Ft of upstream storage credit for exceedence intervals ≥ 100 yrs.

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

# FOLSOM DAM OPERATION
# FOR
# DOWNSTREAM CONTROL

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 2




NOTES:

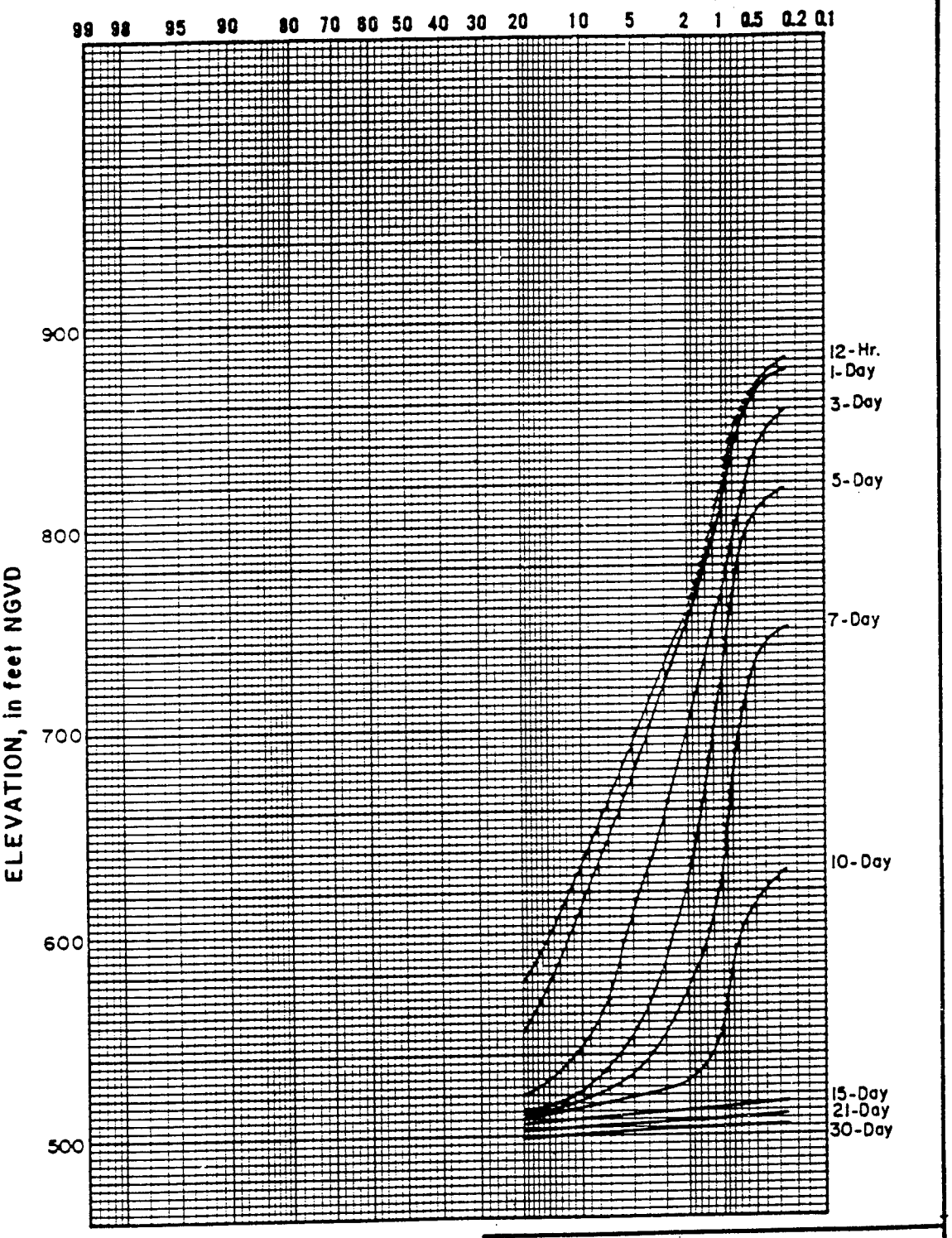
1. Curves represent the design channel capacity in the American River below Folsom Dam.
2. The max. upstream storage that would be effective in the system is 200,000 ac.-ft.
3. Routings reflect little or no surcharge in Folsom Reservoir.
4. Upstream storage is to be proportionally divided among the five upstream Reservoirs: (1) French Meadows, (2) Hell Hole, (3) Loon Lake, (4) Union Valley, (5) Ice House.
5. Upstream Reservoirs control approx. 14% of the drainage area and approx. 18% of the runoff.

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

REQUIRED STORAGE SPACE FOR
EXISTING UPSTREAM RESERVOIRS
100-YEAR PROTECTION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 3




NOTES:

1. Dam located at River Mile 20.1 designed to control a 200-Yr. flood with 400,000 ac.-ft. of flood control space in Folsom Lake and a 115,000 cfs objective release.
2. Top of inactive pool - elevation 490.
3. Curves define the duration of time elevation is equalled or exceeded.

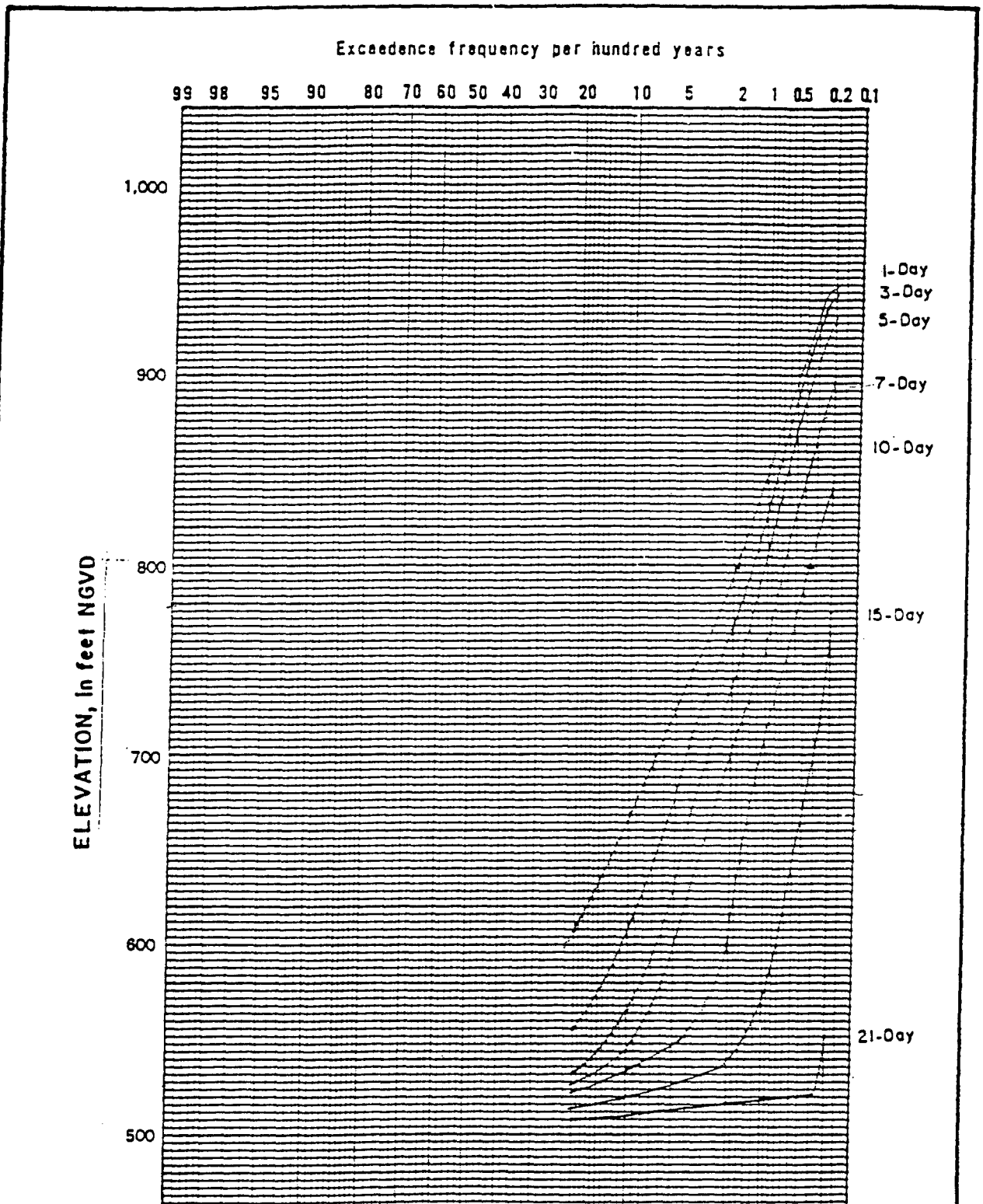
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

ELEVATION -
FREQUENCY-DURATION
FLOOD CONTROL DAM ALTERNATIVE
200–YEAR PROTECTION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

DECEMBER 1991

PLATE 4




NOTES:

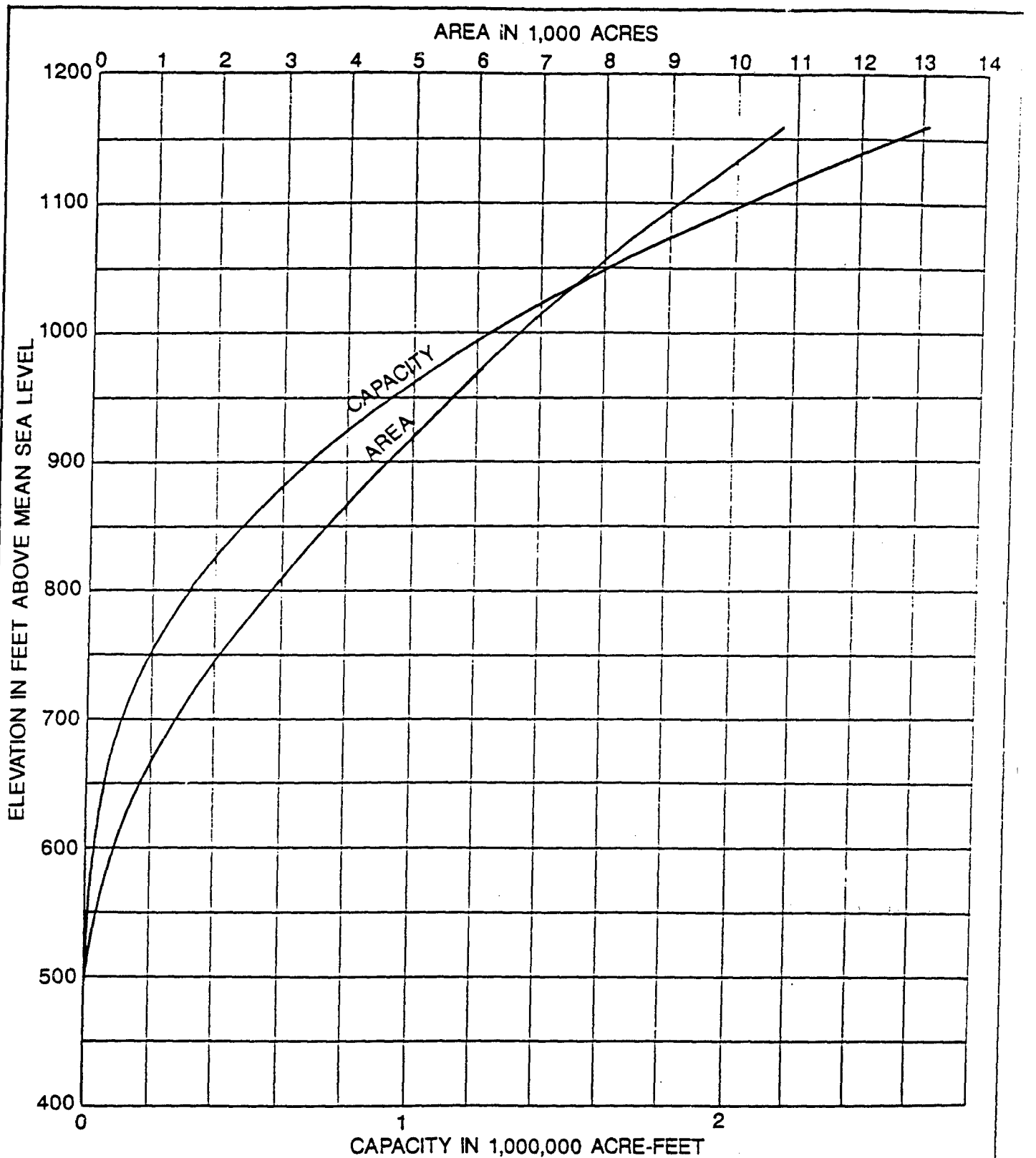
1. Dam located at River Mile 20.1 designed to control a 400-Yr. flood with 400,000 ac.-ft. of flood control space in Folsom Lake and a 115,000 cfs objective release.
2. Top of inactive pool - elevation 490.
3. Curves define the duration of time elevation is equalled or exceeded.

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

# ELEVATION-FREQUENCY-DURATION
## FLOOD CONTROL DAM ALTERNATIVE
## 400-YEAR PROTECTION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 5



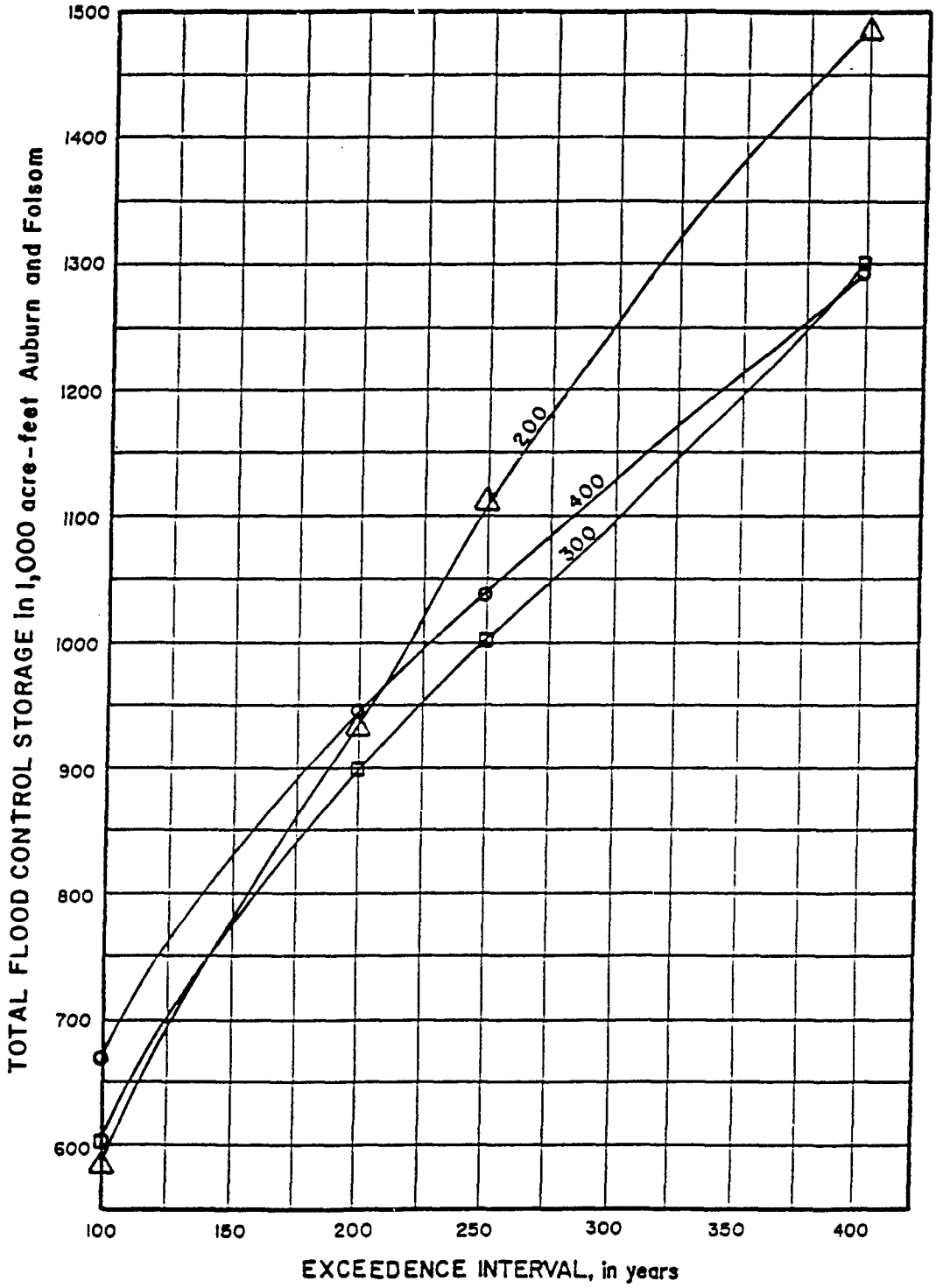

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

AUBURN DAMSITE

AREA-CAPACITY CURVES

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
**DECEMBER 1991**

PLATE 6




LEGEND:

400 Flood Control Storage Used at Folsom Lake (1,000 acre-feet)

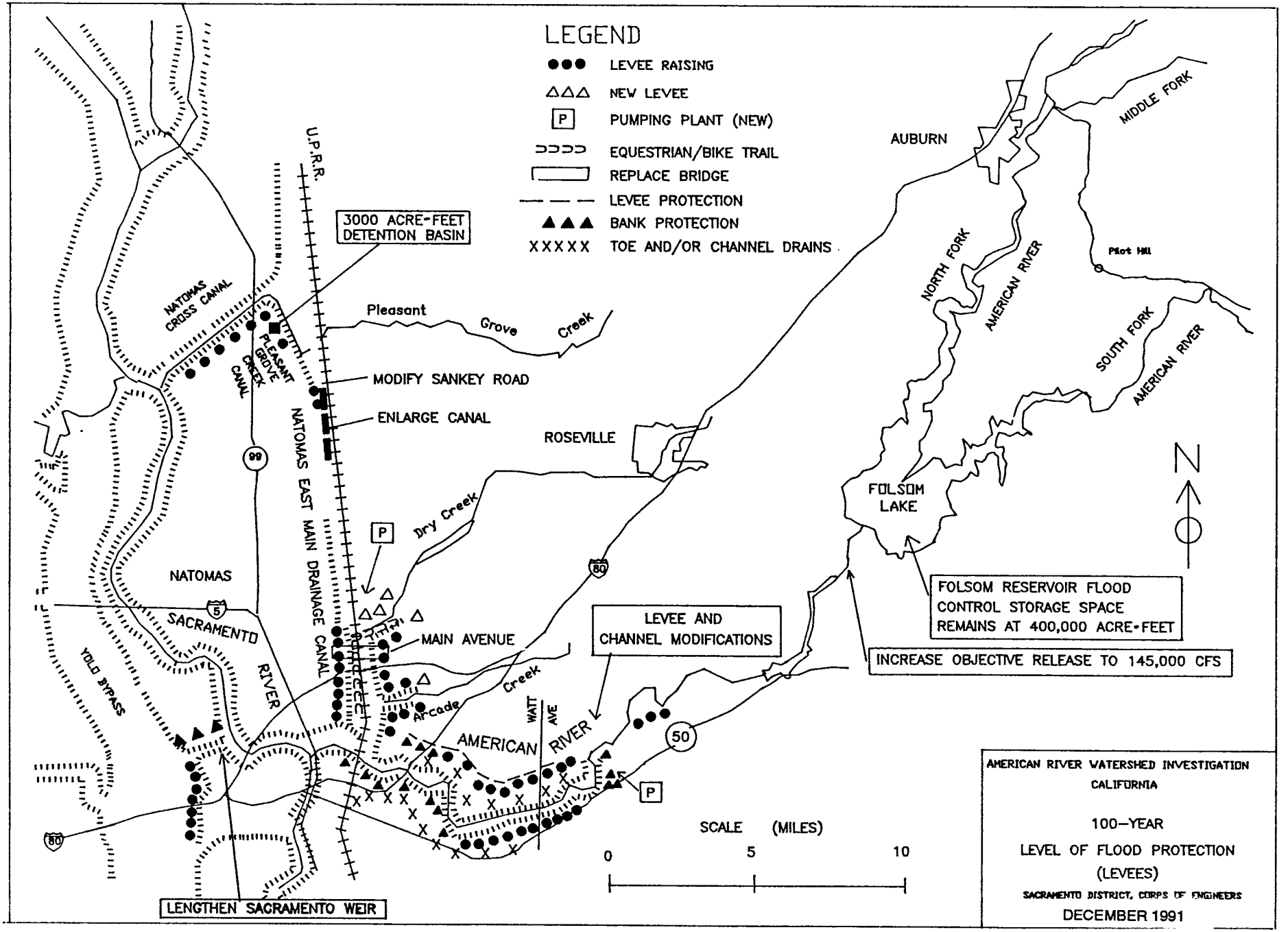
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

## STORAGE-EXCEEDENCE

FLOOD CONTROL DAM OPTIMIZATION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 7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LEVEE RAISING
NEW LEVEE
PUMPING PLANT (NEW)
EQUESTRIAN/BIKE TRAIL
REPLACE BRIDGE
LEVEE PROTECTION
BANK PROTECTION
TOE AND/OR CHANNEL DRAINS
3000 ACRE-FEET DETENTION BASIN
MODIFY SANKEY ROAD
ENLARGE CANAL
LEVEE AND CHANNEL MODIFICATIONS
FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE REMAINS AT 400,000 ACRE-FEET
INCREASE OBJECTIVE RELEASE TO 145,000 CFS
LENGTHEN SACRAMENTO WEIR
AUBURN
MIDDLE FORK
NORTH FORK
AMERICAN RIVER
SOUTH FORK
AMERICAN RIVER
Pilot Hill
ROSEVILLE
FOLSOM LAKE
N
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK CANAL
Pleasant Grove Creek
U.P.R.R.
NATOMAS EAST MAIN DRAINAGE CANAL
Dry Creek
MAIN AVENUE
Arcade Creek
WATT AVE
AMERICAN RIVER
NATOMAS
SACRAMENTO RIVER
YOLO BYPASS
SCALE (MILES)
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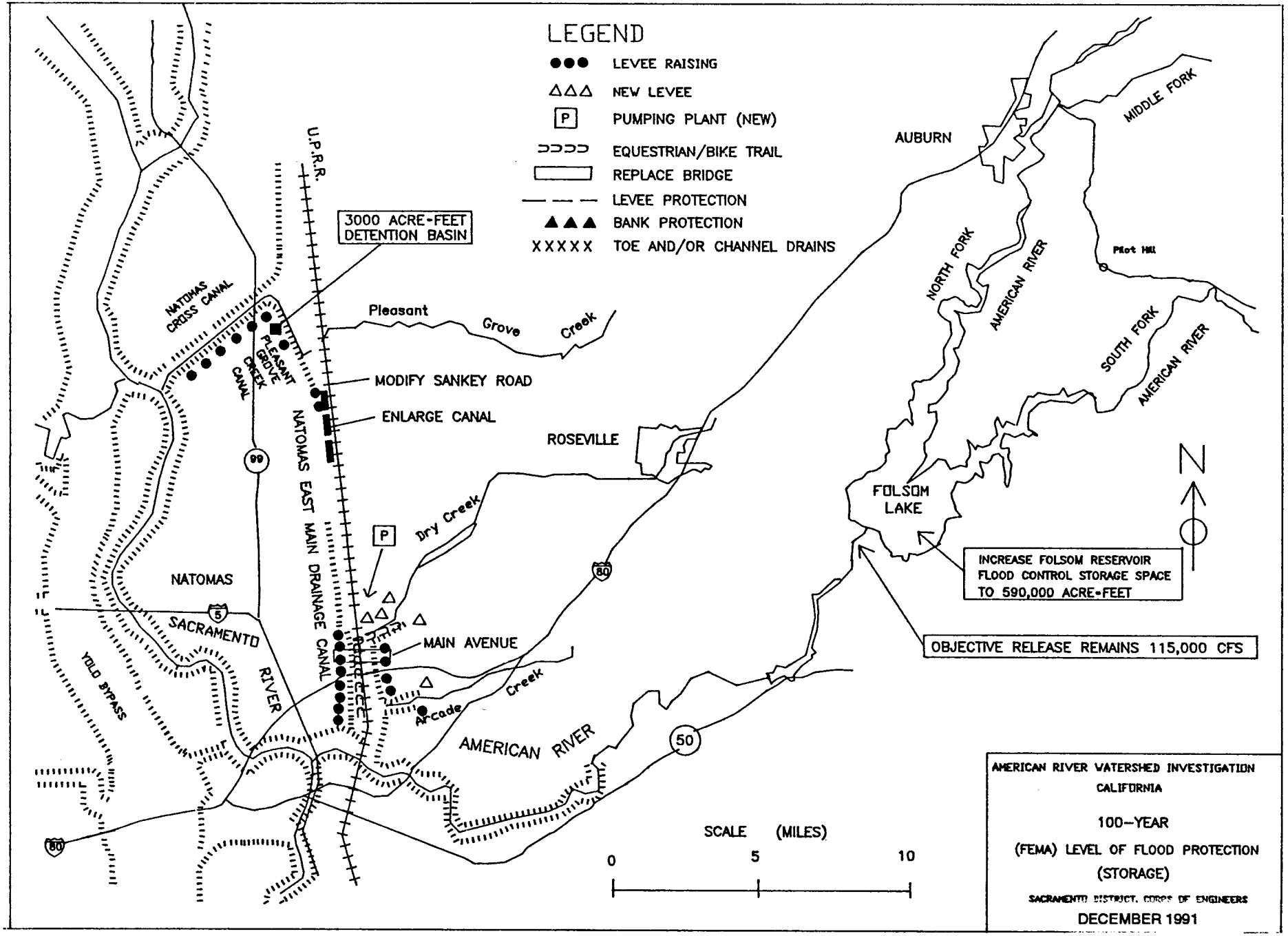
5
10
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
100-YEAR
LEVEL OF FLOOD PROTECTION
(LEVEES)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 8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EQUESTRIAN/BIKE TRAIL
REPLACE BRIDGE
LEVEE PROTECTION
BANK PROTECTION
TOE AND/OR CHANNEL DRAINS
3000 ACRE-FEET DETENTION BASIN
MODIFY SANKEY ROAD
ENLARGE CANAL
INCREASE FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE TO 590,000 ACRE-FEET
OBJECTIVE RELEASE REMAINS 115,000 CFS
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK CANAL
Pleasant Grove Creek
U.P.R.R.
NATOMAS EAST MAIN DRAINAGE CANAL
Dry Creek
MAIN AVENUE
Arcade Creek
NATOMAS
SACRAMENTO RIVER
YOLO BYPASS
AMERICAN RIVER
ROSEVILLE
AUBURN
MIDDLE FORK
NORTH FORK AMERICAN RIVER
SOUTH FORK AMERICAN RIVER
Pilot Hill
FOLSOM LAKE
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SCALE (MILES)
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99
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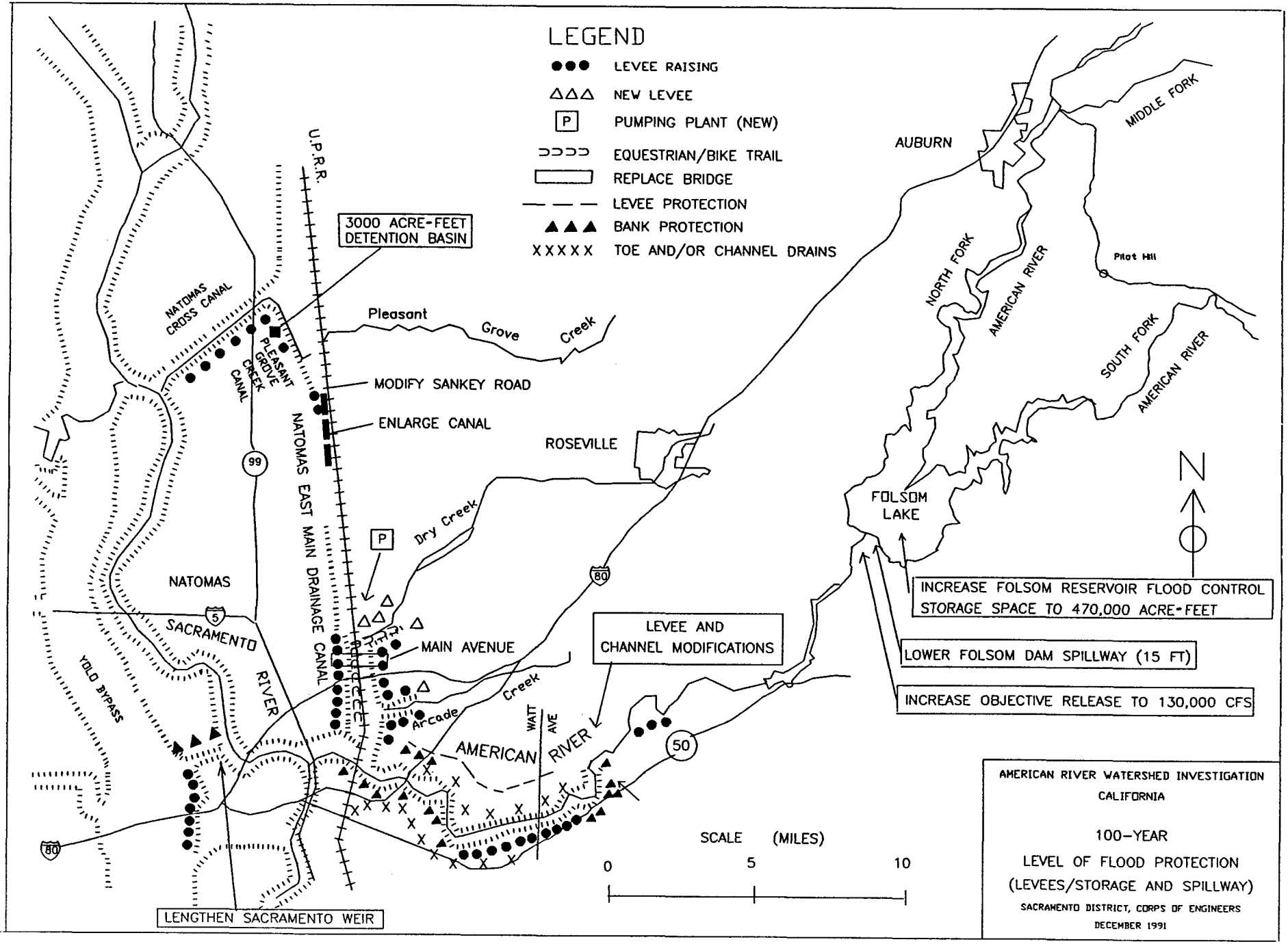
80
50
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
100-YEAR
(FEMA) LEVEL OF FLOOD PROTECTION
(STORAGE)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 9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PUMPING PLANT (NEW)
EQUESTRIAN/BIKE TRAIL
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LEVEE PROTECTION
BANK PROTECTION
TOE AND/OR CHANNEL DRAINS
3000 ACRE-FEET DETENTION BASIN
MODIFY SANKEY ROAD
ENLARGE CANAL
LEVEE AND CHANNEL MODIFICATIONS
LENGTHEN SACRAMENTO WEIR
INCREASE FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE TO 470,000 ACRE-FEET
LOWER FOLSOM DAM SPILLWAY (15 FT)
INCREASE OBJECTIVE RELEASE TO 130,000 CFS
U.P.R.R.
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK CANAL
Pleasant Grove Creek
NATOMAS EAST MAIN DRAINAGE CANAL
Dry Creek
MAIN AVENUE
NATOMAS
SACRAMENTO RIVER
YOLO BYPASS
ROSEVILLE
AUBURN
MIDDLE FORK
NORTH FORK
AMERICAN RIVER
Pilot Hill
SOUTH FORK
AMERICAN RIVER
FOLSOM LAKE
Arcade Creek
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SCALE (MILES)
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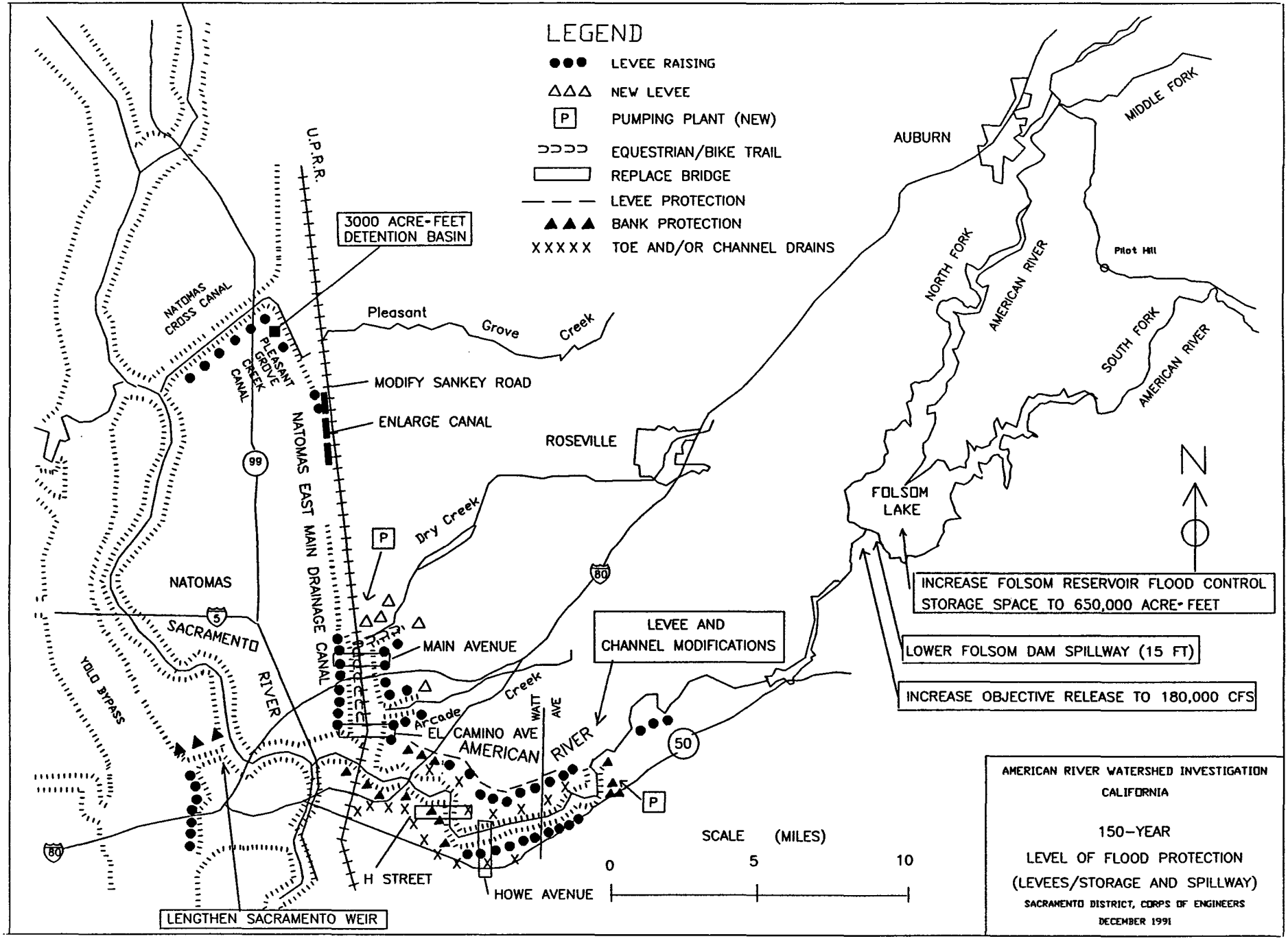
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
100-YEAR
LEVEL OF FLOOD PROTECTION
(LEVEES/STORAGE AND SPILLWAY)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 10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NEW LEVEE
PUMPING PLANT (NEW)
EQUESTRIAN/BIKE TRAIL
REPLACE BRIDGE
LEVEE PROTECTION
BANK PROTECTION
TOE AND/OR CHANNEL DRAINS
3000 ACRE-FEET DETENTION BASIN
MODIFY SANKEY ROAD
ENLARGE CANAL
LENGTHEN SACRAMENTO WEIR
LEVEE AND CHANNEL MODIFICATIONS
INCREASE FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE TO 650,000 ACRE-FEET
LOWER FOLSOM DAM SPILLWAY (15 FT)
INCREASE OBJECTIVE RELEASE TO 180,000 CFS
U.P.R.R.
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK CANAL
Pleasant Grove Creek
NATOMAS EAST MAIN DRAINAGE CANAL
Dry Creek
ROSEVILLE
AUBURN
MIDDLE FORK
NORTH FORK
AMERICAN RIVER
Pilot Hill
SOUTH FORK
AMERICAN RIVER
FOLSOM LAKE
NATOMAS
SACRAMENTO RIVER
YOLO BYPASS
MAIN AVENUE
Arcade Creek
EL CAMINO AVE
AMERICAN RIVER
WATT AVE
H STREET
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SCALE (MILES)
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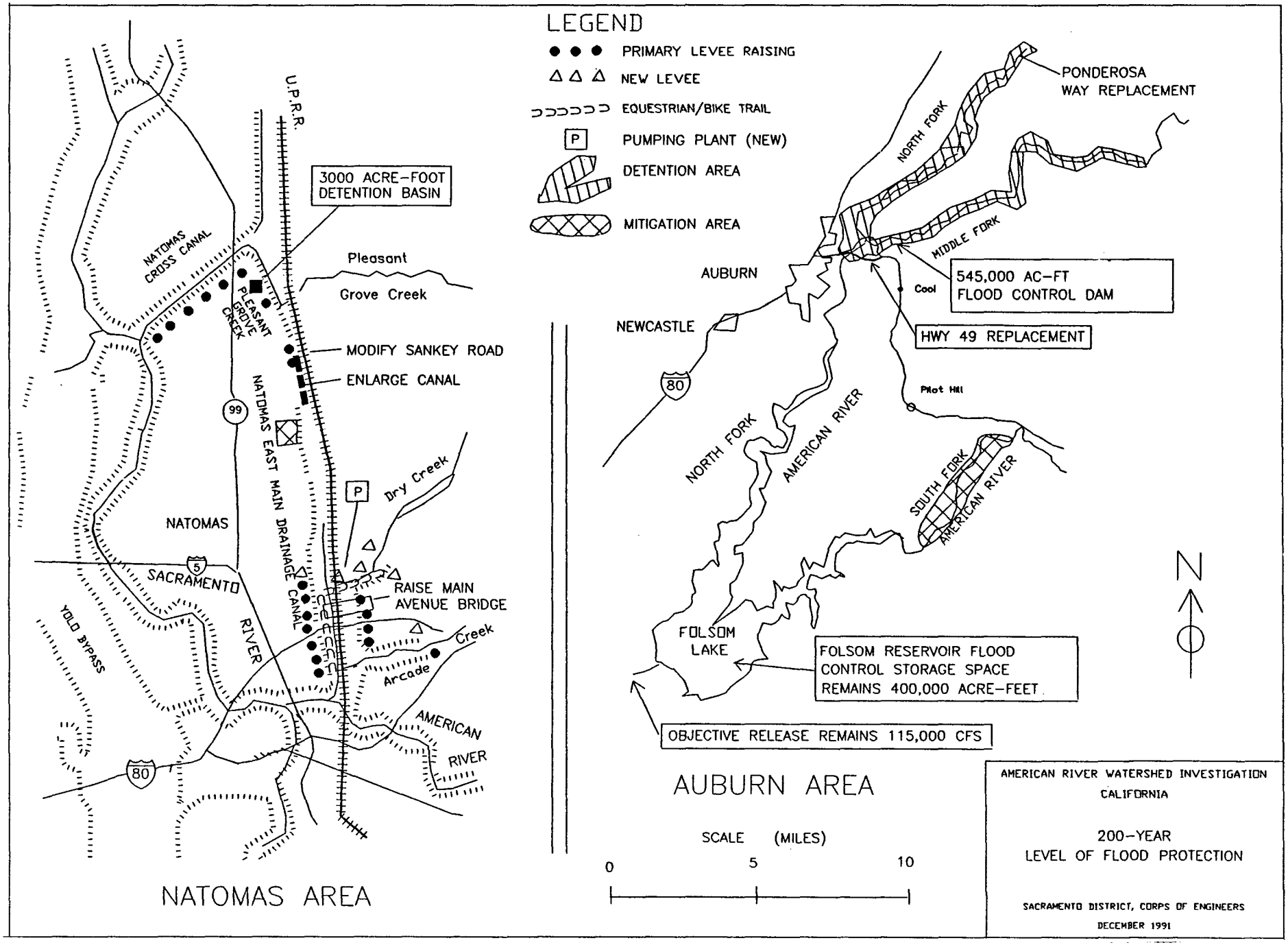
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
150-YEAR
LEVEL OF FLOOD PROTECTION
(LEVEES/STORAGE AND SPILLWAY)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 11


LEGEND
PRIMARY LEVEE RAISING
NEW LEVEE
EQUESTRIAN/BIKE TRAIL
PUMPING PLANT (NEW)
DETENTION AREA
MITIGATION AREA
U.P.R.R.
3000 ACRE-FOOT DETENTION BASIN
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK
Pleasant Grove Creek
MODIFY SANKEY ROAD
ENLARGE CANAL
99
NATOMAS EAST MAIN DRAINAGE CANAL
Dry Creek
NATOMAS
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SACRAMENTO RIVER
YOLO BYPASS
RAISE MAIN AVENUE BRIDGE
Arcade Creek
AMERICAN RIVER
80
NATOMAS AREA
PONDEROSA WAY REPLACEMENT
NORTH FORK
MIDDLE FORK
AUBURN
Cool
545,000 AC-FT FLOOD CONTROL DAM
HWY 49 REPLACEMENT
NEWCASTLE
80
Pilot Hill
NORTH FORK AMERICAN RIVER
SOUTH FORK AMERICAN RIVER
FOLSOM LAKE
FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE REMAINS 400,000 ACRE-FEET
OBJECTIVE RELEASE REMAINS 115,000 CFS
AUBURN AREA
SCALE (MILES)
0
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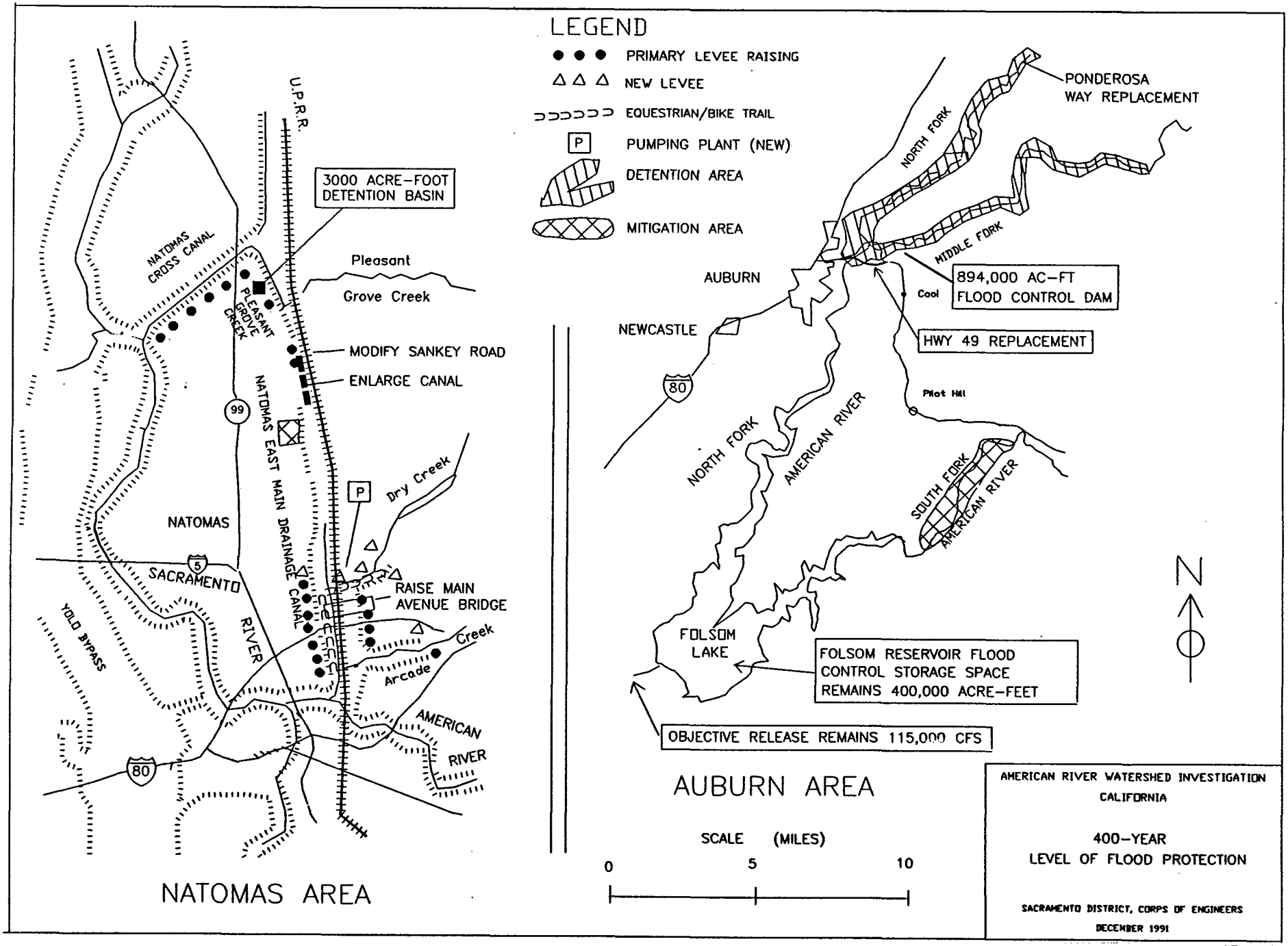
N
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
200-YEAR
LEVEL OF FLOOD PROTECTION
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 12


LEGEND
PRIMARY LEVEE RAISING
NEW LEVEE
EQUESTRIAN/BIKE TRAIL
PUMPING PLANT (NEW)
DETENTION AREA
MITIGATION AREA
3000 ACRE-FOOT DETENTION BASIN
U.P.R.R.
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK
Pleasant Grove Creek
MODIFY SANKEY ROAD
ENLARGE CANAL
NATOMAS EAST MAIN DRAINAGE CANAL
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Dry Creek
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SACRAMENTO RIVER
YOLO BYPASS
RAISE MAIN AVENUE BRIDGE
Arcade Creek
AMERICAN RIVER
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NATOMAS AREA
PONDEROSA WAY REPLACEMENT
NORTH FORK
MIDDLE FORK
AUBURN
894,000 AC-FT FLOOD CONTROL DAM
Cool
NEWCASTLE
HWY 49 REPLACEMENT
80
Pilot Hill
NORTH FORK AMERICAN RIVER
SOUTH FORK AMERICAN RIVER
FOLSOM LAKE
FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE REMAINS 400,000 ACRE-FEET
OBJECTIVE RELEASE REMAINS 115,000 CFS
AUBURN AREA
SCALE (MILES)
0
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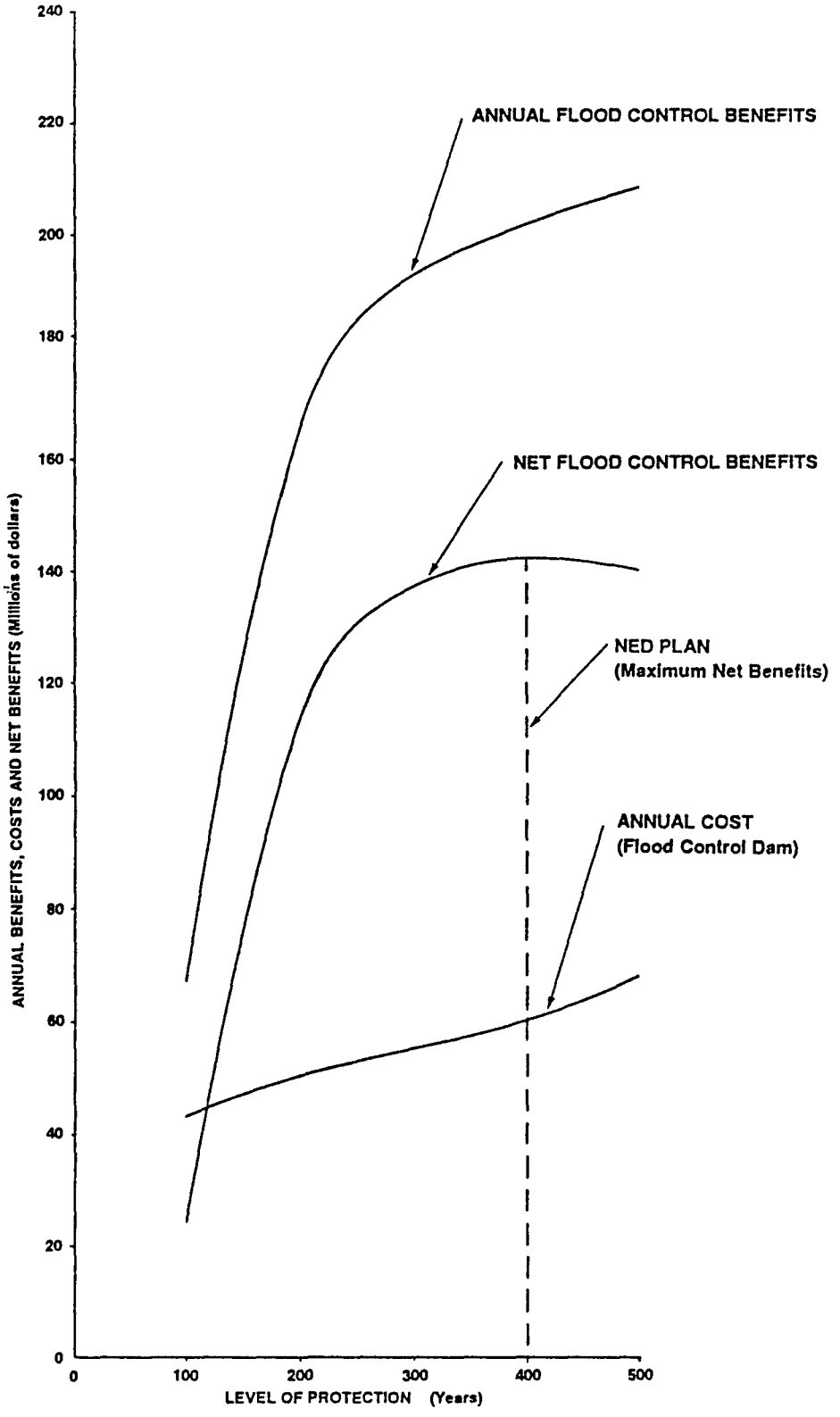
N
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
400-YEAR
LEVEL OF FLOOD PROTECTION
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 13




- OCTOBER 1991 PRICE LEVELS

-100 YEAR PROJECT LIFE AND 8-3/4 PERCENT DISCOUNT RATE

-MITIGATION COSTS FOR SECONDARY IMPACTS NOT INCLUDED

AMERICAN RIVER WATERSHED, CALIFORNIA

**PLAN OPTIMIZATION-**
**BENEFITS & COSTS**
**VS.**
**LEVEL OF PROTECTION**

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
DECEMBER 1991

PLATE 14

# American River Watershed Investigation, California

# APPENDIX C

# Economics

AMERICAN RIVER WATERSHED
INVESTIGATION, CALIFORNIA

APPENDIX C

ECONOMICS

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# APPENDIX - ECONOMICS OF SELECTED PLAN

## CHAPTER I - INTRODUCTION

1. General. - This appendix describes the economic analysis used to develop the selected plan for the American River Watershed Investigation. This plan primarily includes a 545,000 acre-foot flood control dam near Auburn on the American River, levee and related channel flood control improvements around the Natomas area, and recreation trails associated with levee modification and construction for the Natomas area. The selected plan provides a 200-year level of flood protection to areas along main stem American River and in Natomas. This appendix includes a summary description of project costs and a detailed description of project benefits. It also includes a description of the project optimization process. Detailed information on project costs are included in the Design and Costs Estimates Appendix (Appendix N).

# CHAPTER II - COSTS

2. Costs. - Following are brief descriptions of first and annual costs for the project. Again, detailed descriptions are included in the Design and Costs Estimates Appendix.

a. General. - An M-Caces "Code of Accounts Cost Estimate" was made for the selected plan (200-year level of protection). Because the M-CASES cost estimate is extremely costly and time consuming, it was not applied to all the plan alternatives. Therefore, costs used for the plan formulation and optimization (Chapter IV of this appendix) were developed using traditional Corps procedures for feasibility studies.

It is believed that the relationship of the costs for project alternatives described in both the plan formulation and in the project optimization to the costs of the selected plan would be similar if the code of accounts were applied for all plans. Accordingly, the selection of the NED plan is believed to be valid. The project optimization is shown in Chapter IV of this appendix whereby the identification of the plan that maximized net economic development (NED) benefits is shown.

Also included in the first cost are estimated expenditures by the U. S. Bureau of Reclamation (USBR) on the Auburn Dam project to date. That portion of the USBR costs which would not need to be expended to construct the selected plan were considered as creditable costs to a flood control project. These costs amounted to $77.7 million ($74.5 million on 1990 price levels updated by the Corps to 1991 prices). These costs are used in identifying the total first cost and O&M cost allocation. They were not used in determining the economic feasibility of the selected plan. A detailed breakdown of the costs are provided in Appendix I and described more fully in the main report Chapter VIII.

b. First cost. - The estimated first cost for the selected plan is $698.2 million. First costs for major project items are summarized in Table II-1. All estimates are based on 1 October 1991 levels. Estimates include variable contingencies based on essential and expected conditions in project construction. Estimates for engineering and design and supervision and administration were based on experience for similar work in the Sacramento District.

c. Annual cost. - The estimated average annual cost is $61.7 million; item costs are summarized in Table II-2. Annual

costs were determined in accordance with EM 1110-2-1301 and are based on 1 October 1991 price levels, 8-3/4 percent interest, and 100-year amortization. Operation and maintenance (O&M for dam, detention area lands, levees, and related features as well as major replacement costs) were primarily based on experience for similar work in the Sacramento District. O&M costs to offset remaining adverse impacts in the reservoir area were based on the estimated program features.

TABLE II-1

SUMMARY FIRST COST
SELECTED PLAN 1/
($ 1,000)

| Item | Upper American River 2/ | Natomas Area | Total |
|---|---|---|---|
| Lands | 60,500 | 20,800 | 81,300 |
| Flood Control | (16,500) | (10,200) | (26,700) |
| Mitigation | (44,000) | (3,800) | (47,800) |
| Recreation | -- | (6,800) | (6,800) |
| Roads & Relocation | 103,400 | 4,000 | 107,400 |
| Dam | 320,700 | -- | 320,700 |
| Levee Modification | -- | 5,200 | 5,200 |
| Floodways & Channels | -- | 1,000 | 1,000 |
| Pumping Station | -- | 4,300 | 4,300 |
| Recreation Facilities | -- | 1,400 | 1,400 |
| Cultural Resources | 4,000 | 700 | 4,700 |
| Environmental Mitigation 3/ | 3,700 | 5,600 | 9,300 |
| E, D, S, and A 4/ | 79,000 | 6,200 | 85,200 |
| Subtotal | 571,300 | 49,200 | 620,500 |
| Creditable Expenditures to Date | 77,700 | -- | 77,700 |
| Total | 649,000 | 49,200 | 698,200 |

1/ October 1991 price levels.
2/ 545,000 ac-ft flood control storage facility near Auburn Dam site.
3/ Does not include lands.
4/ Engineering, Design, Supervision and Administration.

TABLE II-2

ANNUAL COSTS
SELECTED PLAN
($ 1,000 )

| Item | Upper American River | Natomas Area | Total |
|---|---|---|---|
| Total First Cost | 649,000 | 49,200 | 698,200 |
| Creditable Expenditures Deduction 1/ | -77,700 | -- | -77,700 |
| IDC 2/ | 64,500 | 5,600 | 70,100 |
| Total Investment Cost | 635,800 | 54,800 | 690,600 |
| Annual Cost 3/ | | | |
| Interest and Amortization | 55,700 | 4,700 | 60,400 |
| OMR&R 4/ | 1,000 | 300 | 1,300 |
| Total | 56,700 | 5,000 | 61,700 |

1/ Included for cost apportionment, but not economic analysis.
2/ IDC = Interest during construction period.
3/ 100-year project life and 8-3/4 percent interest rate.
4/ Dam, detention area, levees, and mitigation area.

3. General. - Economic benefits claimed for the Selected Plan would result from:

- 200-year flood protection along the main stem of the American River, in the Natomas area, and certain areas along Dry Creek.

- Recreation associated with pedestrian and equestrian trails, primarily along the Natomas East Main Drainage Canal and lower Dry and Arcade Creeks.

Following are descriptions of the benefit determinations.

4. Flood Control. - Average annual flood damages were estimated under both current and projected future conditions of development within the American River flood plains located in Sacramento, Sutter, and Placer Counties. Only tangible damages have been evaluated; those which accrue as a direct result of flooding and are already ascertained on the basis of monetary terms have been included in this analysis. Intangible damages such as loss of life, impairment of health and living conditions, and other items not subject to monetary evaluation have not been included in the damage analysis. This analysis is based on a 100-year project life (2000-2100), October 1991 price levels, and an 8-3/4 percent interest rate. Average annual damages and benefits are estimated in accordance with ER 1105-2-100. Assumptions and methodology used in developing average annual damages under without- and several alternative with-project conditions are described in the following paragraphs.

a. Historical Flood Damages. - Table III-1 is a listing of historical flood damages along the American River. The data were taken from the Corps post-flood reports.

b. Flood Plain Description. -

(1) Flow/Stage - Frequency Relationships. - Flow-frequency and stage-frequency relationships were developed for various locations in the American River, Sacramento River, and tributaries. A description of the relationships is contained in the Hydrology Appendix. Plates C-1, C-2, and C-3 are from information contained in that appendix and from other sources. Plate C-1 shows flow-frequency relationships for the American River at Fair Oaks under without- and various with-project conditions. Included in Plate C-2 are flow/stage-frequency relationships in the Natomas East Main Drainage Canal (NEMDC) and American River at the mouth of the canal for various frequency events. Plate C-3 shows a profile for various plans, stages and

TABLE III-1

HISTORICAL FLOOD DAMAGES
AMERICAN RIVER

| Date of Flood Event | Acres Flooded | Total Damages at Time of Flood |
|---|---|---|
| NOVEMBER - DECEMBER 1950 | | |
| Above Folsom Dam | 300 | 484,000 |
| Below Folsom Dam | 8,800 | 3,021,000 |
| Total | 9,100 | $3,505,000 |
| DECEMBER 1955 | | |
| Above Folsom Dam | 100 | 808,000 |
| Below Folsom Dam | 0 | 0 |
| Total | 100 | 808,000 |
| OCTOBER 1962 | | |
| Above Folsom Dam | 0 | 3,000 |
| Below Folsom Dam | 0 | 3,000 |
| Total | 0 | 3,000 |
| JANUARY - FEBRUARY 1963 | | |
| Above Folsom Dam | 100 | 307,000 |
| Below Folsom Dam | 1,300 | 251,000 |
| Total | 1,400 | 558,000 |
| DECEMBER 1964 - JANUARY 1965 | | |
| Above Folsom Dam | 0 | 3,231 |
| Below Folsom Dam | 3,780 | 1,214 |
| Total | 3,780 | 4,445 |
| FEBRUARY 1986 | N/A | 2,600,000 |

N/A = Not available

levee crown elevations for the 100-year (FEMA), 200-year, 400-year, and 500-year events in the NEMDC. Relationships in these plates were used to identify the frequency of levee failure under without- and with- project conditions.

(2) Levee Failure. - Major flooding in the Sacramento area would occur in the event of levee failure. Levees can fail for several reasons, and it is difficult to predict how and where the failures will occur. Levees have been known to fail when water stages are significantly below the design freeboard. On the American River during the February 1986 storms, levees were damaged by erosion at several locations having adequate freeboard. At other locations, freeboard was encroached, but damages were not significant. For the economic analysis in this study, the assumed levee failure mode was based on encroachment into the levee freeboard and a projection of the impacts of this encroachment on the physical system. Failure was assumed at varying degrees of encroachment into the freeboard based on a knowledge of levee conditions, exposure to high velocities or wave runup and overtopping, and levee performance during the February 1986 high water conditions.

The existing-condition levee failure analyses were based on four primary factors. One was the assumption that construction of levee improvements described in the Sacramento River Flood Control System Evaluation, Initial Appraisal Report, Sacramento Urban Area (Phase I) would be complete (i.e., Sacramento-area levees are as stable as their design flow). A second assumption was that deposited sediment in the Fremont Weir would be removed (i.e., weir elevation would be 30.5 feet for its entire length). The third assumption was the observed condition of the levees in relation to geotechnical evaluation and the function of the system during the February 1986 high flows. The last was hydrologic, and related observations and forecasts are fully described in the hydrology appendix.

Table III-2 is a summary of remaining freeboard, stages (or flows), and frequencies for the assumed levee failure. Plate C-4 shows backwater profiles along the American River for several flow rates ranging from 115,000 to 180,000 cfs. The plate also shows several locations of expected failure (shown on Plate C-5). The relationship between freeboard, design water surface elevations, observed highwater conditions, and assumed levee breaching stages are also shown in Plate C-5. As can be seen, in all cases, the stage of the assumed levee breaching (for economic purpose) is above the observed high water level and the design water surface. In four of the six examples shown, the breach stage is over 50 percent encroachment into the levee freeboard. It is important to note that if the six levee locations shown in the plate were raised, the estimated breach sites would simply shift to nearby locations on the levee.

TABLE III-2

POTENTIAL LEVEE FAILURE 1/

| Levee Reach | Remaining Freeboard 2/ at Failure (ft) | Stage (ft-msl) or Flows 3/ | Approximate Return Period (years) |
|---|---|---|---|
| Reclamation District 1000 | | | |
| Sacramento River (Left Bank) Natomas Cross Canal to the Natomas Main Drain | 3 | 5/ | -- |
| Natomas Cross Canal (North and South Levees) | 2 4/ | 40.0 | 200 |
| Natomas East Main Drain (West Levee) | 1.5 4/ | 35.4 | 71 |
| American River Levee System | | | |
| North (Right) Bank, Sacramento River to River Mile 5.2 | 3 | 180,000+ | 85+ |
| North (Right) Bank, upstream of River Mile 5.2 | 4 | 140,000 | 71 |
| South (Left) Bank, Sacramento River to River Mile 5.2 | 5 | 140,000 | 71 |
| South (Left) Bank, River Mile 5.2 to River Mile 7.8 | 5 | 145,000 | 73 |
| South (Left) Bank, upstream of River Mile 7.8 | 4 | 200,000 6/ | 94 |
| Dry Creek, Arcade Creek, and the East Levee of the Natomas East Main Drain | 3 | 7/ | -- |
| Sacramento River East (Left) Bank from the American River to Freeport | 3 | 4/ | -- |
| Sacramento River West (Right) Bank from the Sacramento Bypass to Riverview | 3 | 4/ | -- |
| Yolo Bypass and Tributary Levees | 3 | 4/ | -- |
| Sacramento River West (Right) Bank from the Natomas Cross Canal to the Sacramento Bypass | 8/ | -- | -- |

1/ For flood damage estimates only. Actual levee failures may occur at higher or lower flows and stages.

2/ Basis is (a) levee rehabilitation as part of the Sacramento River Flood Control and Sacramento River Bank Protection Projects in Sacramento area have been completed, and (b) the remaining sediment in Fremont Weir has been removed.

3/ Unless otherwise noted, flows are at Fair Oaks gage.

4/ Freeboard encroached condition chosen based on February 1986 Flood conditions.

5/ Not applicable due to failure at other locations reducing threat.

6/ Non damaging flow is approximately 145,000 cfs.

7/ Levee failure is not the condition of flood damage on Dry Creek.

8/ For evaluation of flood damages, zero remaining freeboard was selected to be consistent with FEMA's approach to establishing failures.

The assumed remaining freeboard at levee failure shown in Table III-2 and illustrated on Plate C-5 were estimated considering the following facts:

- Expected flow velocities and duration of high stages.
- Levee cross sections, depths of flow, and height of freeboard during high stages.
- Potential for erosion of levee material.
- Wind and wave action and overtopping.
- Levee performance based on observed conditions.
- Potential for animal borings, cracks, and otherwise loss of homogeneity.

Each of the above parameters are significantly important in estimating potential levee failure. However, levee instability at increasing river stages is perhaps the predominant factor. Geotechnical investigations of the levees in the Sacramento area, including core borings, were conducted. These investigations considered the potential for levee instability at various river stages. Along the main stem American River, for example, stages generated by flows of 115,000, 130,000, and 180,000 cfs were evaluated. Three criteria were considered: (1) minimum freeboard of 3 feet, (2) minimum slope stability factor at safety of 1.4, and (3) for a safety against piping of 3.0. The evaluation concluded that at flows of 130,000 cfs, five locations are estimated to exceed at least one of the above criteria. Accordingly, the levees are structurally stable for flows not exceeding 115,000 cfs. Detailed descriptions of the potential for high stages in the various waterways around Sacramento and results of geotechnical explorations of the levees with respect to various riverflows and stages are contained in the Hydrology and Geotechnical Investigations Appendixes.

It should be mentioned that a railroad embankment which roughly parallels the south side of the south project levee is expected to offer additional flood protection to the downtown area. The elevation of the top of the embankment is similar to the project levee. The City of Sacramento has an emergency plan to seal openings through the embankment (railroad, roadways, footpaths, etc.) in the event of impending flooding. However, for economic purposes in this study, it was assumed that, should the south project levee fail, the river stages would be significantly great enough to also cause a breaching of the railroad embankment. As the flood prevention effectiveness of the embankment depends on several critical parameters (stability of the embankment and closures and successful implementation of closure actions), this assumption appeared appropriate for this study.

(3) Resulting Flood Plains. - Flood plains, shown in Plates C-6a, C-6b, and C-6c, were developed to identify areas subject to flooding in and around Sacramento. They were developed for the 100-year and 400-year events (500-year event for the Dry Creek area). The flood plains were further delineated into six reaches. Each reach was then broken into sub-reaches (85) based on hydrologic data that separated these sub-reaches into either ponding or overflow areas. It is estimated that the 400-year flood plain covers an area of approximately 116,000 acres. The six reaches include: (1) Natomas; (2) Dry Creek; (3) North Sacramento; (4) Rancho Cordova; (5) South Sacramento; and (6) Richards Boulevard.

- Natomas. -

* Sub-area I - Southern Natomas - The area bounded by Power Line Road on the north, the Natomas East Main Drainage Canal (NEMDC) on the east, Del Paso Road from the NEMDC to Highway 99, southwesterly to the Sacramento River, the Sacramento River on the west, and the American River and Sacramento River on the south.

* Sub-area II - Mid-Natomas - The area bounded by Elkhorn Boulevard from the Sacramento River to Power Line Road on the north, northerly along Power Line Road to Elverta Road and along Elverta Road to NEMDC, the NEMDC on the east, the Sacramento River on the west, and the northern limit of Area I on the south.

* Sub-area III - Airport and Vicinity - The area bounded by Elverta Road on the north, Power Line Road on the east, the Sacramento River on the west, and Elkhorn Boulevard on the South.

* Sub-area IV - Northern Natomas - The area bounded by the Natomas Cross Canal on the north, the NEMDC on the east, the Sacramento River on the west, and Elverta Road on the south.

- Dry Creek. -

* Sub-area V - The area bounded by the NEMDC on the east and Sankey Road to 1/2 mile south of Elverta Road.

* Sub-area VI - The area bounded by the NEMDC on the east, 1/2 mile south of Elverta Road to Dry Creek.

* Sub-area VII - The area bounded by Dry Creek upstream of the Rio Linda/ Marysville Road to the Sacramento/Placer County Line.

- North Sacramento. -

* Sub-area VIII - American River Drive - The area bounded by Fair Oaks on the north, high ground to the east, Watt Avenue on the west, and the American River to the south.

* Sub-area IX - Cal Expo East - The area bounded by El Camino Avenue on the north, Watt Avenue on the east, the levee west and north of the race track, and Ethan Way from Arden Way to El Camino Avenue on the west, and the American River on the south.

* Sub-area X - North Sacramento - The area bounded by Arcade Creek on the north, Ethan Way and Cal Expo race track levee on the east, Natomas East Main Drainage Canal on the west, and the American River on the south.

- Rancho Cordova. -

* Sub-area XI - Rancho Cordova - The area bounded by US Highway 50 on the north, Bradshaw Road on the east, Sunrise Boulevard on the west, and the American River on the south.

* Sub-area XII - Gold River - The area bounded by Keifer Boulevard on the north and Sunrise Boulevard on the east.

- South Sacramento. -

* Sub-area XIII - Old Downtown - The area bounded by Broadway on the north, the McKinley Park area on the east, west to the Sacramento River, and the American River on the south.

* Sub-area XIV - Executive Airport Meadowview - The area bounded by the levee north of the airport to Morrison Creek, the Union Pacific Railroad tracks and Freeport Boulevard, and the boundary of South Sacramento.

* Sub-area XV - South Sacramento - The area bounded by Broadway to the Executive Airport levee on the north, flood limits boundary, and the Sacramento River on the west.

* Sub-area XVI - South East Sacramento - The area bounded between the Southern Pacific Railroad and the Union Pacific Railroad, then a line running from a junction at J Street and Elvas to Highway 99 and Fruitridge Road and then along Fruitridge Road to Union Pacific Railroad, southern boundary Laguna Creek Drainage.

* Sub-area XVII - Army Depot - The area bounded by the Southern Pacific Railroad on the east and south of Highway 16.

* Sub-area XVIII - East Sacramento - The area bounded by the American River on the north, then along Bradshaw to the east, southern boundary Southern Pacific from Business 80 to US Highway 50, and then the railroad line to Florin Perkins and Highway 16.

* Sub-area XXI - Pocket Area - The area bounded by the levee south of Fruitridge to (former) Southern Pacific tracks and then north along tracks to the River, Freeport Boulevard to the east, and the Sacramento River on the west.

- Richards Boulevard. -

* Sub-area XXII - Richards Boulevard - The area bounded by the American River to the north, Highway 80 to the east, the Sacramento River to the west, and the Southern Pacific Railroad tracks to the south.

The 400-year flood plain includes areas in Sacramento City and Sacramento, Placer, and Sutter Counties. Table III-3 shows population projections and estimated acres per reach for the 400-year flood plain. Population data were taken from Corps' inventory of residential structures and compared with SACOG (Sacramento Area Council of Governments) growth projections (January 1988).

Once levees fail, regardless of the frequency, the flooded areas would be similar in the Natomas, Downtown Sacramento, and, to some extent, North Sacramento because (1) the ground elevation adjacent to the levees in these locations is low in comparison to the water surface in the river and (2) the volume of runoff available in the American River (and Sacramento River in the case of Natomas and Downtown) would fill the flood plains. However, for Dry Creek, South Sacramento, and Rancho Cordova, the areas of flooding would expand as a function of flow diverted from the American River, depending on the stage in the river.

Flooding in Natomas can be influenced by flows and stages in the Sacramento River and failure of levees upstream on the Sacramento River and along the Feather River. Any levee failure on the Natomas Cross Canal would permit flow from the Sacramento River to enter the Natomas area by way of the canal. In addition, runoff entering the Natomas Cross Canal from the east would also flow through the breach and is a function of breach size, flood stage and duration of floodflows in the Sacramento River, direct runoff into the Pleasant Grove area, and other factors. If there are several days or more of high flood stages in the Sacramento River after a breach has occurred, it would likely be sufficient to flood the entire Natomas area to significant flood depths. In both cases, the levee embankment heights range from 15 to 20 feet higher than the surrounding land surface.

TABLE III-3

AMERICAN RIVER WATERSHED
ESTIMATED POPULATION AND AREA

| Area | 1990 Population 1/ | Area (Acres) |
|---|---|---|
| Natomas | 31,100 | 54,900 |
| Dry Creek | 2,500 | 5,800 |
| North Sacramento | 54,950 | 5,900 |
| Rancho Cordova | 18,900 | 4,200 |
| South Sacramento | 278,500 | 44,000 |
| Richards Blvd. | 550 | 1,000 |
| Total | 386,500 | 115,800 |

1/ Population in the 100-year and the 400-year flood plains (excluding Upper American River) are 366,500 and 386,500. Source: Population and Housing Data by Community Plan Area, City of Sacramento, Feb. 1990; SACOG, Jan. 1988.

(4) Flood Event Frequency. - Important to the inundation reduction analysis is the estimate of flow-stage as a function of flood frequency, (Plates C-1 through C-3). Using the "Damages" computer program, a maximum of 10 data entry points defines each flow-frequency or stage-frequency relationship for without- and with-project alternatives. It is important that the points chosen accurately delineate these relationships. Table III-4 shows information taken from the levee failure analysis and flow/stage frequency relationships under various conditions (existing and several with-project alternatives) for the six major flood plains. The first entry in each column for a particular flood plain is the estimated non-damaging point.

c. Flood Plain Inventory. - Flood plain structures were inventoried in 1989. Essentially, two steps were performed in this inventory: (1) estimates of the number and size of physical units and (2) assessments of existing and future replacement cost of units. By means of field surveys, aerial photography, and analysis of available data, the number and size of physical units in the flood plain were determined by hazard zones (100-year and 400-year flood plain delineations) for each land use category. Land use within the sub-reaches is composed of the following: residential (single-family, multiple-family, and mobile homes), commercial, industrial, public, and agriculture.

The residential structures were inventoried first by indicating the flood plains on 1"=400' aerial photographs. Residential acreage were then measured from the photographs and separated into similar construction types. Field checks were accomplished of the acreage estimates to determine if the structures were one or two stories. According to the Sacramento County Assessor's office, the structure values used in this analysis take into account depreciation and are representative of replacement cost less depreciation for the Sacramento area. It should be noted that replacement cost less depreciation shall be referred to as replacement cost. The replacement costs for existing structures within the flood plain came from various sources: personal interviews, telephone conversations, SACOG data, realtors, and the Marshall & Swift appraisal handbook.

Realtors were contacted for a price range of dwelling units in the designated blocked areas. The residential units within a given blocked area were assigned an average replacement cost for each structure. The average structure replacement costs were then compared to estimates from the Marshall & Swift appraisal handbook. Replacement costs of the contents of a structure were estimated as a percent of structure replacement cost for residential, commercial, and public structures. The replacement costs for industrial structures and contents were determined by personal interviews.

TABLE III-4
Event-Frequency Relationships
Full Basin Alternatives

| Reach | Existing | | | 100-Yr FEMA | | | Alternative 150-Yr | | | 200-Yr | | | 400-Yr | | | 500-Yr | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Event 1/ | Frequency 2/ | Return Period 3/ | Event | Frequency | Return Period | Event | Frequency | Return Period | Event | Frequency | Return Period | Event | Frequency | Return Period | Event | Frequency | Return Period |
| Natomas (Based on Stage) | 0.0 | 1.43 | 70 | 0.0 | 0.96 | 104 | 0.0 | 0.50 | 200 | 0.0 | 0.334 | 299 | 0.0 | 0.1602 | 624 | 0.0 | 0.1302 | 768 |
| | 24.2 | 1.41 | 71 | 24.4 | 0.95 | 105 | 34.0 | 0.497 | 201 | 24.4 | 0.333 | 300 | 34.3 | 0.16 | 625 | 34.3 | 0.13004 | 769 |
| | 24.4 | 1.00 | 100 | 24.4 | 0.91 | 110 | 34.3 | 0.33 | 300 | 27.0 | 0.25 | 400 | 34.3 | 0.154 | 650 | 34.4 | 0.125 | 800 |
| | 27.0 | 0.5 | 200 | 27.0 | 0.333 | 300 | 34.3 | 0.25 | 400 | 34.0 | 0.249 | 401 | 34.3 | 0.148 | 675 | | | |
| | 34.0 | 0.497 | 201 | 34.0 | 0.25 | 400 | 34.3 | 0.20 | 500 | 34.3 | 0.20 | 500 | 34.3 | 0.143 | 700 | | | |
| | 34.2 | 0.25 | 400 | 34.3 | 0.20 | 500 | 34.3 | 0.17 | 600 | 34.3 | 0.167 | 600 | | | | | | |
| | 34.3 | 0.167 | 600 | 34.3 | 0.167 | 600 | | | | | | | | | | | | |
| North Sacramento (Based on Flow) | 139K 4/ | 1.43 | 70 | 142K | 1.01 | 99 | 195K | 0.503 | 199 | 139K | 0.402 | 249 | 139K | 0.2004 | 499 | 139K | 0.1502 | 666 |
| | 140K | 1.41 | 71 | 143 | 1.00 | 100 | 196 | 0.5 | 200 | 140 | 0.40 | 250 | 140 | 0.20 | 500 | 140 | 0.15 | 667 |
| | 156K | 1.33 | 75 | 156 | 0.98 | 102 | 234 | 0.46 | 217 | 205 | 0.30 | 333 | 205 | 0.14 | 714 | 205 | 0.10 | 1000 |
| | 157K | 1.32 | 76 | 157 | 0.97 | 103 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 234K | 1.00 | 100 | 234 | 0.70 | 143 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | | | | | | | | | |
| South Sacramento (Based on Flow) | 139K | 1.43 | 70 | 139K | 1.03 | 97 | 195K | 0.503 | 199 | 139K | 0.402 | 249 | 139K | 0.2004 | 499 | 139K | 0.1502 | 666 |
| | 140K | 1.41 | 71 | 140 | 1.02 | 98 | 196 | 0.50 | 200 | 140 | 0.40 | 250 | 140 | 0.20 | 500 | 140 | 0.15 | 667 |
| | 205K | 1.12 | 89 | 205 | 0.80 | 125 | 234 | 0.46 | 217 | 205 | 0.30 | 333 | 205 | 0.14 | 714 | 205 | 0.10 | 1000 |
| | 234K | 1.00 | 100 | 234 | 0.70 | 143 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Rancho Cordova (Based on Flow) | 144K | 1.45 | 69 | 144K | 0.999 | 100 | 195K | 0.503 | 199 | 139K | 0.402 | 249 | 139K | 0.2004 | 499 | 139K | 0.1502 | 666 |
| | 145K | 1.43 | 70 | 145 | 0.99 | 101 | 196 | 0.50 | 200 | 140 | 0.40 | 250 | 140 | 0.20 | 500 | 140 | 0.15 | 667 |
| | 234K | 1.00 | 100 | 234 | 0.7 | 143 | 234 | 0.46 | 217 | 205 | 0.30 | 333 | 205 | 0.14 | 714 | 205 | 0.10 | 1000 |
| | 370K | 0.67 | 150 | 370 | 0.54 | 185 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Richards Blvd. (Based on Flow) | 179K | 1.22 | 82 | 179K | 0.91 | 110 | 195K | 0.503 | 199 | 179K | 0.322 | 311 | 179K | 0.1502 | 666 | 179K | 0.1502 | 666 |
| | 180K | 1.20 | 83 | 180 | 0.90 | 111 | 196 | 0.50 | 200 | 180 | 0.32 | 312 | 180 | 0.15 | 667 | 180 | 0.15 | 667 |
| | 200K | 1.11 | 90 | 200 | 0.80 | 125 | 234 | 0.46 | 217 | 200 | 0.30 | 333 | 200 | 0.14 | 714 | 200 | 0.10 | 1000 |
| | 234K | 1.00 | 100 | 234 | 0.70 | 143 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Dry Creek (Based on Stage) | 1.2 5/ | 20 | 5 | 1.2 | 20 | 5 | 1.2 | 20 | 5 | 1.2 | 20 | 5 | 1.2 | 20 | 5 | 1.2 | 20 | 5 |
| | 57.2 | 1.60 | 63 | 16.0 | 10 | 10 | 16.0 | 10 | 10 | 16.0 | 10 | 10 | 16.0 | 10 | 10 | 16.0 | 10 | 10 |
| | 61.5 | 1.00 | 100 | 18.5 | 0.85 | 118 | 18.8 | 0.452 | 222 | 19.0 | 0.32 | 313 | 19.3 | 0.15 | 667 | 19.6 | 0.125 | 800 |
| | 64.8 | 0.50 | 200 | 62.2 | 0.84 | 119 | 65.0 | 0.45 | 221 | 65.9 | 0.318 | 314 | 68.0 | 0.145 | 668 | 68.2 | 0.1248 | 801 |
| | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 73.1 | 0.01 | 10000 |
| | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | | | |

1/ Stage in feet (MSL) or flow in 1,000 cubic feet per second (cfs). See note under reach.
2/ Exceedence frequency per 100 years.
3/ Return period in years.
4/ K=1,000 cfs.

There are approximately 168,000 structures with a replacement cost of about $37 billion within the 400-year flood plain. Existing and futures units for each area by land use category are presented in Table III-5. The value of property by type of structure is shown in Table III-6. The value for commercial and industrial properties includes replacement cost of the structure, inventory on hand, and value of fixtures and equipment. Replacement cost of residential and public and semi-public property includes structure and content values.

Approximately 7,560 acres of vacant and agricultural land in the 400-year flood plain are subject to development. Estimates of future land use are based on projected population growth, the City and County of Sacramento General Plans, and the availability of land to accommodate this growth. All future growth within the flood plain area is estimated to take place by the year 2010.

d. Without-Project Flood Damages

(1) Categories. - Flood damages are estimated by relating damages to flood depths, flows, and frequencies of flooding. Damages are determined for the following categories:

- Industrial Damages. - Facilities that take raw materials and manufacture or fabricate commodities were classified as industrial. Losses and destruction of industrial properties from inundation consist of three categories: (1) fixtures and equipment; (2) inventory; and (3) structure.

- Commercial Damages. - Commercial damages were computed by using the structure value and content value, which includes equipment and furniture, supplies, merchandise, and other items used in the conduct of business.

- Residential Damages. - Residential damages were comprised of two separate categories: (1) physical damages to dwelling units (single-family, multiple-family, and mobile homes) and (2) damages to residential contents, including household items and personal property.

Based on discussions with Sacramento area insurance agents, the value of contents is equal to 50 percent of the replacement cost less depreciation of the structure. Benefits were not estimated for the projected increase in household content value (affluence).

- Public Damages. - The tangible damages associated with inundation to hospitals; churches; libraries; schools; Federal, State, and local government facilities, (including equipment and furnishings); parks; roads; bridges; and highway structures.

- Agricultural Damages. - Agricultural damages were estimated for non-crop losses which include damages to farm buildings and their contents. Agricultural damages to crops were not considered

TABLE III-5

Existing and Future Number of Structures

400-Year Flood Plain

| AREA | (Existing) 1989 | 1992 | 2000 | 2010* | 2100 |
|---|---|---|---|---|---|
| *Natomas* | | | | | |
| Residential | 13,516 | 14,025 | 14,025 | 14,025 | 14,025 |
| Commercial | 197 | 563 | 563 | 563 | 563 |
| Industrial | 7 | 17 | 17 | 17 | 17 |
| Public | 10 | 10 | 10 | 10 | 10 |
| Subtotal | 13,730 | 14,615 | 14,615 | 14,615 | 14,615 |
| *Dry Creek* | | | | | |
| Residential | 1,000 | 1,000 | 1,000 | 1,000 | 1,000 |
| Commercial | 41 | 41 | 41 | 41 | 41 |
| Industrial | 9 | 9 | 9 | 9 | 9 |
| Public | 6 | 6 | 6 | 6 | 6 |
| Subtotal | 1,056 | 1,056 | 1,056 | 1,056 | 1,056 |
| *North Sacramento* | | | | | |
| Residential | 21,980 | 22,095 | 22,788 | 22,788 | 22,788 |
| Commercial | 973 | 999 | 1,103 | 1,103 | 1,103 |
| Industrial | 18 | 28 | 68 | 68 | 68 |
| Public | 226 | 226 | 228 | 228 | 228 |
| Subtotal | 23,197 | 23,348 | 24,187 | 24,187 | 24,187 |
| *Rancho Cordova* | | | | | |
| Residential | 7,563 | 9,322 | 9,322 | 9,322 | 9,322 |
| Commercial | 207 | 488 | 488 | 488 | 488 |
| Industrial | 20 | 38 | 250 | 250 | 250 |
| Public | 9 | 9 | 9 | 9 | 9 |
| Subtotal | 7,799 | 9,857 | 10,069 | 10,069 | 10,069 |
| *South Sacramento* | | | | | |
| Residential | 118,000 | 122,421 | 134,210 | 148,947 | 148,947 |
| Commercial | 2,649 | 2,723 | 2,920 | 3,166 | 3,166 |
| Industrial | 87 | 169 | 387 | 661 | 661 |
| Public | 784 | 813 | 891 | 988 | 988 |
| Subtotal | 121,520 | 126,126 | 138,408 | 153,762 | 153,762 |
| *Richards Blvd.* | | | | | |
| Residential | 231 | 231 | 231 | 231 | 231 |
| Commercial | 215 | 215 | 215 | 215 | 215 |
| Industrial | 21 | 21 | 21 | 21 | 21 |
| Public | 43 | 43 | 43 | 43 | 43 |
| Subtotal | 510 | 510 | 510 | 510 | 510 |
| **Total** | 167,812 | 175,512 | 188,845 | 204,199 | 204,199 |

* Growth is assumed to remain constant after the year 2010.

TABLE III-6
Structural Values Existing Conditions 1/
400-Year Flood Plain
($millions)

| *REACH* | *Residential* | *Residential Content* | *Commercial* | *Industrial* | *Public* |
|---|---|---|---|---|---|
| *Natomas* | 1,000 | 499 | 743 | 5 | 104 |
| *Dry Creek* | 64 | 31 | 37 | 15 | 10 |
| *North Sacramento* | 3,328 | 1,663 | 2,016 | 18 | 290 |
| *Rancho Cordova* | 1,011 | 506 | 440 | 52 | 13 |
| *South Sacramento* | 11,545 | 5,772 | 5,276 | 302 | 1,961 |
| *Richards Bl.* | 9 | 5 | 406 | 24 | 42 |
| Total | 16,957 | 8,476 | 8,918 | 416 | 2,420 |

1/ 1989 conditions, 1991 prices.

in this analysis. Natomas is approximately 50,000 acres and is the predominant area within the flood plain where agricultural crops are grown. Both South Natomas and North Natomas are within this area and are currently undergoing rapid residential, commercial, and industrial development in accordance with there corresponding general plans. The economic evaluation for the Reconnainance Report, American River Watershed Investigation, January 1988, indicated that the benefits attributable to agricultural crops were less than 1/2 of 1 percent. As a result, flood damage reduction benefits were not estimated for agricultural crops.

- Emergency Costs. - Additional costs are incurred during flood emergencies for evacuation and reoccupation; flood fighting; disaster relief; and extra duty police, fire, and military protection. These costs are called emergency costs.

- Auto Damages. - Auto damages were divided into two categories: (1) Damages to autos located at private homes and (2) Damages to autos located at car dealership lots.

(2) Depth-damage Relationship. - Depth-damage relationships describe the probable damages that would occur under different depths of flooding conditions, either as a percentage of the total value of damageable property or in the probable loss expected, as shown in Table III-7. The 1988 Federal Insurance Administration (FIA) depth-damage relationships were used for residential and public structures. Damage surveys conducted immediately after the February 1986 rainstorms of flood damaged structures along Dry Creek in Roseville, California, confirmed the reasonableness of these 1988 FIA depth-damage relationships.

The depth-damage relationships developed by the Tennessee Valley Authority (TVA) for the Department of Housing and Urban Development (HUD) in December 1969, Small Business Research for Flood Insurance Rate-Setting, were used in estimating damages to commercial structures. For the Morrison Creek Investigation, interviews with owners and/or managers of commercial buildings established depth-percent damage relationships that are very similar to those in the aforementioned HUD study. Portions of the floodplains for the Morrison Creek Investigation are included in the floodplains for the American River Watershed Investigation. Structures in the Morrison Creek and American River areas are comparable in there type of construction and use. Therefore, it is felt that the HUD depth-percent damage relationships are acceptable and reflect actual damage information.

Industrial structures were grouped into four categories: food and food related, construction, auto/machinery, and miscellaneous. Field interviews with managers of industrial structures identified specific uses, values of inventories and equipment, and estimates of extent of damages for various levels of water inside their buildings. Other factors considered in the flood damage analysis were velocity and duration of flood waters.

## TABLE III-7 Depth/Percent Damage Relationships

| FIRST FLOOR | RESIDENTIAL 3/ STR 1/ 1 STORY | RESIDENTIAL 3/ CONT 2/ 1 STORY | RESIDENTIAL 3/ STR 2 STORY | RESIDENTIAL 3/ CONT 2 STORY | COMMERCIAL 4/ STR 1 STORY | COMMERCIAL 4/ CONTENT 6/ S-SHAP | COMMERCIAL 4/ CONTENT 6/ U-SHAP | COMMERCIAL 4/ STR 2 STORY | INDUSTRIAL CONTENT 6/ S-SHAP | INDUSTRIAL CONTENT 6/ U-SHAPE | INDUSTRIAL STRUCTURE | INDUSTRIAL CONTENT FOOD | INDUSTRIAL CONTENT CONSTRU | INDUSTRIAL CONTENT AUTO | INDUSTRIAL CONTENT MISC | PUBLIC STR 1 STORY | PUBLIC CONT 1 STORY | PUBLIC STR 2 STORY | PUBLIC CONT 2 STORY | MOBILE HOME STR | MOBILE HOME CONT | BASEMENT STR 1 STORY | BASEMENT CONT 1 STORY | BASEMENT STR 2 STORY | BASEMENT CONT 2 STORY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (10) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| (3) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| (2) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| (1) | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.04 | 0 | 0.04 | 0 |
| 0 | 0.07 | 0.1 | 0.05 | 0.07 | 0.04 | 0 | 0 | 0.04 | 0 | 0 | 0.04 | 0 | 0 | 0 | 0 | 0.07 | 0.1 | 0.05 | 0.07 | 0.08 | 0 | 0.1 | 0 | 0.08 | 0 |
| 0.5 | 0.08 | 0.14 | 0.07 | 0.08 | 0.07 | 0.04 | 0.2 | 0.06 | 0.04 | 0.2 | 0.07 | 1 | 0.41 | 0.28 | 0.45 | 0.08 | 0.14 | 0.07 | 0.08 | 0.29 | 0.2 | 0.23 | 0.15 | 0.15 | 0.08 |
| 1 | 0.1 | 0.17 | 0.09 | 0.09 | 0.09 | 0.11 | 0.36 | 0.07 | 0.11 | 0.36 | 0.09 | 1 | 0.57 | 0.35 | 0.48 | 0.1 | 0.17 | 0.09 | 0.09 | 0.5 | 0.35 | 0.29 | 0.16 | 0.18 | 0.09 |
| 1.5 | 0.12 | 0.2 | 0.11 | 0.13 | 0.11 | 0.18 | 0.46 | 0.08 | 0.18 | 0.46 | 0.11 | 1 | 0.57 | 0.35 | 0.49 | 0.12 | 0.2 | 0.11 | 0.13 | 0.6 | 0.43 | 0.29 | 0.23 | 0.19 | 0.13 |
| 2 | 0.14 | 0.23 | 0.13 | 0.17 | 0.13 | 0.3 | 0.54 | 0.09 | 0.3 | 0.54 | 0.13 | 1 | 0.575 | 0.4 | 0.5 | 0.14 | 0.23 | 0.13 | 0.17 | 0.71 | 0.56 | 0.3 | 0.29 | 0.2 | 0.17 |
| 2.5 | 0.2 | 0.26 | 0.16 | 0.2 | 0.16 | 0.45 | 0.59 | 0.11 | 0.45 | 0.59 | 0.16 | 1 | 0.58 | 0.45 | 0.5 | 0.2 | 0.26 | 0.16 | 0.2 | 0.76 | 0.64 | 0.31 | 0.32 | 0.21 | 0.2 |
| 3 | 0.26 | 0.29 | 0.18 | 0.22 | 0.18 | 0.54 | 0.64 | 0.12 | 0.54 | 0.64 | 0.18 | 1 | 0.58 | 0.5 | 0.51 | 0.26 | 0.29 | 0.18 | 0.22 | 0.82 | 0.72 | 0.32 | 0.35 | 0.23 | 0.22 |
| 3.5 | 0.27 | 0.32 | 0.19 | 0.25 | 0.2 | 0.61 | 0.68 | 0.13 | 0.61 | 0.68 | 0.2 | 1 | 0.58 | 0.5 | 0.51 | 0.27 | 0.32 | 0.19 | 0.25 | 0.84 | 0.75 | 0.36 | 0.4 | 0.25 | 0.25 |
| 4 | 0.28 | 0.35 | 0.2 | 0.28 | 0.22 | 0.69 | 0.71 | 0.14 | 0.69 | 0.71 | 0.22 | 1 | 0.59 | 0.5 | 0.52 | 0.28 | 0.35 | 0.2 | 0.28 | 0.87 | 0.79 | 0.39 | 0.45 | 0.28 | 0.28 |
| 4.5 | 0.28 | 0.38 | 0.21 | 0.31 | 0.24 | 0.73 | 0.75 | 0.15 | 0.73 | 0.75 | 0.24 | 1 | 0.59 | 0.6 | 0.53 | 0.28 | 0.38 | 0.21 | 0.31 | 0.88 | 0.81 | 0.41 | 0.49 | 0.3 | 0.31 |
| 5 | 0.29 | 0.4 | 0.22 | 0.33 | 0.27 | 0.75 | 0.78 | 0.16 | 0.75 | 0.78 | 0.27 | 1 | 0.6 | 0.6 | 0.54 | 0.29 | 0.4 | 0.22 | 0.33 | 0.89 | 0.84 | 0.43 | 0.53 | 0.33 | 0.33 |
| 5.5 | 0.35 | 0.43 | 0.23 | 0.36 | 0.29 | 0.77 | 0.81 | 0.18 | 0.77 | 0.81 | 0.29 | 1 | 0.6 | 0.6 | 0.55 | 0.35 | 0.43 | 0.23 | 0.36 | 0.9 | 0.85 | 0.46 | 0.52 | 0.36 | 0.36 |
| 6 | 0.41 | 0.45 | 0.24 | 0.39 | 0.31 | 0.78 | 0.83 | 0.19 | 0.78 | 0.83 | 0.31 | 1 | 0.61 | 0.6 | 0.56 | 0.41 | 0.45 | 0.24 | 0.39 | 0.91 | 0.87 | 0.49 | 0.51 | 0.38 | 0.39 |
| 6.5 | 0.42 | 0.48 | 0.25 | 0.42 | 0.33 | 0.79 | 0.85 | 0.2 | 0.79 | 0.85 | 0.33 | 1 | 0.61 | 0.65 | 0.57 | 0.42 | 0.48 | 0.24 | 0.42 | 0.91 | 0.88 | 0.54 | 0.61 | 0.41 | 0.42 |
| 7 | 0.43 | 0.5 | 0.26 | 0.44 | 0.35 | 0.8 | 0.85 | 0.21 | 0.8 | 0.85 | 0.35 | 1 | 0.61 | 0.65 | 0.58 | 0.43 | 0.5 | 0.26 | 0.44 | 0.91 | 0.88 | 0.58 | 0.7 | 0.44 | 0.44 |
| 7.5 | 0.43 | 0.53 | 0.29 | 0.47 | 0.37 | 0.8 | 0.85 | 0.22 | 0.8 | 0.85 | 0.37 | 1 | 0.61 | 0.65 | 0.59 | 0.43 | 0.53 | 0.29 | 0.47 | 0.91 | 0.89 | 0.58 | 0.71 | 0.47 | 0.47 |
| 8 | 0.44 | 0.55 | 0.31 | 0.5 | 0.38 | 0.8 | 0.85 | 0.23 | 0.8 | 0.85 | 0.38 | 1 | 0.61 | 0.7 | 0.6 | 0.44 | 0.55 | 0.31 | 0.5 | 0.91 | 0.9 | 0.58 | 0.73 | 0.49 | 0.5 |
| 8.5 | 0.44 | 0.58 | 0.35 | 0.53 | 0.4 | 0.8 | 0.85 | 0.23 | 0.8 | 0.85 | 0.4 | 1 | 0.61 | 0.7 | 0.61 | 0.44 | 0.58 | 0.35 | 0.53 | 0.91 | 0.9 | 0.58 | 0.74 | 0.5 | 0.54 |
| 10 | 0.46 | 0.6 | 0.38 | 0.58 | 0.49 | 0.8 | 0.85 | 0.28 | 0.8 | 0.85 | 0.49 | 1 | 0.61 | 0.75 | 0.63 | 0.46 | 0.6 | 0.38 | 0.58 | 1 | 0.9 | 0.58 | 0.75 | 0.53 | 0.56 |
| 13 | 0.49 | 0.6 | 0.38 | 0.58 | 0.6 | 0.8 | 0.85 | 0.38 | 1 | 0.85 | 0.6 | 1 | 0.61 | 0.8 | 0.68 | 0.49 | 0.6 | 0.38 | 0.58 | 1 | 1 | 0.58 | 0.75 | 0.59 | 0.56 |
| 15 | 0.5 | 0.6 | 0.38 | 0.58 | 0.6 | 0.8 | 0.85 | 0.43 | 1 | 0.85 | 0.6 | 1 | 0.61 | 0.85 | 0.72 | 0.5 | 0.6 | 0.38 | 0.58 | 1 | 1 | 0.58 | 0.75 | 0.6 | 0.58 |
| 19 | 0.5 | 0.6 | 0.38 | 0.58 | 0.6 | 0.8 | 0.85 | 0.52 | 1 | 0.85 | 0.6 | 1 | 0.61 | 0.85 | 0.8 | 0.5 | 0.6 | 0.38 | 0.58 | 1 | 1 | 0.58 | 0.75 | 0.6 | 0.58 |
| 21 | 0.5 | 0.6 | 0.38 | 0.58 | 0.6 | 1 | 1 | 0.58 | 1 | 1 | 0.6 | 1 | 0.61 | 0.85 | 0.8 | 0.5 | 0.6 | 0.38 | 0.58 | 1 | 1 | 0.58 | 0.75 | 0.6 | 0.58 |
| 25 | 0.5 | 0.6 | 0.38 | 0.58 | 0.6 | 1 | 1 | 0.6 | 1 | 1 | 0.6 | 1 | 0.61 | 0.85 | 0.8 | 0.5 | 0.6 | 0.38 | 0.58 | 1 | 1 | 0.58 | 0.75 | 0.6 | 0.58 |

1/ STR=Structure

2/ CONT=Content

3/ FIA (Flood Insurance Administration), 1988; Holbrook Study, 1988 FEMA.

4/ TVA (Tennessee Valley Authority), Dec. 1969.

5/ Due to the greater duration in flooding and the deeper depths of flooding in the Natomas area as compared to the rest ofthe floodplain, all structure and content curves were set at 100% for depths greater than 13 feet.

6/ Two basic types of depth-damage relationships, "U" and "S" for the contents of commercial businesses were used to estimate flood damages. Whether one uses a "U" or an "S" shpaed depth-damage relationship is dependent upon how goods are stacked and stored within different types of businesses. For commerical enterprises with "U" shaped curves, the damages to the contents begin and are therefore higher at lower depths of flooding then those businesses with *"S" shaped curves. Floo d damages for "U" shaped curves are also higher at greater depths of flooding.* Examples of commercial businesses with "U" shaped curves are warehouses, newstands, bookstores, carpet sales stores, and upholstery shops. Commercial businesses with "S" shaped curves are auto dealers, supply an d repair facilities, department and clothing stores, and office buildings.

For the Natomas reach, duration is 30 days, and the average velocity is less than 0.5 feet per second. Duration has a significant effect on flood damages for this area. Damages to structure and content for each land use category were set at 100 percent for depths greater that 13 feet. For the remaining reaches in the flood plain, duration is less than 5 days, and the average velocities range from 0.5 to 5 feet per second. Neither duration nor velocity had any significant effect on damages.

(3) Damage-flow Relationship. - Damage-flow relationships describe the probable damages expected at various frequencies. They are derived by estimating the probable flood damages of several hypothetical floods. Intermediate damage points are interpolated from these estimates by using standard mathematical-integration techniques. The probable flood damages that would result from a particular flow are estimated by describing the flood plain area associated with that flow, inventorying this area by damage category and depth of flooding, and applying the appropriate depth-damage relationships for each category. Probable damages were determined for two flood events in each sub-area. These damages, shown in Table III-8, represent damages for the 100- and 400-year events for existing development.

(4) Average Annual Damages. - Due to the resources available, both the Structure Inventory for Damage Analysis (SID) computer program and the Damages computer program were used to assist in estimating average annual equivalent damages and benefits. With the assistance of the Corps Hydrologic Engineering Center, the inventory of structures located within the 400-year flood plain was entered into the SID program to develop elevation-damage functions by damage category and by reach. Elevation-damage relationships from the SID program were input into the Damages program. Several utility programs were written to obtain the necessary data for the Damages program. From this data, the Damages program derived the damage-frequency relationships and estimated average annual damages and benefits.

Average annual damages are the expected value of damages for a given economic condition and point in time. They are determined by weighing the estimated damages from varying degrees of flooding by their probability of occurrence and may be approximated by measuring the area under the damage-frequency curve using standard mathematical integration procedures.

Table III-9 shows the average annual damages without a project for 1989, the base year, and annually throughout the study period. Average annual equivalent damages for the period 2000-2100 were estimated on the basis of an 8-3/4 percent interest level and October 1991 prices, using standard discounting procedures.

e. With-Project Flood Damage.- With-project flood damages are computed similarly to without-project as described above. Under with-project conditions, however, the river flows,

TABLE III-8

Without Project Flood Damage For Selected Events 1/

($Millions)

| REACH | 400 year | 100 year | Non-Damaging |
|---|---|---|---|
| Natomas | | | 70 year |
| Residential | 1,034.74 | 748.08 | - |
| Commercial | 505.54 | 349.96 | - |
| Industrial | 2.73 | 1.85 | - |
| Public | 49.18 | 36.36 | - |
| Emergency | 33.62 | 20.32 | - |
| Auto | 65.01 | 38.90 | - |
| Dry Creek | | | 5 year |
| Residential | 24.42 | 22.21 | - |
| Commercial | 17.02 | 16.05 | - |
| Industrial | 5.26 | 5.05 | - |
| Public | 3.44 | 3.33 | - |
| Emergency | 0.10 | 0.09 | - |
| Auto | 2.88 | 1.75 | - |
| North Sacramento | | | 70 year |
| Residential | 2,111.06 | 1,470.05 | - |
| Commercial | 1,050.30 | 493.58 | - |
| Industrial | 10.70 | 0.39 | - |
| Public | 110.77 | 40.30 | - |
| Emergency | 5.72 | 2.77 | - |
| Auto | 118.79 | 101.33 | - |
| Rancho Cordova | | | 69 year |
| Residential | 605.51 | 60.17 | - |
| Commercial | 151.95 | 1.06 | - |
| Industrial | 16.52 | 0.00 | - |
| Public | 3.43 | 0.00 | - |
| Emergency | 0.72 | 0.10 | - |
| Auto | 25.86 | 5.51 | - |
| South Sacramento | | | 70 year |
| Residential | 6,805.70 | 3,937.56 | - |
| Commercial | 2,131.00 | 836.00 | - |
| Industrial | 131.00 | 39.00 | - |
| Public | 570.00 | 302.00 | - |
| Emergency | 10.25 | 7.87 | - |
| Auto | 455.00 | 168.00 | - |
| Richards Blvd. | | | 82 year |
| Residential | 6.41 | 6.41 | - |
| Commercial | 267.55 | 259.68 | - |
| Industrial | 15.39 | 15.28 | - |
| Public | 19.14 | 18.97 | - |
| Emergency | 0.03 | 0.01 | - |
| Auto | 6.80 | 1.36 | - |
| TOTAL | 16,373.54 | 9,011.35 | |

1/ October 1991 price levels.

TABLE III-9
AVERAGE ANNUAL WITHOUT PROJECT DAMAGES 1/
($1,000)

| | 1989 | 2000 | 2010 | 2100 | *Avg.Annual Equiv. @ 8-3/4% interest* |
|---|---|---|---|---|---|
| NATOMAS | | | | | |
| Residential | 12,213 | 12,213 | 12,213 | 12,213 | 12,213 |
| Commercial | 5,834 | 6,128 | 6,128 | 6,128 | 6,128 |
| Mobile Home | 30 | 30 | 30 | 30 | 30 |
| Industrial | 31 | 31 | 31 | 31 | 31 |
| Public | 590 | 590 | 590 | 590 | 590 |
| Emergency | 360 | 360 | 360 | 360 | 360 |
| Auto damage | 692 | 692 | 692 | 692 | 692 |
| Subtotal | 19,750 | 20,044 | 20,044 | 20,044 | 20,044 |
| DRY CREEK | | | | | |
| Residential | 739 | 739 | 739 | 739 | 739 |
| Commercial | 612 | 612 | 612 | 612 | 612 |
| Mobile Home | 0 | 0 | 0 | 0 | 0 |
| Industrial | 431 | 431 | 431 | 431 | 431 |
| Public | 160 | 160 | 160 | 160 | 160 |
| Emergency | 1 | 1 | 1 | 1 | 1 |
| Auto damage | 102 | 102 | 102 | 102 | 102 |
| Subtotal | 2,045 | 2,045 | 2,045 | 2,045 | 2,045 |
| NORTH SACRAMENTO | | | | | |
| Residential | 25,070 | 25,570 | 25,570 | 25,570 | 25,570 |
| Commercial | 10,750 | 12,310 | 12,310 | 12,310 | 12,310 |
| Mobile Home | 0 | 0 | 0 | 0 | 0 |
| Industrial | 70 | 160 | 160 | 160 | 160 |
| Public | 1,040 | 1,040 | 1,040 | 1,040 | 1,040 |
| Emergency | 60 | 60 | 60 | 60 | 60 |
| Auto damage | 1,430 | 1,430 | 1,430 | 1,430 | 1,430 |
| Subtotal | 38,420 | 40,570 | 40,570 | 40,570 | 40,570 |
| RANCHO CORDOVA | | | | | |
| Residential | 3,627 | 4,461 | 4,461 | 4,461 | 4,461 |
| Commercial | 770 | 831 | 831 | 831 | 831 |
| Mobile Home | 39 | 39 | 39 | 39 | 39 |
| Industrial | 81 | 81 | 81 | 81 | 81 |
| Public | 18 | 18 | 18 | 18 | 18 |
| Emergency | 4 | 4 | 4 | 4 | 4 |
| Auto damage | 169 | 169 | 169 | 169 | 169 |
| Subtotal | 4,708 | 5,603 | 5,603 | 5,603 | 5,603 |
| SOUTH SACRAMENTO | | | | | |
| Residential | 66,730 | 76,532 | 76,532 | 76,532 | 76,532 |
| Commercial | 19,000 | 23,100 | 23,100 | 23,100 | 23,100 |
| Mobile Home | 900 | 900 | 900 | 900 | 900 |
| Industrial | 1,000 | 5,000 | 8,100 | 8,100 | 8,100 |
| Public | 5,800 | 5,800 | 5,800 | 5,800 | 5,800 |
| Emergency | 113 | 113 | 113 | 113 | 113 |
| Auto damage | 4,000 | 4,000 | 4,000 | 4,000 | 4,000 |
| Subtotal | 97,543 | 115,445 | 118,545 | 118,545 | 118,545 |
| RICHARDS BLVD | | | | | |
| Residential | 78 | 78 | 78 | 78 | 78 |
| Commercial | 3,275 | 3,275 | 3,275 | 3,275 | 3,275 |
| Mobile Home | 0 | 0 | 0 | 0 | 0 |
| Industrial | 191 | 191 | 191 | 191 | 191 |
| Public | 237 | 237 | 237 | 237 | 237 |
| Emergency | 0 | 0 | 0 | 0 | 0 |
| Auto damage | 51 | 51 | 51 | 51 | 51 |
| Subtotal | 3,832 | 3,832 | 3,832 | 3,832 | 3,832 |
| TOTAL | 166,298 | 187,539 | 190,639 | 190,639 | 190,639 |

1/ 1989 conditions, 1991 prices, 8-3/4% interest.

stages, levee failure, and resulting flooding are influenced by the various projects being considered. Various flood protection projects were evaluated. Five are presented below. They include full basin protection from the 100-, 150-, 200-, 400-, and 500-year floods. Average annual equivalent damages for each of the with-project alternatives and the without-project conditions are summarized in Table III-10.

Table III-11 shows the average annual damages with the project for the selected plan (200-year full basin level of flood protection). The aforementioned table lists data by damage category for 1989, the base year, and annually throughout the study period.

f. Benefit Evaluation. - Benefits that accrue from the evaluation of flood control projects include inundation reduction benefits, savings in flood proofing costs, location benefits, advance bridge replacement benefits, and savings in flood insurance administration costs.

(1) Inundation Reduction Benefits.- Inundation reduction benefits were estimated by evaluating damages with and without a project. The flood damage reduction benefits for each alternative level of protection are the difference between the equivalent average annual flood losses without the project and the residual average annual losses with the project. Economic criteria and projections used in arriving at the benefit estimates encompass recent evaluation guidelines (ER 1105-2-100) and the Flood Disaster Protection Act of 1973. A summary of the inundation reduction benefits (including emergency costs) by reach is presented in Table III-12. Plates C-7 through C-12 show the flow-frequency, flow-damage, and damage-frequency relationships under without project conditions for the Natomas, Dry Creek, Rancho Cordova, Richards Blvd., North Sacramento, and South Sacramento reaches.

Natomas is the only reach where flood damages would exceed 50 percent of the market value of the structure. Due to a flood duration of 30 days and depths of flooding in excess of 13 feet, depth-percent damage curves for all structures and contents reached 100 percent damage. FEMA has indicated that any repair, reconstruction, or improvement of a structure that has flood damages equal to or exceeding 50 percent of the market value of the structure must be flood proofed to the 100-year level of protection.

The average annual benefits for Natomas were estimated using two techniques. In the first, average annual benefits were estimated using traditional Corps of Engineers methods. This method used flow-frequency, flow-damage, and damage-frequency relationships under without- and with-project conditions. Using

TABLE III-10
Average Annual Equivalent Damages 1/
($1,000)

| | | Full Basin With-Project Residual Damages | | | | |
|---|---|---|---|---|---|---|
| Reach | W/O Proj | 100yr FEMA | 150yr | 200yr | 400yr | 500yr |
| *Natomas* | 20,040.0 | 13,460.0 | 8,740.0 | 5,430.0 | 2,810.0 | 2,290.0 |
| *Dry Creek* | 2,040.0 | 1,020.0 | 840.0 | 780.0 | 700.0 | 690.0 |
| *North Sacto.* | 40,570.0 | 29,770.0 | 17,360.0 | 11,800.0 | 5,680.0 | 4,380.0 |
| *Rancho Cordova* | 5,600.0 | 4,630.0 | 3,820.0 | 2,180.0 | 990.0 | 810.0 |
| *South Sacto.* | 118,540.0 | 87,170.0 | 56,740.0 | 35,370.0 | 16,550.0 | 12,770.0 |
| *Richards Blvd.* | 3,830.0 | 2,890.0 | 1,670.0 | 1,050.0 | 490.0 | 490.0 |
| Total | 190,620.0 | 138,940.0 | 89,170.0 | 56,610.0 | 27,220.0 | 21,430.0 |

1/ 8-3/4% Interest Rate, October 1991 Prices, 100 year project life.
* Figures rounded to the nearest ten thousand.

TABLE III-11
200-Year Flood Plain
With Project Damages For The Selected Plan 1/
($1,000)

| | 1989 | 2000 | 2010 | 2100 | @ 8-3/4% interest |
|---|---|---|---|---|---|
| NATOMAS | | | | | |
| Residential | 3,250 | 3,250 | 3,250 | 3,250 | 3,250 |
| Commercial | 1,570 | 1,720 | 1,720 | 1,720 | 1,720 |
| Industrial | 10 | 10 | 10 | 10 | 10 |
| Public | 150 | 150 | 150 | 150 | 150 |
| Emergency | 100 | 100 | 100 | 100 | 100 |
| Auto damage | 200 | 200 | 200 | 200 | 200 |
| Subtotal | 5,280 | 5,430 | 5,430 | 5,430 | 5,430 |
| DRY CREEK | | | | | |
| Residential | 270 | 270 | 270 | 270 | 270 |
| Commercial | 230 | 230 | 230 | 230 | 230 |
| Industrial | 180 | 180 | 180 | 180 | 180 |
| Public | 60 | 60 | 60 | 60 | 60 |
| Emergency | 0 | 0 | 0 | 0 | 0 |
| Auto damage | 40 | 40 | 40 | 40 | 40 |
| Subtotal | 780 | 780 | 780 | 780 | 780 |
| NORTH SACRAMENTO | | | | | |
| Residential | 7,140 | 7,290 | 7,290 | 7,290 | 7,290 |
| Commercial | 3,240 | 3,710 | 3,710 | 3,710 | 3,710 |
| Industrial | 20 | 50 | 50 | 50 | 50 |
| Public | 320 | 320 | 320 | 320 | 320 |
| Emergency | 20 | 20 | 20 | 20 | 20 |
| Auto damage | 410 | 410 | 410 | 410 | 410 |
| Subtotal | 11,150 | 11,800 | 11,800 | 11,800 | 11,800 |
| RANCHO CORDOVA | | | | | |
| Residential | 1,400 | 1,720 | 1,720 | 1,720 | 1,720 |
| Commercial | 330 | 360 | 360 | 360 | 360 |
| Industrial | 30 | 30 | 30 | 30 | 30 |
| Public | 10 | 10 | 10 | 10 | 10 |
| Emergency | 0 | 0 | 0 | 0 | 0 |
| Auto damage | 60 | 60 | 60 | 60 | 60 |
| Subtotal | 1,830 | 2,180 | 2,180 | 2,180 | 2,180 |
| SOUTH SACRAMENTO | | | | | |
| Residential | 19,740 | 22,940 | 22,940 | 22,940 | 22,940 |
| Commercial | 6,000 | 7,000 | 7,000 | 7,000 | 7,000 |
| Industrial | 0 | 2,000 | 3,000 | 3,000 | 2,500 |
| Public | 1,700 | 1,700 | 1,700 | 1,700 | 1,700 |
| Emergency | 30 | 30 | 30 | 30 | 30 |
| Auto damage | 1,200 | 1,200 | 1,200 | 1,200 | 1,200 |
| Subtotal | 28,670 | 34,870 | 35,870 | 35,870 | 35,370 |
| RICHARDS BLVD | | | | | |
| Residential | 20 | 20 | 20 | 20 | 20 |
| Commercial | 900 | 900 | 900 | 900 | 900 |
| Industrial | 50 | 50 | 50 | 50 | 50 |
| Public | 60 | 60 | 60 | 60 | 60 |
| Emergency | 0 | 0 | 0 | 0 | 0 |
| Auto damage | 20 | 20 | 20 | 20 | 20 |
| Subtotal | 1,050 | 1,050 | 1,050 | 1,050 | 1,050 |
| TOTAL | 48,760 | 56,110 | 57,110 | 57,110 | 56,610 |

1/ 1989 conditions, 1991 prices, 8-3/4% interest.

* Figures rounded to the nearest ten thousand.

TABLE III-12
Full Basin Alternative
Average Annual Inundation Reduction Benefits 1/
($1,000)

| | Levels of Protection | | | | |
|---|---|---|---|---|---|
| Reach | 100yr FEMA | 150yr | 200yr | 400yr | 500yr |
| Natomas | 6,580.0 | 11,300.0 | 14,610.0 | 17,230.0 | 17,750.0 |
| Dry Creek | 1,020.0 | 1,200.0 | 1,260.0 | 1,340.0 | 1,350.0 |
| North Sacto. | 10,800.0 | 23,210.0 | 28,770.0 | 34,890.0 | 36,190.0 |
| Rancho Cordova | 970.0 | 1,780.0 | 3,420.0 | 4,610.0 | 4,790.0 |
| South Sacto. | 31,370.0 | 61,800.0 | 83,170.0 | 101,990.0 | 105,770.0 |
| Richards Blvd. | 940.0 | 2,160.0 | 2,780.0 | 3,340.0 | 3,340.0 |
| Total | 51,680.0 | 101,450.0 | 134,010.0 | 163,400.0 | 169,190.0 |

1/ 8-3/4% Interest Rate, October 1991 prices, 100-year project life.
* Figures rounded to the nearest ten thousand.

this method, the average annual benefits for the Natomas reach totaled $14.6 million for the plan with 200-year protection (see Table III-12).

In the second analysis, the cost of buying the damaged structures and discounting the cost over the life of the project is the alternate method of estimating average annual benefits. This analysis is considered a test on the flood damage reduction computation. In it, since flood damages are very likely to be in excess of 50 percent of the market value of the structure, it is assumed the Federal Government would purchase the homes rather than repair them after each major flood event. Under existing conditions, there are 13,730 structures in Natomas, valued at $1.5 billion that would need to be purchased. Multiplying $1.5 billion by the capital recovery factor (8-3/4% and 100-year life) of .08752 equals $131.3 million in average annual benefits. In comparing these two methods, the lessor or $13.6 million is the average annual benefit attributable to the Natomas reach.

Based upon the levee failure assumptions discussed earlier in this appendix, freeboard benefits were estimated for the Natomas area only. The freeboard benefits in the Natomas area were estimated by failing the levee one-half of the distance between the top and bottom of freeboard. For the five other reaches, freeboard benefits were not estimated due to geotechnical considerations. The geotechnical analysis failed the levees at the same stage with different frequencies of occurrence for without and with project conditions. In all cases, these failure paths were into the freeboard of the levees.

(2) Savings in Flood Proofing.- The Flood Disaster Protection Act of 1973 (Public Law 93-234) requires that communities having flood prone areas participate in the National Flood Insurance Program. Participation in the regular flood insurance program requires local adoption and certification by the FIA of land use regulations that would require, as a minimum, that all new residential and non-residential structures have their first floors elevated to the 100-year flood elevation.

Table III-13 lists the number of future units by decade, the depth of flood proofing needed, and the costs associated with the types of flood proofing. Flood proofing costs that would be incurred prior to project completion are not considered as a structural benefit. Based on an 8-3/4 percent interest rate, the average annual equivalent costs of the nonstructural measures are estimated to be $170,000 for the 2000-2100 period.

(3) Location Benefits.- The location benefit analysis is based on the following assumptions: 1) the extension of the FEMA moratorium from 1992 to 2000; 2) the land use as explained in the Land Use Appendix; 3) the Flood Disaster Protection Act of 1973; and 4) Section 308 of the Water Resources Development Act of 1990.

# Table III-13
## Flood Proofing Units and Costs 1/ 2/

| | Raise by feet | Cost Per Unit ($) 3/ | Units 2010 | 2020 | 2100 |
|---|---|---|---|---|---|
| Residential | 3.0 | 9,930 | 2653 | 0 | 0 |
| 1,600 sq.ft. | 2.5 | 7,920 | 5747 | 0 | 0 |
| | 1.5 | 7,920 | 6337 | 0 | 0 |
| Commercial 22,000 sq.ft. | 6.1 | 7,370 | 246 | 0 | 0 |
| Industrial 27,000 sq.ft. | 3.0 | 4,070 | 274 | 0 | 0 |

1/ Flood proofing would be required to the project base year 2000, and the cost of such flood proofing is not considered as a project benefit.

2/ No development is projected beyond 2010.

3/ 1991 price levels.

The land use analysis indicated that there are significant differences in land development for the Natomas area under without- and with-project conditions. Table III-14 shows the projected development of location acreage over the period 2000-2100. The location acreage is the difference between the without-project and with-project land use projections for the South Natomas and North Natomas areas. Maps showing the without project and with project land uses are shown in the Land Use Appendix. The land use projections are in conformance with the General Plan of the City of Sacramento, which does not forecast land use beyond 2010. These land use projections are discussed in greater detail in the Land Use Appendix. The maximum number of location acres are 7,283.

TABLE III-14
LOCATION ACRES

| Area | 2000 | 2010 | 2020-2100 |
|---|---|---|---|
| South Natomas | 635 | 1,055 | 1,055 |
| North Natomas | 2,549 | 6,228 | 6,228 |
| Total | 3,184 | 7,283 | 7,283 |

The year 2000 is the first year of project life for the proposed flood control project. No acreage can be claimed prior to the year 2000 for locational advantage. This is consistent with both the Flood Disaster Protection Act of 1973 and Section 308 of the Water Resources Development Act of 1990 which requires not to include in the benefit base any new or substantially improved structures built in the 100-year flood plain with a first floor elevation less than the 100-year flood elevation after July 1, 1991. Based upon this information, the change in location acreage is shown in Table III-15. The change in location acreage between the year 2000 and 2010 is 4099 acres.

TABLE III-15
THE CHANGE IN LOCATION ACREAGE

| Area | 2000 | 2010 | 2020-2100 |
|---|---|---|---|
| South Natomas | 0 | 420 | 0 |
| North Natomas | 0 | 3,679 | 0 |
| Total | 0 | 4,099 | 0 |

With the proposed flood control project, a minimum of 200-year flood protection would be provided and development would continue to occur in South Natomas and North Natomas. Without the proposed flood control project, development would stop in South Natomas and North Natomas for failure to meet FEMA flood control requirements. This development would be transferred to other locations in the Sacramento Metropolitan area.

The market value method was used to estimate location benefits in South Natomas and North Natomas. Caution must be exercised in estimating without- and with-project land values. The County Assessor's Office, private real estate appraisers, and private developers were contacted to determine a viable market value for raw land under without- and with-project conditions.

Under the with-project condition, the market value of raw land is higher in South Natomas than North Natomas. A significant portion of South Natomas is highly developed. With the exception of a small commercial-industrial strip parallel to Interstate 80, North Natomas is substantially less developed with significant acreage in agricultural production. On the average, commercial-industrial land in South Natomas is selling for $5 per square foot or $220,000 per acre. Development costs for the installation of infrastructure is $1 per square foot or $43,500 per acre. The market value of an acre of commercial-industrial land, excluding development cost, is $176,500 per acre. The average price paid for raw land in North Natomas is between $40,000 and $ 100,000 per acre. The arithmetic mean of this range is $70,000 per acre. Table III-16 shows the market value of lands in South Natomas and North Natomas.

It is felt that the aforementioned market values for raw land are reasonable. Recent real estate sales information for South Natomas and North Natomas show a wide range in the purchasing price for land. In April 1988, 1.89 acres of land sold for $393,000 per acre. In September 1989, 1.85 acres sold for $281,000 per acre. Both of these sales were for

commercial-industrial land in South Natomas and include some part of the development costs. The prices paid for commercial-industrial land in North Natomas with immediate access to Interstate 80 are equal in magnitude to those in South Natomas. For example, 1.62 acres of land zoned for commercial development sold for $250,000 per acre in 1987. However, as one proceeds north, prices paid for land in North Natomas decline due to the predominance of agricultural and/or open spaced land. In 1985, 257 acres of agricultural land in the northern extremities of North Natomas sold for $48,000 per acre. Two conclusions appear to be true. First, the higher the price paid for an acre of land, the smaller the number of acres purchased. This is particularly true for areas which are highly urbanized. Secondly, the further the land is away from the urban area, the lower the price paid for an acre of land. Based upon these factors, the market values for an acre of land shown in Table III-16 are representative for residential and commercial-industrial land use categories.

Under the without-project condition, development in South Natomas and North Natomas would stop. This development would be transferred to other locations in the Sacramento Metropolitan area where development would not be constrained. One such area is geographically located from the Sacramento Army Depot to Elk Grove. Another area is located near the intersection of U.S. Highway 50 and Sunrise Boulevard to Elk Grove. Consultation with the County Assessors Office, private appraisers, and private developers indicated that the market value for land in South Natomas and North Natomas is higher than the market value of comparable land in any of these alternative areas within the Sacramento Metropolitan area. Table III-16 shows the market values for residential and commercial-industrial lands for these areas. Two values were estimated: one for a more densely urbanized alternate site (comparable to South Natomas) and the other for a less urbanized alternative site on the immediate fringe of the urban area (comparable to North Natomas). It is felt that the environmental impacts of developing land in South Natomas and North Natomas would not be different from the environmental impacts of developing lands in these other areas.

TABLE III-16
MARKET VALUE OF RAW LAND

| | Market Value With Development Cost Per Acre | Development Cost Per Acre | Market Value Without Development Cost Per Acre |
|---|---|---|---|
| **South Natomas** | | | |
| Residential | $175,000 | $43,500 | $131,500 |
| Commercial-Industrial | 220,000 | 43,500 | 176,500 |
| **North Natomas** | | | |
| Residential | 113,500 | 43,500 | 70,000 |
| Commercial-Industrial | 113,500 | 43,500 | 70,000 |
| **More Urbanized Alternative Site** | | | |
| Residential | 131,000 | 43,500 | 87,500 |
| Commercial-Industrial | 174,000 | 43,500 | 130,500 |
| **Less Urbanized Alternative Site** | | | |
| Residential | 103,500 | 43,500 | 60,000 |
| Commercial-Industrial | 103,500 | 43,500 | 60,000 |

TABLE III-17
LOCATION BENEFITS FOR SOUTH NATOMAS
RESIDENTIAL CATEGORY

| Year | Market Value Per Acre W Proj. | Market Value Per Acre W/O Proj. | Difference In Market Value | Acres | Value | Present Worth Factor | Present Worth Amount |
|---|---|---|---|---|---|---|---|
| 1 | $131,500 | $87,500 | $44,000 | 22 | $968,000 | 0.91960 | 890,000 |
| 2 | 131,500 | 87,500 | 44,000 | 43 | 1,892,000 | 0.84560 | 1,600,000 |
| 3 | 131,500 | 87,500 | 44,000 | 65 | 2,860,000 | 0.77760 | 2,224,000 |
| 4 | 131,500 | 87,500 | 44,000 | 86 | 3,784,000 | 0.71500 | 2,706,000 |
| 5 | 131,500 | 87,500 | 44,000 | 108 | 4,752,000 | 0.65750 | 3,124,000 |
| 6 | 131,500 | 87,500 | 44,000 | 129 | 5,676,000 | 0.60460 | 3,432,000 |
| 7 | 131,500 | 87,500 | 44,000 | 151 | 6,644,000 | 0.55590 | 3,693,000 |
| 8 | 131,500 | 87,500 | 44,000 | 172 | 7,568,000 | 0.51120 | 3,869,000 |
| 9 | 131,500 | 87,500 | 44,000 | 194 | 8,536,000 | 0.47010 | 4,013,000 |
| 10 | 131,500 | 87,500 | 44,000 | 215 | 9,460,000 | 0.43230 | 4,090,000 |
| 11-100 | 131,500 | 87,500 | 44,000 | 215 | 9,460,000 | 4.94160 | 46,748,000 |
| | | | | | | Total Present Worth | $76,389,000 |
| | | | | | | Capital Recovery Factor | 0.08752 |
| | | | | | | | $6,686,000 |

TABLE III-18
LOCATION BENEFITS FOR SOUTH NATOMAS
COMMERCIAL - INDUSTRIAL CAT EGORY

| Year | Market Value Per Acre W Proj. | Market Value Per Acre W/O Proj. | Difference In Market Value | Total Acres | Total Acres | Present Worth Factor | Present Worth Amount |
|---|---|---|---|---|---|---|---|
| 1 | $176,500 | $130,500 | $46,000 | 21 | $966,000 | 0.9196 | $888,000 |
| 2 | 176,500 | 130,500 | 46,000 | 41 | 1,886,000 | 0.8456 | 1,595,000 |
| 3 | 176,500 | 130,500 | 46,000 | 62 | 2,852,000 | 0.7776 | 2,218,000 |
| 4 | 176,500 | 130,500 | 46,000 | 82 | 3,772,000 | 0.7150 | 2,697,000 |
| 5 | 176,500 | 130,500 | 46,000 | 103 | 4,738,000 | 0.6570 | 3,113,000 |
| 6 | 176,500 | 130,500 | 46,000 | 123 | 5,658,000 | 0.6046 | 3,421,000 |
| 7 | 176,500 | 130,500 | 46,000 | 144 | 6,624,000 | 0.5559 | 3,682,000 |
| 8 | 176,500 | 130,500 | 46,000 | 164 | 7,544,000 | 0.5112 | 3,856,000 |
| 9 | 176,500 | 130,500 | 46,000 | 185 | 8,510,000 | 0.4701 | 4,001,000 |
| 10 | 176,500 | 130,500 | 46,000 | 205 | 9,430,000 | 0.4323 | 4,077,000 |
| 11-100 | 176,500 | 130,500 | 46,000 | 205 | 9,430,000 | 4.9416 | 46,599,000 |
| | | | | | | Total Present Worth | 76,147,000 |
| | | | | | | Capital Recovery Factor | 0.08752 |
| | | | | | | | $6,664,000 |

TABLE III-19
LOCATION BENEFITS FOR NORTH NATOMAS
RESIDENTIAL CATEG ORY

| Year | Market Value Per Acre W Proj. | Market Value Per Acre W/O Proj. | Difference In Market Value | Total Acres | Total Value | Present Worth Factor | Present Worth Amount |
|---|---|---|---|---|---|---|---|
| 1 | $70,000 | $60,000 | $10,000 | 138 | $1,380,000 | 0.9196 | $1,269,000 |
| 2 | 70,000 | 60,000 | 10,000 | 277 | 2,770,000 | 0.8456 | 2,342,000 |
| 3 | 70,000 | 60,000 | 10,000 | 415 | 4,150,000 | 0.7776 | 3,227,000 |
| 4 | 70,000 | 60,000 | 10,000 | 553 | 5,530,000 | 0.715 | 3,954,000 |
| 5 | 70,000 | 60,000 | 10,000 | 692 | 6,920,000 | 0.657 | 4,546,000 |
| 6 | 70,000 | 60,000 | 10,000 | 830 | 8,300,000 | 0.6046 | 5,018,000 |
| 7 | 70,000 | 60,000 | 10,000 | 968 | 9,680,000 | 0.5559 | 5,381,000 |
| 8 | 70,000 | 60,000 | 10,000 | 1,106 | 11,060,000 | 0.5112 | 5,654,000 |
| 9 | 70,000 | 60,000 | 10,000 | 1,245 | 12,450,000 | 0.4701 | 5,853,000 |
| 10 | 70,000 | 60,000 | 10,000 | 1,383 | 13,830,000 | 0.4323 | 5,979,000 |
| 11-100 | 70,000 | 60,000 | 10,000 | 1,383 | 13,830,000 | 4.9416 | 68,342,000 |
| | | | | | | Total Present Worth | $111,565,000 |
| | | | | | | Capital Recovery Factor | 0.08752 |
| | | | | | | | $9,764,000 |

TABLE III-20
LOCATION BENEFITS FOR NORTH N ATOMAS
COMMERCIAL - INDUSTRIAL CAT EGORY

| Year | Market Value Per Acre W Proj. | Market Value Per Acre W/O Proj. | Difference In Market Value | Total Acres | Total Value | Factor | Amount |
|---|---|---|---|---|---|---|---|
| 1 | $70,000 | $60,000 | $10,000 | 230 | $2,300,000 | 0.9196 | $2,115,000 |
| 2 | 70,000 | 60,000 | 10,000 | 460 | 4,600,000 | *0.8456 | 3,890,000 |
| 3 | 70,000 | 60,000 | 10,000 | 689 | 6,890,000 | 0.7776 | 5,358,000 |
| 4 | 70,000 | 60,000 | 10,000 | 919 | 9,190,000 | 0.715 | 6,571,000 |
| 5 | 70,000 | 60,000 | 10,000 | 1,148 | 11,480,000 | 0.657 | 7,542,000 |
| 6 | 70,000 | 60,000 | 10,000 | 1,378 | 13,780,000 | 0.6046 | 8,331,000 |
| 7 | 70,000 | 60,000 | 10,000 | 1,608 | 16,080,000 | 0.5559 | 8,939,000 |
| 8 | 70,000 | 60,000 | 10,000 | 1,837 | 18,370,000 | 0.5112 | 9,391,000 |
| 9 | 70,000 | 60,000 | 10,000 | 2,067 | 20,670,000 | 0.4701 | 9,717,000 |
| 10 | 70,000 | 60,000 | 10,000 | 2,296 | 22,960,000 | 0.4323 | 9,926,000 |
| 11-100 | 70,000 | 60,000 | 10,000 | 2,296 | 22,960,000 | 4.9416 | 113,459,000 |
| | | | | | | Total Present Worth | $185,239,000 |
| | | | | | | Capital Recovery Factor | 0.08752 |
| | | | | | | | $16,212,000 |

TABLE III-21
MARKET VALUE METHOD
LOCATION BENEFITS

| Alternative | Present Worth Difference In Market Value | Residual Flood Damage | Average Annual Equivalent Benefits |
|---|---|---|---|
| 100-YR FEMA | $39,000,000 | $27,000,000 | $12,000,000 |
| 100-YR | 39,000,000 | 27,000,000 | 12,000,000 |
| 150-YR | 39,000,000 | 15,000,000 | 24,000,000 |
| 200-YR | 39,000,000 | 11,000,000 | 28,000,000 |
| 400-YR | 39,000,000 | 5,000,000 | 34,000,000 |
| 500-YR | 39,000,000 | 4,000,000 | 35,000,000 |

Tables III-17, III-18, III-19, III-20, and III-21 show the market value method of estimating location benefits. The residual flood damages had structures been built on these location acres is subtracted from the market value to determine the benefits in Table III-21. These aforementioned five tables must be reviewed as a whole in understanding the technique used to estimate location benefits.

Current guidance indicates a limitation on location benefits. The limitation is to take the lesser of either the expected flood damages that the new activity would have if it had been built in the flood plain or the costs of fill. The use of fill over 4099 acres at depths of 13 feet or more is not a practical approach. The appearance of new structures corresponding with future growth would be elevated on 13 feet of fill while those structures associated with existing development would not be on fill and this would have aesthetic limitations. During flood stages, the displacement of flood water from these structures constructed on fill may cause higher residual flood damages to existing structures. The cost of fill over the aforementioned acreage and depth would be prohibitive.

The location benefits should not account for a change in land use productivity beyond the reduction in expected flood losses. Based on land use densities and local zoning ordinances, the number of structures were determined and the resulting flood damages were estimated. In this case the expected flood damages in Table III-22 are lower than the benefits estimated with the market value method displayed in Table III-21. Therefore, the expected flood damages in Table III-22 are the location benefits.

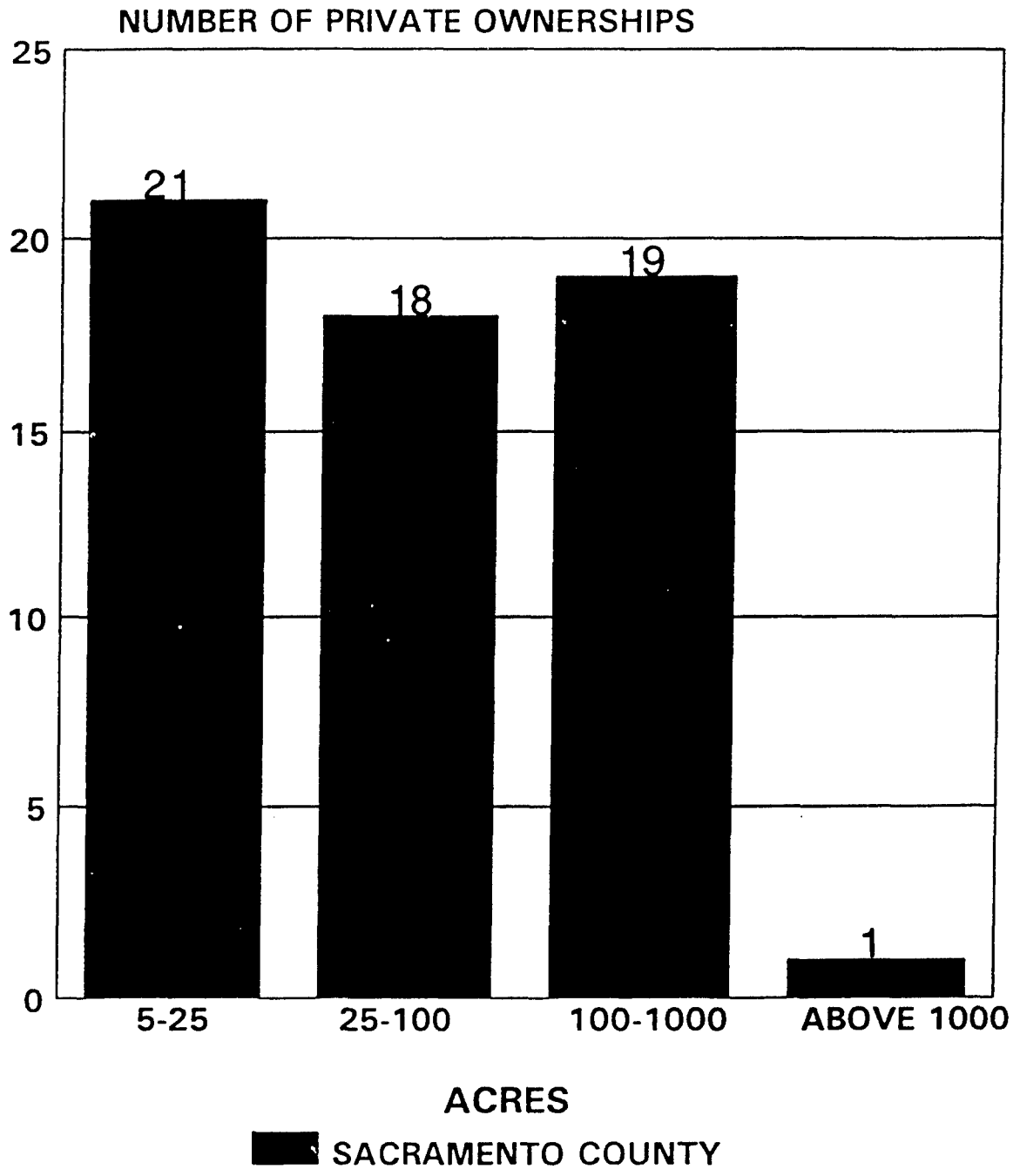
Projects that provide location benefits of tremendously large magnitude to a few beneficiaries are subject to special cost-sharing provisions. This type of locational advantage is a windfall to a few landowners who may gain financially from the Federal project. In the roughly 55,000 acres in Natomas basin, there are currently 13,500 residential structures. The population is estimated at over 34,000 people and growing.

The 1988-89 assessor's rolls for Sacramento and Sutter Counties were evaluated for land ownership in South Natomas and North Natomas. The specific location of the 4,099 acres (Table III-15) is not known. However, the location of the original 7,283 acres (Table III-14) is known. Therefore, the analysis of land ownership must be limited to these acres. Figure III-1 shows the number of landowners who own land parcels in excess of 5 acres. Of the 7,283 locations acres, 59 landowners hold more than 5 acres of land. The largest holding of land by a single owner is approximately 1,026 acres. Six landowners own between 400 and 500 acres. In the future, these properties will eventually be broken into smaller parcels. Even though there may be a few property owners who may at some time benefit financially from a Federal project in Natomas, there are many more people who would only

TABLE III-22
EXPECTED FLOOD DAMAGES

| Alternative | Without Project Damages | With Project Damages | Average Annual Equivalent Benefits |
|---|---|---|---|
| 100-YR FEMA | $35,000,000 | $27,000,000 | $8,000,000 |
| 100-YR | 35,000,000 | 27,000,000 | 8,000,000 |
| 150-YR | 35,000,000 | 15,000,000 | 20,000,000 |
| 200-YR | 35,000,000 | 11,000,000 | 24,000,000 |
| 400-YR | 35,000,000 | 5,000,000 | 30,000,000 |
| 500-YR | 35,000,000 | 4,000,000 | 31,000,000 |

## FIGURE III-1
## PARCEL SIZE




(5 ACRES & GREATER)

benefit from the flood protection. Accordingly, it is believed that special cost sharing due to locational advantages is not appropriate for Natomas.

The development of South Natomas and North Natomas have specific locational advantages over other alternative areas in the Sacramento Metropolitan area. South Natomas and North Natomas are approximately 4 miles and 7 miles from downtown Sacramento. Residents have short commute distances to jobs in the downtown area. Interstate Highways 5 and 80 provides excellent access for residents and commercial-industrial companies. Cultural and entertainment opportunities in the downtown area as well as easy extension of mass transit from downtown to the Natomas area is a major advantage.

With the FEMA moratorium, there are limitations to the development of the alternative areas. Development could possibly be curtailed in foothill areas where limitations already exist on water supply and sewage treatment. Since these alternative sites are more distant from the downtown area, increased traffic on existing roads and highways would impact current air quality standards in the region. Commuters would add substantially to their daily travel times as they drive to their jobs in downtown Sacramento. These limitations could be mitigated by providing additional flood protection to the Natomas area so that development could occur.

(4) Advance Bridge Replacement Benefits.- Advance bridge replacement benefits are calculated as that portion of the annual cost of a bridge replaced as a project feature from the time the existing bridge's economic life ends until the end of the project life. Bridges that are to be replaced vary depending on the flood control alternative. Advance bridge replacement benefits are summarized in Table III-23.

TABLE III-23
BRIDGE REPLACEMENT BENEFITS
(IN $1,000)

| | Average Annual Benefits |
|---|---|
| 100-Year(FEMA) | |
| Main Avenue Bridge | $131,000 |
| 150-Year | |
| Howe Avenue Bridge | $24,000 |
| El Camino Avenue Bridge | 69,000 |
| Main Avenue Bridge | 131,000 |
| Norwood Avenue Bridge | 31,000 |
| | $255,000 |
| 200-Year | |
| Highway 49 Bridge | $1,534,000 |
| Ponderosa Way Bridge | 104,000 |
| Main Avenue Bridge | 131,000 |
| | $1,769,000 |
| 400-Year | |
| Highway 49 Bridge | $1,534,000 |
| Ponderosa Way Bridge | 104,000 |
| Main Avenue Bridge | 131,000 |
| | $1,769,000 |
| 500-Year | |
| Highway 49 Bridge | $1,534,000 |
| Ponderosa Way Bridge | 104,000 |
| Main Avenue Bridge | 131,000 |
| | $1,769,000 |

1/ October 1991 prices, 8-3/4% interest rate, and 100-year project life.

(5) Savings in Flood Insurance Administration Costs.- Savings in the flood insurance program operating costs are the reduction in costs associated with the administration of the National Flood Insurance Program. The cost of servicing flood insurance policies includes the average cost per policy (including agent commissions) and the costs of servicing and adjusting claims. The National Flood Insurance Program operating cost is currently $77 per policy (EC 1105-2-177). A Federal Emergency Management Agency (FEMA) representative was contracted to determine how many flood insurance policies had been issued in the Sacramento area. A small number of policies are actually in force, however, the representative explained that it was probably due to the fact that the extent of the potential flood hazard had only surfaced in the last few years. FEMA would like to see 100% of the property owners within the 100-year flood plain purchase flood insurance and is coordinating an effort among private mortgage companies to eventually achieve this goal. Currently, flood insurance is only required if a property in a 100-year flood plain is bought, sold or re-financed. For purposes of this analysis, several assumptions were made: (1) the extension of the FEMA moratorium from 1992 to 2000 and (2) the small percentage of flood insurance policies in force continues until the moratorium ends in 2000. At that time the percentage of those insured would increase to 10% which currently is the U.S. average for FEMA's flood insurance program. By 2010 the coverage would be 100% because properties currently located in the 100-year flood plain will have been bought, sold, or re-financed by that time and would have to purchase flood insurance.

The tabulation below shows the number of structures and benefits attributable to savings in flood insurance administration costs. The benefits remain the same because the flood insurance coverage that is currently required would no longer be mandatory once a 100-year level of protection is provided. The COE 100-year flood plain was used to estimate these benefits.

Savings in Flood Insurance Administration Costs
(Benefits in $1,000)

| | 100-YEAR FEMA | 150-YEAR | 200-YEAR | 400-YEAR | 500-YEAR |
|---|---|---|---|---|---|
| Benefits | 0 | $6,400 | $6,400 | $6,400 | $6,400 |
| Number of Structures (100-year Flood-Plain) | 0 | 113,000 | 113,000 | 113,000 | 113,000 |

g. Summary. - A summary of average annual flood control benefits for the five whole-basin alternative levels of protection on the American River Watershed is shown in the following tabulation. Amounts, shown in Table III-24, do not include NED employment benefits. The project is located in Sacramento, Sutter, Placer, and El Dorado Counties. Of these counties, only Sutter County qualifies for employment benefits. Due to financial and time constraints, employment benefits were not estimated.

h. Sensitivity Analysis. - An analysis was conducted to determine the effects on the inundation reduction benefits due to changing the location of failure within the levee freeboard under with-project conditions. Two scenarios were evaluated and compared to the with-project failure condition used to assess the selected plan: top of freeboard and bottom of freeboard.

As described above, a geotechnical evaluation was conducted to determine the point at which the levees would fail. For levee reaches which did not include modification as part of the selected plan, this evaluation resulted in failed levees, for economic purposes, at the same stage but with different frequencies of occurrence for both without-project and with-project conditions. The Natomas reach was the only location in which raising the levees is required and freeboard benefits can be estimated. Accordingly for the Natomas reach, the location of levee failure within the freeboard is different in the without- and with-project condition.

The first comparison scenario was to estimate the average annual damages under with-project conditions and resulting average annual benefits if all reaches ( except Natomas) failed at the bottom of freeboard instead of failing at those frequencies as determined by the geotechnical analysis. The second comparison scenario estimated the average annual damages and average annual benefits if the levees for all reaches failed under with-project conditions at the top of freeboard. Information primarily in Plates C-1 through C-3 were used to predict expected river stages and frequency of flooding along the American River and stage-flow relationships along the NEMDC. The 400-year plan (NED plan, see Chapter IV) was used as the with-project condition for the sensitivity analysis.

The frequency and return periods for various flows, or stages, under existing conditions and the aforementioned scenarios are shown in Table III-25. The result of the sensitivity analysis is shown in Table III-26. As shown, the change in average annual benefits is relatively insensitive to varying the location of levee failure within the freeboard. The average annual benefits for all scenarios are sizeable but similar.

Derivation of accurate flood plains based on a specific levee failure scenario is extremely complex, time consuming, and costly. Accordingly, flood plains for alternatives locations of failure

Table III-24
Full Basin Alternative
Average Annual Flood Control Benefits1/
(In $1,000)

| | Alternatives | | | | |
|---|---|---|---|---|---|
| | 100YR FEMA | 150YR | 200YR | 400YR | 500YR |
| Inundation Reduction | 51,680 | 101,450 | 134,010 | 163,400 | 169,190 |
| Location | 8,000 | 20,000 | 24,000 | 30,000 | 31,000 |
| Savings in Flood Proofing Costs | 170 | 170 | 170 | 170 | 170 |
| Bridge Replacement | 130 | 260 | 1,770 | 1,770 | 1,770 |
| Flood Insurance Program | 0 | 6,400 | 6,400 | 6,400 | 6,400 |
| Total | 59,980 | 128,280 | 166,350 | 201,740 | 208,530 |

1/8-3/4% Interest Rate, October 1991 Prices, 100 year project life.
* Figures rounded to the nearest ten thousand.

TABLE III-25

Frequency-Return Relationships Under Existing and Project Conditions

Sensitivity Analysis

| | EXISTING | | | NED PLAN | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| REACH | | | | FREEBOARD BOTTOM | | | TOP OF LEVEE | | |
| | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD |
| *NATOMAS* | 0.0 | 1.43 | 70 | 0.0 | 0.502 | 199 | 0.0 | 0.118 | 847 |
| (Based | 24.2 | 1.41 | 71 | 33.2 | 0.5 | 200 | 33.6 | 0.117 | 850 |
| on stage) | 24.4 | 1.0 | 100 | 33.5 | 0.25 | 400 | 33.6 | 0.1 | 1000 |
| | 27.0 | 0.5 | 200 | 33.7 | 0.167 | 600 | | | |
| | 34.0 | 0.497 | 201 | | | | | | |
| | 34.2 | 0.25 | 400 | | | | | | |
| | 34.3 | 0.167 | 600 | | | | | | |
| *NORTH* | 139K 1/ | 1.43 | 70 | 129 | 0.205 | 488 | 189 | 0.151 | 662 |
| *SAC.* | 140 | 1.41 | 71 | 130 | 0.204 | 490 | 190 | 0.15 | 667 |
| (Based | 156 | 1.33 | 75 | 139 | 0.202 | 496 | | | |
| on flow) | 157 | 1.32 | 76 | 140 | 0.20 | 500 | 200 | 0.145 | 690 |
| | 234 | 1.00 | 100 | 205 | 0.14 | 714 | 520 | 0.06 | 1667 |
| | 520 | 0.25 | 400 | 234 | 0.12 | 833 | | | |
| | 600 | 0.167 | 600 | 520 | 0.06 | 1667 | | | |
| | | | | 600 | 0.05 | 2000 | | | |
| *SOUTH* | 139K | 1.43 | 70 | 139 | 0.21 | 476 | 199 | 0.146 | 685 |
| *SAC.* | 140 | 1.41 | 71 | 140 | 0.20 | 500 | 200 | 0.145 | 690 |
| (Based | 205 | 1.12 | 89 | 205 | 0.144 | 694 | | | |
| on flow) | 234 | 1.00 | 100 | 234 | 0.12 | 833 | 520 | 0.06 | 1667 |
| | 520 | 0.25 | 400 | 520 | 0.06 | 1667 | | | |
| | 600 | 0.167 | 600 | 600 | 0.05 | 2000 | | | |
| *RANCHO* | 144K | 1.45 | 69 | 144 | 0.19 | 526 | 209 | 0.141 | 709 |
| *CORDOVA* | 145 | 1.43 | 70 | 145 | 0.18 | 556 | 210 | 0.140 | 714 |
| (Based | 234 | 1.00 | 100 | 234 | 0.12 | 833 | 520 | 0.06 | 1667 |
| on flow) | 370 | 0.67 | 150 | | | | | | |
| | 520 | 0.25 | 400 | 520 | 0.06 | 1667 | | | |
| | 600 | 0.167 | 600 | 600 | 0.05 | 2000 | | | |
| *RICHARDS* | 179K | 1.22 | 82 | 179 | 0.152 | 658 | 200 | 0.145 | 690 |
| *BLVD.* | 180 | 1.20 | 83 | 180 | 0.151 | 662 | 201 | 0.144 | 694 |
| (Based | 200 | 1.11 | 90 | 200 | 0.145 | 690 | 520 | 0.06 | 1667 |
| on flow) | 234 | 1.00 | 100 | 234 | 0.12 | 833 | | | |
| | 520 | 0.25 | 400 | 520 | 0.06 | 1667 | | | |
| | 600 | 0.167 | 600 | 600 | 0.05 | 2000 | | | |
| *DRY* | 1.2 | 20 | 5 | 1.2 | 20 | 5.0 | 1.2 | 20 | 5.0 |
| *CREEK* | 57.2 | 1.6 | 63 | 16.0 | 10 | 10 | 16.0 | 10 | 10 |
| (Based | 61.5 | 1.0 | 100 | 19.3 | 0.15 | 667 | 19.3 | 0.15 | 667 |
| on stage) | 64.8 | 0.5 | 200 | 68.0 | 0.145 | 690 | 68.0 | 0.145 | 690 |
| | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 |
| | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 |

1/K= 1,000 Cubic Feet Per Second (CFS)

TABLE III-26
SENSITIVITY ANALYSIS 1/
($1,000)

| *Category* | Natomas | North Sacramento | Dry Creek | Rancho Cordova | South Sacramento | Richards Blvd |
|---|---|---|---|---|---|---|
| Average Annual Damages for the Without Project Condition 2/ | 20,040 | 40,570 | 2,040 | 5,600 | 118,540 | 3,830 |
| Average Annual Damages for the With Project Condition (Selected Plan) | | | | | | |
| Freeboard Bottom | 8,700 | 5,690 | 700 | 990 | 16,640 | 500 |
| Selected Condition | 3,170 | 5,680 | 700 | 990 | 16,550 | 490 |
| Levee Top | 2,040 | 4,760 | 700 | 980 | 14,490 | 450 |
| Average Annual Benefits for the (Selected Plan) | | | | | | |
| Freeboard Bottom | 11,340 | 34,880 | 1,340 | 4,610 | 101,900 | 3,330 |
| Selected Condition | 16,870 | 34,890 | 1,340 | 4,610 | 101,990 | 3,340 |
| Levee Top | 18,000 | 35,810 | 1,340 | 4,620 | 104,050 | 3,380 |

1/ October 1991 prices.

2/ Levee failure is based upon geotechnical and related engineering analysis of levee stablility condition.

were not accomplished. However, an effort was made to estimate the relative effect on flooding of levee failures upstream and/or downstream from the initially assumed breaching location. It was concluded that during major flow events (rare floods), the location of levee failure would not greatly influence the lateral extent or depth of flooding.

5. Recreation. - Following is a description of recreation demand and the methodology used to calculate recreation benefits.

a. Description of Demand. - The following table shows an estimate of the existing and potential future recreation use without and with the Natomas project elements for the portions of the project area proposed for recreation development. Estimates are based on 1989 sample use surveys and 1989 and 1990 use data for the American River Parkway facilities. These samples were adjusted using factors developed from similar central California recreation areas to estimated average annual use.

SUMMARY OF ESTIMATED ANNUAL RECREATION USE

| Reach/ Alternative | Existing Recreation Use Without Project Use | | Potential Recreation Use With Project Use | | Estimated Net Increase in Use | |
|---|---|---|---|---|---|---|
| | Annual Recreation Days | | Annual Recreation Days | | Increase In Annual Recreation Days | |
| | YEAR 1 | End Year | YEAR 1 | End Year | YEAR 1 | End Year |
| NEMD Trail | 1,400 | 1,700 | 81,800 | 102,300 | 80,400 | 100,600 |
| Dry Creek Trail | 500 | 700 | 54,600 | 68,200 | 54,100 | 67,500 |
| Arcade Creek Trail | 800 | 1,000 | 81,800 | 102,300 | 81,000 | 101,300 |
| Jedadiah Smith Trail | 109,100 | 136,400 | 163,700 | 204,600 | 54,600 | 68,200 |
| Totals | 111,800 | 139,800 | 381,900 | 477,400 | 270,100 | 337,600 |

When recreation demand is compared to existing recreation use in the study area it is seen that there is a significant unmet need for recreation opportunities. Recreation that is occurring in this area is primarily on existing American River parkway

facilities. But significant use is being made of undeveloped areas on the NEMD canal and tributary creeks. Developed recreation facilities in these areas with the project would both improve the value of existing recreation experiences and provide new recreation opportunities to meet the identified area demand.

b. Benefit Analysis. - An estimate of the recreation day use values for existing and improved facilities is provided in the following table. The recreation day-use values were determined according to procedures outlined in ER 1105-2-100, Planning Guidance; Chapter 6, Economic Considerations; Section VIII, NED Benefit Evaluation Procedure: Recreation. The low value of the existing recreation opportunities reflects the lack of access and developed facilities.

GENERAL RECREATION UNIT DAY VALUES

| | Value per Recreation Day | |
|---|---|---|
| | Existing | New |
| NEMDC Trail | 3.00 | 4.01 |
| Dry Creek Trail | 3.00 | 4.78 |
| Arcade Creek Trail | 3.00 | 4.78 |
| Jedadiah Smith Trail | 5.16 | 6.32 |

Using the day-use recreation values and average annual recreation use derived from the above table, the recreation benefits for new recreation use and for the increased value of the existing recreation use were calculated (the existing recreation use is expected to continue, but the new facilities would make the recreation experience more valuable). The following table displays these benefits. The average annual values were calculated using an 8-3/4 percent interest rate and a 100-year period of analysis.

RECREATION BENEFITS

| | Value of Increase ($1,000) | Change in Value for Existing ($1,000) | Total (Average Annual) ($1,000) |
|---|---|---|---|
| NEMD Trail | 368 | 3 | 371 |
| Dry Creek Trail | 277 | 3 | 280 |
| Arcade Creek Trail | 440 | 3 | 443 |
| Jedadiah Smith Trail | 360 | 116 | 476 |
| | $1,445 | $125 | $1,570 |

The proposed recreation developments are expected to provide in excess of 335,000 user days annually at a value of approximately $1.57 million dollars annually.

The estimated average annual costs for the recreation features are about $890,000 (see cost estimate in main report). Accordingly, the estimated net average annual recreation benefits are $660,000. The benefit-to-cost ratio for the recreation increment is 1.7 to 1.

# CHAPTER IV - OPTIMIZATION

6. General. - Optimization in this report is defined as the process to identify the plan that maximizes Net Economic Development (NED) Benefits. Optimization was accomplished under two separate formulation assumptions. The first method analysed the American River independent of Natomas; then Natomas was evaluated as a last added increment. It included identifying that alternative that maximized net NED benefits along the main stem of the American River and then, as a last added increment, identifying the level of flood protection that maximized the net NED benefits in Natomas. The second method was to optimize the flood control alternative that maximizes net NED benefits from a system, or full basin approach (i.e. each full basin alternative provided a consistent level of flood protection to the main stem American River and Natomas).

7. Separate Area. - Tables IV-1 and IV-2 show frequency and return periods for various flows or stages under without- and with-project conditions for the main stem American River and the Natomas area, respectively. The first entry in the event column (either flow or stage) for each flood plain area is the non-damaging condition. The second entry is the flow or stage at a major levee failure or when damages begin. Project conditions are specific to various alternatives along the main stem American River and in Natomas. The American River alternatives do not include any features to protect Natomas. For reasons to be described, the Natomas alternatives assume a project along the American River capable of providing a 400-year level of protection.

a. Main Stem American River. - As explained in the Plan Formulation Appendix, various alternatives were formulated to provide levels of flood protection along the American River, ranging from the minimum necessary to satisfy requirements of FEMA to the 500-year levels of protection. With one exception, each of the alternatives representing specific levels of protection would provide the greatest net economic benefit. That exception was the 150-year level of protection. In that alternative, features were selected based on other than economic reasons.

Table IV-3 shows a breakdown of estimated first and annual costs for project features along the American River and in Natomas for providing protection to all the American River basin. Tables IV-4 and IV-5 show the estimated flood damages and resulting inundation reduction benefits (based on information provided in

TABLE IV-1
Frequency-Return Relationships Under Without and With Project Conditions
Main Stem Optimization
Alternatives

| | EXISTING | | | 100YR FEMA | | | 150YR | | | 200YR | | | 400YR | | | 500YR | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REACH | EVENT | FREQ. | RETURN 3/ PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD |
| Natomas | 0.0 | 1.43 | 70 | 0.0 | 1.123 | 89 | 0.0 | 0.5 | 200 | 0.0 | 0.5 | 200 | 0.0 | 0.5 | 200 | 0.0 | 0.5 | 200 |
| (Based | 24.2 | 1.41 | 71 | 24.4 | 1.111 | 90 | 24.4 | 0.498 | 201 | 24.4 | 0.498 | 201 | 24.4 | 0.498 | 201 | 24.4 | 0.498 | 201 |
| on stage) | 24.4 | 1.00 | 100 | 24.4 | 1.00 | 100 | 27.0 | 0.495 | 202 | 27.0 | 0.495 | 202 | 27.0 | 0.495 | 202 | 27.0 | 0.495 | 202 |
| | 27.0 | 0.5 | 200 | 27.0 | 0.5 | 200 | 34.0 | 0.493 | 203 | 34.0 | 0.493 | 203 | 34.0 | 0.493 | 203 | 34.0 | 0.493 | 203 |
| | 34.0 | 0.497 | 201 | 34.0 | 0.497 | 201 | 34.3 | 0.25 | 400 | 34.3 | 0.25 | 400 | 34.3 | 0.25 | 400 | 34.3 | 0.25 | 400 |
| | 34.2 | 0.25 | 400 | 34.3 | 0.25 | 400 | 34.3 | 0.167 | 600 | 34.3 | 0.167 | 600 | 34.3 | 0.167 | 600 | 34.3 | 0.167 | 600 |
| | 34.3 | 0.167 | 600 | 34.3 | 0.167 | 600 | | | | | | | | | | | | |
| North | 139K 1/ | 1.43 | 70 | 142K | 1.01 | 99 | 195K | 0.503 | 199 | 139K | 0.402 | 249 | 139K | 0.2004 | 499 | 139K | 0.150 | 666 |
| Sac. | 140K | 1.41 | 71 | 143 | 1.00 | 100 | 196 | 0.50 | 200 | 140 | 0.40 | 250 | 140 | 0.20 | 500 | 140 | 0.15 | 667 |
| (Based | 156K | 1.33 | 75 | 156 | 0.98 | 102 | 234 | 0.46 | 217 | 205 | 0.30 | 333 | 205 | 0.14 | 714 | 205 | 0.10 | 1000 |
| on flow) | 157K | 1.32 | 76 | 157 | 0.97 | 103 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 234K | 1.00 | 100 | 234 | 0.70 | 143 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | | | | | | | | | |
| South | 139K | 1.43 | 70 | 139K | 1.03 | 97 | 195K | 0.503 | 199 | 139K | 0.402 | 249 | 139K | 0.2004 | 499 | 139K | 0.150 | 666 |
| Sac. | 140K | 1.41 | 71 | 140 | 1.02 | 98 | 196 | 0.50 | 200 | 140 | 0.40 | 250 | 140 | 0.20 | 500 | 140 | 0.15 | 667 |
| (Based | 205K | 1.12 | 89 | 205 | 0.80 | 125 | 234 | 0.46 | 217 | 205 | 0.30 | 333 | 205 | 0.14 | 714 | 205 | 0.10 | 1000 |
| on flow) | 234K | 1.00 | 100 | 234 | 0.70 | 143 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Rancho | 144K | 1.45 | 69 | 144K | 0.999 | 100 | 195K | 0.503 | 199 | 139K | 0.402 | 249 | 139K | 0.2004 | 499 | 139K | 0.150 | 666 |
| Cordova | 145K | 1.43 | 70 | 145 | 0.99 | 101 | 196 | 0.50 | 200 | 140 | 0.40 | 250 | 140 | 0.20 | 500 | 140 | 0.15 | 667 |
| (Based | 234K | 1.00 | 100 | 234 | 0.70 | 143 | 234 | 0.46 | 217 | 205 | 0.30 | 333 | 205 | 0.14 | 714 | 205 | 0.10 | 1000 |
| on flow) | 370K | 0.67 | 150 | 370 | 0.54 | 185 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Richards | 179K | 1.22 | 82 | 179K | 0.91 | 110 | 195K | 0.503 | 199 | 179K | 0.322 | 311 | 179K | 0.1502 | 666 | 179K | 0.150 | 666 |
| Blvd. | 180K | 1.20 | 83 | 180 | 0.90 | 111 | 196 | 0.50 | 200 | 180 | 0.32 | 312 | 180 | 0.15 | 667 | 180 | 0.15 | 667 |
| (Based | 200K | 1.11 | 90 | 200 | 0.80 | 125 | 234 | 0.46 | 217 | 200 | 0.30 | 333 | 200 | 0.14 | 714 | 200 | 0.10 | 1000 |
| on flow) | 234K | 1.00 | 100 | 234 | 0.70 | 143 | 520 | 0.25 | 400 | 234 | 0.27 | 370 | 234 | 0.12 | 833 | 234 | 0.085 | 1176 |
| | 520K | 0.25 | 400 | 520 | 0.24 | 417 | 600 | 0.167 | 600 | 520 | 0.13 | 769 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.167 | 600 | | | | 600 | 0.10 | 1000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Dry Creek | 1.2 2/ | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 |
| (Based | 57.2 | 1.60 | 63 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 |
| on stage) | 61.5 | 1.00 | 100 | 18.5 | 0.85 | 118 | 18.8 | 0.452 | 221 | 19.0 | 0.32 | 313 | 19.3 | 0.15 | 667 | 19.6 | 0.13 | 800 |
| | 64.8 | 0.50 | 200 | 62.2 | 0.84 | 119 | 65.0 | 0.45 | 222 | 65.9 | 0.318 | 314 | 68.0 | 0.145 | 668 | 68.2 | 0.125 | 769 |
| | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 73.1 | 0.01 | 10000 |
| | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | | | |

1/ K= 1,000 Cubic Feet Per Second (CFS)
2/ Dimensionless indicator (relationship) for event versus frequency
3/ Return period in years

TABLE IV-2
Frequency-Return Relationships Under With and Without Project Conditions
Optimization
Natomas 1/

| | EXISTING | | | 100YR FEMA | | | 200YR | | | 400YR | | | 500YR-a | | | 500YR-b | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| REACH | EVENT | FREQ. | RETURN 2/ PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD | EVENT | FREQ. | RETURN PERIOD |
| Natomas | 0.0 | 1.43 | 70 | 0.00 | 0.2227 | 449 | 0.00 | 0.2004 | 449 | 0.00 | 0.1802 | 555 | 0.00 | 0.125 | 800 | 0.00 | 0.1759 | 574 |
| (Based | 24.2 | 1.41 | 71 | 33.4 | 0.2222 | 450 | 33.5 | 0.20 | 500 | 33.5 | 0.18 | 556 | 33.6 | 0.1248 | 801 | 33.6 | 0.1742 | 575 |
| on stage) | 24.4 | 1.00 | 100 | 33.6 | 0.125 | 800 | 33.6 | 0.125 | 800 | 33.6 | 0.167 | 599 | 33.6 | 0.10 | 1000 | 33.6 | 0.10 | 1000 |
| | 27.0 | 0.5 | 200 | 33.6 | 0.10 | 1000 | 33.6 | 0.10 | 1000 | 33.6 | 0.154 | 649 | | | | | | |
| | 34.0 | 0.497 | 201 | | | | | | | 33.7 | 0.148 | 676 | | | | | | |
| | 34.2 | 0.25 | 400 | | | | | | | 33.7 | 0.0143 | 6993 | | | | | | |
| | 34.3 | 0.167 | 600 | | | | | | | | | | | | | | | |
| North | 139K 3/ | 1.43 | 70 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 |
| Sac. | 140K | 1.41 | 71 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 |
| (Based | 156K | 1.33 | 75 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 |
| on flow) | 157K | 1.32 | 76 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 |
| | 234K | 1.00 | 100 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 520K | 0.25 | 400 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| | 600K | 0.167 | 600 | | | | | | | | | | | | | | | |
| South | 139K | 1.43 | 70 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 |
| Sac. | 140K | 1.41 | 71 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 |
| (Based | 205K | 1.12 | 89 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 |
| on flow) | 234K | 1.00 | 100 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 |
| | 520K | 0.25 | 400 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Rancho | 144K | 1.45 | 69 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 | 139K | 0.2004 | 499 |
| Cordova | 145K | 1.43 | 70 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 | 140 | 0.20 | 500 |
| (Based | 234K | 1.00 | 100 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 | 205 | 0.14 | 714 |
| on flow) | 370K | 0.67 | 150 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 |
| | 520K | 0.25 | 400 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Richards | 179K | 1.22 | 82 | 179K | 0.1502 | 666 | 179K | 0.1502 | 666 | 179K | 0.1502 | 666 | 179K | 0.1502 | 666 | 179K | 0.1502 | 666 |
| Blvd. | 180K | 1.20 | 83 | 180 | 0.15 | 667 | 180 | 0.15 | 667 | 180 | 0.15 | 667 | 180 | 0.15 | 667 | 180 | 0.15 | 667 |
| (Based | 200K | 1.11 | 90 | 200 | 0.14 | 714 | 200 | 0.14 | 714 | 200 | 0.14 | 714 | 200 | 0.14 | 714 | 200 | 0.14 | 714 |
| on flow) | 234K | 1.00 | 100 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 | 234 | 0.12 | 833 |
| | 520K | 0.25 | 400 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 | 520 | 0.06 | 1667 |
| | 600K | 0.167 | 600 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 | 600 | 0.05 | 2000 |
| Dry Creek | 1.2 4/ | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 | 1.2 | 20.0 | 5 |
| (Based | 57.2 | 1.60 | 63 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 | 16.0 | 10.0 | 10 |
| on stage) | 61.5 | 1.00 | 100 | 19.0 | 0.2227 | 449 | 19.0 | 0.2004 | 499 | 19.0 | 0.15 | 667 | 19.6 | 0.13 | 769 | 19.6 | 0.13 | 769 |
| | 64.8 | 0.50 | 200 | 62.2 | 0.2222 | 450 | 62.2 | 0.125 | 500 | 62.2 | 0.145 | 668 | 68.2 | 0.125 | 800 | 68.2 | 0.125 | 800 |
| | 68.2 | 0.13 | 769 | 68.2 | 0.13 | 769 | 68.2 | 0.17 | 769 | 68.2 | 0.13 | 769 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 |
| | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | 73.1 | 0.01 | 10000 | | | | | | |

1/ Flows and stages assume a 890,000 acre foot flood detention dam on Main Stem American River
2/ Return period in years
3/ K= 1,000 Cubic Feet Per Second (CFS)
4/ Dimensionless indicator (relationship) for event versus frequency

TABLE IV-3
COST COMPARISON FOR NED ANALYSIS 1/ 2/
FULL BASIN ALTERNATIVES

| Item | 100 Yr (FEMA – No Dam) 3/ | | | 150 Yr | | | 100 Yr (With Dam) | | | 200 Yr | | | 400 Yr | | | 500 Yr | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | American River | Natomas | Total | American River | Natomas | Total | American River | Natomas | Total | American River | Natomas | Total | American River | Natomas | Total | American River | Natomas | Total |
| First Cost | | | | | | | | | | | | | | | | | | |
| Lands – Project 4/ | 0.0 | 6.4 | 6.4 | 7.8 | 17.5 | 25.3 | 38.8 | 6.4 | 45.2 | 43.4 | 8.5 | 51.9 | 49.2 | 10.2 | 59.4 | 52.4 | 11.0 | 63.4 |
| Roads and Relocations | 0.0 | 5.1 | 5.1 | 56.8 | 10.7 | 67.5 | 110.0 | 5.1 | 115.1 | 110.0 | 5.3 | 115.3 | 110.0 | 5.7 | 115.7 | 110.4 | 5.9 | 116.3 |
| Dams | 0.0 | 0.0 | 0.0 | 40.6 | 0.0 | 40.6 | 154.4 | 0.0 | 154.4 | 212.3 | 0.0 | 212.3 | 274.0 | 0.0 | 274.0 | 324.0 | 0.0 | 324.0 |
| Levees | 0.0 | 7.0 | 7.0 | 62.4 | 11.4 | 73.8 | 0.0 | 7.0 | 7.0 | 0.0 | 7.6 | 7.6 | 0.0 | 8.4 | 8.4 | 0.0 | 9.0 | 9.0 |
| Pump Plant and Relsted | 0.0 | 5.4 | 5.4 | 13.5 | 5.4 | 18.9 | 0.0 | 5.4 | 5.4 | 0.0 | 5.4 | 5.4 | 0.0 | 5.4 | 5.4 | 0.0 | 5.4 | 5.4 |
| Floodway and Diversion Str. | 0.0 | 0.0 | 0.0 | 20.4 | 0.0 | 20.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Eng., Des., Sup., & Admin. | 0.0 | 3.6 | 3.6 | 38.6 | 5.6 | 44.2 | 52.7 | 3.6 | 56.3 | 64.3 | 3.7 | 68.0 | 76.5 | 3.9 | 80.4 | 90.6 | 4.2 | 94.8 |
| Subtotal | 0.0 | 27.5 | 27.5 | 240.1 | 50.6 | 290.7 | 355.9 | 27.5 | 383.4 | 430.0 | 30.5 | 460.5 | 509.7 | 33.6 | 543.3 | 577.4 | 35.5 | 612.9 |
| Environmental Mitigation 5/ | 0.0 | 4.1 | 4.1 | 36.0 | 7.6 | 43.6 | 53.4 | 4.1 | 57.5 | 64.5 | 4.6 | 69.1 | 76.5 | 5.0 | 81.5 | 86.6 | 5.3 | 91.9 |
| Cultural Res. Mitigation 6/ | 0.0 | 0.3 | 0.3 | 3.0 | 0.6 | 3.6 | 12.5 | 0.3 | 12.8 | 5.3 | 0.4 | 5.7 | 6.4 | 0.4 | 6.8 | 7.2 | 0.4 | 7.7 |
| Resources Replacement | 96.9 | 0.0 | 96.9 | 158.0 | 0.0 | 158.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Total – First Cost | 96.9 | 32.0 | 128.9 | 437.1 | 58.8 | 495.9 | 421.7 | 32.0 | 453.7 | 499.8 | 35.5 | 535.3 | 592.5 | 39.0 | 631.5 | 671.2 | 41.2 | 712.5 |
| Interest During Construction | 0.0 | 2.4 | 2.4 | 27.7 | 5.8 | 33.5 | 30.3 | 2.4 | 32.7 | 36.7 | 2.9 | 39.6 | 43.5 | 3.2 | 46.7 | 57.7 | 3.3 | 61.0 |
| Total Investment Cost | 96.9 | 34.4 | 131.3 | 464.8 | 64.6 | 529.4 | 452.0 | 34.4 | 486.4 | 536.5 | 38.4 | 574.9 | 636.0 | 42.2 | 678.2 | 728.9 | 44.5 | 773.4 |
| Annual Cost | | | | | | | | | | | | | | | | | | |
| Interest and Ammor. 7/ | 8.5 | 3.0 | 11.5 | 40.7 | 5.7 | 46.3 | 39.6 | 3.0 | 42.6 | 47.0 | 3.4 | 50.3 | 55.7 | 3.7 | 59.4 | 63.8 | 3.9 | 67.7 |
| Operation and Maintenance | 0.0 | 0.1 | 0.1 | 0.2 | 0.1 | 0.3 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.2 |
| Total | 8.5 | 3.1 | 11.6 | 40.9 | 5.8 | 46.6 | 39.7 | 3.1 | 42.8 | 47.1 | 3.5 | 50.5 | 55.8 | 3.8 | 59.6 | 63.9 | 4.0 | 67.9 |

1/ October 1991 price levels.
2/ Does not include recreation costs in Natomas which would be the same for all alternatives. Does not include creditable expenditures to date for Auburn Dam project.
3/ 85 year Corps level of flood protection.
4/ Lands for flood control only. Subsequent analysis for MCACES resulted in a substantial reduction in land requirements for detention dam and resulting costs (see main report).
5/ Environmental mitigation equals 15 percent of the subtotal and includes allowance for mitigation lands.
6/ Cultural resources mitigation equals the subtotal multiplied by 0.0125.
7/ 8 3/4%

TABLE IV–4
Main Stem Optimization 1/
Average Annnual Damages
($1,000)

| Reach | Without Project | 100yr | 150yr | 200yr | 400yr | 500yr |
|---|---|---|---|---|---|---|
| *Natomas* | 20,040 | 16,450 | 8,720 | 8,720 | 8,720 | 8,720 |
| *Dry Creek* | 2,040 | 1,020 | 840 | 780 | 700 | 700 |
| *North Sac* | 40,570 | 29,760 | 17,360 | 11,800 | 5,680 | 4,380 |
| *Rancho Cordova South Sac* | 5,600 118,540 | 4,580 87,170 | 3,820 56,740 | 2,180 35,370 | 990 16,550 | 810 12,770 |
| *Richards Bl.* | 3,830 | 2,890 | 1,670 | 1,050 | 490 | 490 |
| Total | 190,620 | 141,870 | 89,150 | 59,900 | 33,130 | 27,870 |

1/ October 1991 prices, 8–3/4% interest rate.

TABLE IV–5
Main Stem Optimization 1/
Inundation Reduction Benefits
($1,000)

| Reach | 100yr | 150yr | 200yr | 400yr | 500yr |
|---|---|---|---|---|---|
| *Natomas* | 3,590 | 11,320 | 11,320 | 11,320 | 11,320 |
| *Dry Creek* | 1,020 | 1,200 | 1,260 | 1,340 | 1,340 |
| *North Sac* | 10,810 | 23,210 | 28,770 | 34,890 | 36,190 |
| *Rancho Cordova South Sac* | 1,020 31,370 | 1,780 61,800 | 3,420 83,170 | 4,610 101,990 | 4,790 105,770 |
| *Richards Bl.* | 940 | 2,160 | 2,780 | 3,340 | 3,340 |
| Total | 48,750 | 101,470 | 130,720 | 157,490 | 162,750 |

1/ October 1991 prices, 8–3/4% interest rate.
* Figures rounded to the nearest ten thousand.

TABLE IV-6 1/2/
AMERICAN RIVER PROJECT ELEMENTS
MAIN STEM ALTERNATIVES
($ MILLIONS)

| Item | 100 Yr FEMA (No Dam) 3/ | 150 Yr | 100 Yr (Dam) | 200 Yr | 400 Yr | 500 Yr |
|---|---|---|---|---|---|---|
| First Cost | 96.90 | 437.10 | 421.70 | 499.80 | 592.50 | 671.20 |
| Interest During Construction | 0.00 | 27.70 | 30.30 | 36.70 | 43.50 | 57.70 |
| Total Investment Cost | 96.90 | 464.80 | 452.00 | 536.50 | 636.00 | 728.90 |
| Annual Cost 4/ | | | | | | |
| Interest & Amortization | 8.50 | 40.70 | 39.60 | 47.00 | 55.70 | 63.80 |
| Operation and Maintenance | 0.00 | 0.20 | 0.10 | 0.10 | 0.10 | 0.10 |
| Total | 8.50 | 40.90 | 39.70 | 47.10 | 55.80 | 63.90 |
| Annual Benefits 4/ | | | | | | |
| Inundation Reduction | 48.75 | 101.47 | 48.75 | 130.72 | 157.49 | 162.75 |
| Flood Proofing Cost Sav. | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| Bridge Replacement | 0.00 | 0.24 | 1.64 | 1.64 | 1.64 | 1.64 |
| Flood Insurance | 0.00 | 5.62 | 5.62 | 5.62 | 5.62 | 5.62 |
| Total | 48.92 | 107.50 | 56.18 | 138.15 | 164.92 | 170.18 |
| Net Annual Benefits 4/ | 40.42 | 66.60 | 16.48 | 91.05 | 109.12 | 106.28 |

1/ Does not include Natomas elements other than for increased objective release.
2/ October 1991 Price Levels.
3/ 85-year Corps level of flood protection.
4/ At 8-3/4 % interest for 100-year project life.

Table IV-1) for the various alternatives. Table IV-6 shows a summary comparison of the costs and benefit categories for the 100-year FEMA, and 150-, 200-, 400-, and 500-year levels of flood protection. Plate C-13 is a plot of pertinent information in Table IV-6. It shows the relationships in the first and annual costs, benefits, and net benefits for the various alternatives. The NED plan along the Main Stem of the American River is the 400-year alternative.

The identification of the plan that maximized net benefits was also made using a marginal cost to marginal benefit approach. The point where marginal cost equals marginal benefits is the optimal project size. The 400-year level of protection was identified as that increment along the American River that maximized net economic benefits.

b. Natomas. - Flood protection from plan elements along the American River can significantly reduce flooding in the watershed. Furthermore, these elements can greatly help, but cannot resolve, flooding in Natomas. On the other hand, flood protection in Natomas cannot easily or economically be accomplished by itself. In other words, Natomas can be considered a last added increment to a flood project in the watershed, however, it cannot be considered as a first-added increment.

An analysis was conducted, assuming the economic optimal-main stem American River plan element mentioned above for all conditions, and then providing varying levels of protection in Natomas. Included in Table IV-2 are the estimated frequencies of flows or stages of flooding in the various flood plains. Tables IV-7 and IV-8 show the estimated average annual damages under without- and with-project conditions and resulting benefits based on the information in Table IV-2 for the 100 (FEMA)-, 200-, 400-, and 500-year levels of protection. Table IV-9 shows a summary of costs and benefits for each alternative. Included in Table IV-9 is an estimated cost for levee modifications along the American River and elsewhere. These modifications are intended to offset hydraulically induced impacts resulting from Natomas being protected to the 500-year event while the remainder of the area is only protected to the 400-year level.

The alternative which maximizes net annual economic benefits is that alternative with 400-year level of flood protection. The net benefits are also shown for the 100-year FEMA, 200-year, 400-year, and 500-year levels of flood protection. The net benefits for the 500-year alternative are less than the net benefits for the 400-year alternative since the costs disproportionately increased for the added increment of flood protection.

TABLE IV-7
Natomas Optimization 1/
Average Annual Damages 2/
($1,000)

| Reach | Without Project | 100yr FEMA | 200yr | 400yr | 500yr |
|---|---|---|---|---|---|
| *Natomas* | 20,040 3/ | 3,870 | 3,480 | 3,130 | 2,170 |
| *Dry Creek* | 2,040 | 730 | 700 | 700 | 690 |
| *North Sac* | 40,570 | 5,680 | 5,680 | 5,680 | 5,680 |
| *Rancho Cordova* | 5,600 | 990 | 990 | 990 | 990 |
| *South Sac* | 118,540 | 16,550 | 16,550 | 16,550 | 16,550 |
| *Richards Bl.* | 3,830 | 490 | 490 | 490 | 490 |
| Total | 190,620 | 28,310 | 27,890 | 27,540 | 26,570 |

TABLE IV-8
Natomas Optimization 1/
Inundation Reduction Benefits
($1,000) 2/

| Reach | 100yr FEMA | 200yr | 400yr | 500yr |
|---|---|---|---|---|
| Natomas | 16,170 3/ | 16,560 | 16,910 | 17,870 |
| Dry Creek | 1,310 | 1,340 | 1,340 | 1,350 |
| North Sac | 34,890 | 34,890 | 34,890 | 34,890 |
| Rancho Cordova | 4,610 | 4,610 | 4,610 | 4,610 |
| South Sac | 101,990 | 101,990 | 101,990 | 101,990 |
| Richards Bl. | 3,340 | 3,340 | 3,340 | 3,340 |
| Total | 162,310 | 162,730 | 163,080 | 164,050 |

1/ October 1991 prices.
2/ Figures rounded to the nearest ten thousand.
3/ Damages and benefits assume 400-year level of flood protection along the Main Stem American River and varying levels of flood protection (100yr fema, 200yr, 400yr, and 500yr) in Natomas.

TABLE IV-9
OPTIMIZATION OF NATOMAS ELEMENTS - AS A LAST ADDED INCREMENT 1/
($ MILLIONS)

| Item | Natomas Level of Protection Alternatives | | | | | |
|---|---|---|---|---|---|---|
| | 70 Yr (Non-Damaging) 2/ | 80 Yr 2/ | 100 Yr (FEMA) 3/ | 200 Yr | 400 Yr | 500 Yr |
| First Cost | | | | | | |
| Detention Dam and Related 4/ | 592.50 | 592.50 | 592.50 | 592.50 | 592.50 | 592.50 |
| American River Levee Mod. 5/ 10/ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 218.55 |
| Natomas Area Levee Modifications 10/ | 0.00 | 31.80 | 32.00 | 35.50 | 39.00 | 58.80 |
| Total Alternative | 592.50 | 624.30 | 624.50 | 628.00 | 631.50 | 869.85 |
| Total Natomas Specific 6/ | 0.00 | 31.80 | 32.00 | 35.50 | 39.00 | 277.35 |
| IDC 7/ | 0.00 | 2.41 | 2.40 | 2.90 | 3.20 | 31.80 |
| Total | 0.00 | 34.21 | 34.40 | 38.40 | 42.20 | 309.15 |
| Annual Costs - Natomas | | | | | | |
| Interest and Amortization 8/ | 0.00 | 2.99 | 3.00 | 3.36 | 3.70 | 27.10 |
| Oper. and Maint. | 0.00 | 0.40 | 0.10 | 0.10 | 0.10 | 0.40 |
| Total | 0.00 | 3.39 | 3.10 | 3.46 | 3.80 | 27.50 |
| Annual Benefits 8/ | | | | | | |
| Inundation Reduction | | | | | | |
| Total Alternative | 0.00 | | 162.31 | 162.73 | 163.08 | 164.05 |
| American River Specific 9/ | 0.00 | | 157.49 | 157.49 | 157.49 | 157.49 |
| Subtotal Natomas | 0.00 | | 4.82 | 5.24 | 5.59 | 6.56 |
| Location | 0.00 | | 8.00 | 24.00 | 30.00 | 31.00 |
| Bridge Replacement | 0.00 | | 0.13 | 0.13 | 0.13 | 0.13 |
| Flood Insurance | 0.00 | | 0.00 | 0.78 | 0.78 | 0.78 |
| Total | 0.00 | | 12.95 | 30.15 | 36.50 | 38.47 |
| Net Annual Benefits 8/ | 0.00 | | 9.85 | 26.69 | 32.70 | 10.97 |

1/ October 1991 - Price Levels
2/ Approximate
3/ 85-Year Corps level of flood protection.
4/ Includes 894,000 acre foot flood control dam at Auburn.
5/ Include features along lower American River to mitigate adverse hydraulic impacts due to Natomas protection.
6/ Total for alternative less cost for flood control dam at Auburn.
7/ Natomas area and lower American River levee features only.
8/ At 8-3/4 % interest for 100-year project life.
9/ Flood control benefits attributable to an 894,000 acre foot flood control dam at Auburn.
10/ Costs were derived on a proportional basis for projects including features to accommodate an increased objective release from Folsom Dam.

8. System. - Due to (1) the similarities in maximizing at net annual benefits in Natomas and the main stem American River and (2) the expressed desire by the non-Federal sponsor to evaluate the Natomas and American River elements on a system basis, an optimization was accomplished on alternatives providing consistent levels of flood protection. The estimated frequencies of flows and/or stages of flooding for the various alternatives are shown in Table III-4. Costs for these alternatives are shown in Table IV-3. Table IV-10 and Plate C-14 show a summary of the first and annual costs, benefits, and net benefits. As indicated on Plate C-14, the alternative on a system basis that appears to maximize net annual (NED) benefits is the 400-year plan.

9. Natomas As Last Added Increment. - The estimated average annual flood control related benefits for a project designed to protect the main stem American River (detention dam near Auburn capable of providing a 200-year level of protection to the main stem of the American River (excluding Natomas)) is approximately $138.2 million. About 8 percent of this benefit is attributable to reduction of flood damages in Natomas. The total average annual flood control related benefits for the selected project (full basin alternative) are $166.4 million. Accordingly, the benefits creditable to the Natomas increment of the selected plan are $28.2 million ($166.4 - $138.2 million).

There would be no location benefits included in a project aimed only at protecting the main stem of the American River. Accordingly, location benefits make up a large amount ($24 million) of the difference in annual flood control related benefits between the selected plan (full basin alternative) and a project aimed only at providing flood protection to the main stem of the American River. The tabulation below shows the benefits for the Natomas (200-year level of flood protection) last added increment:

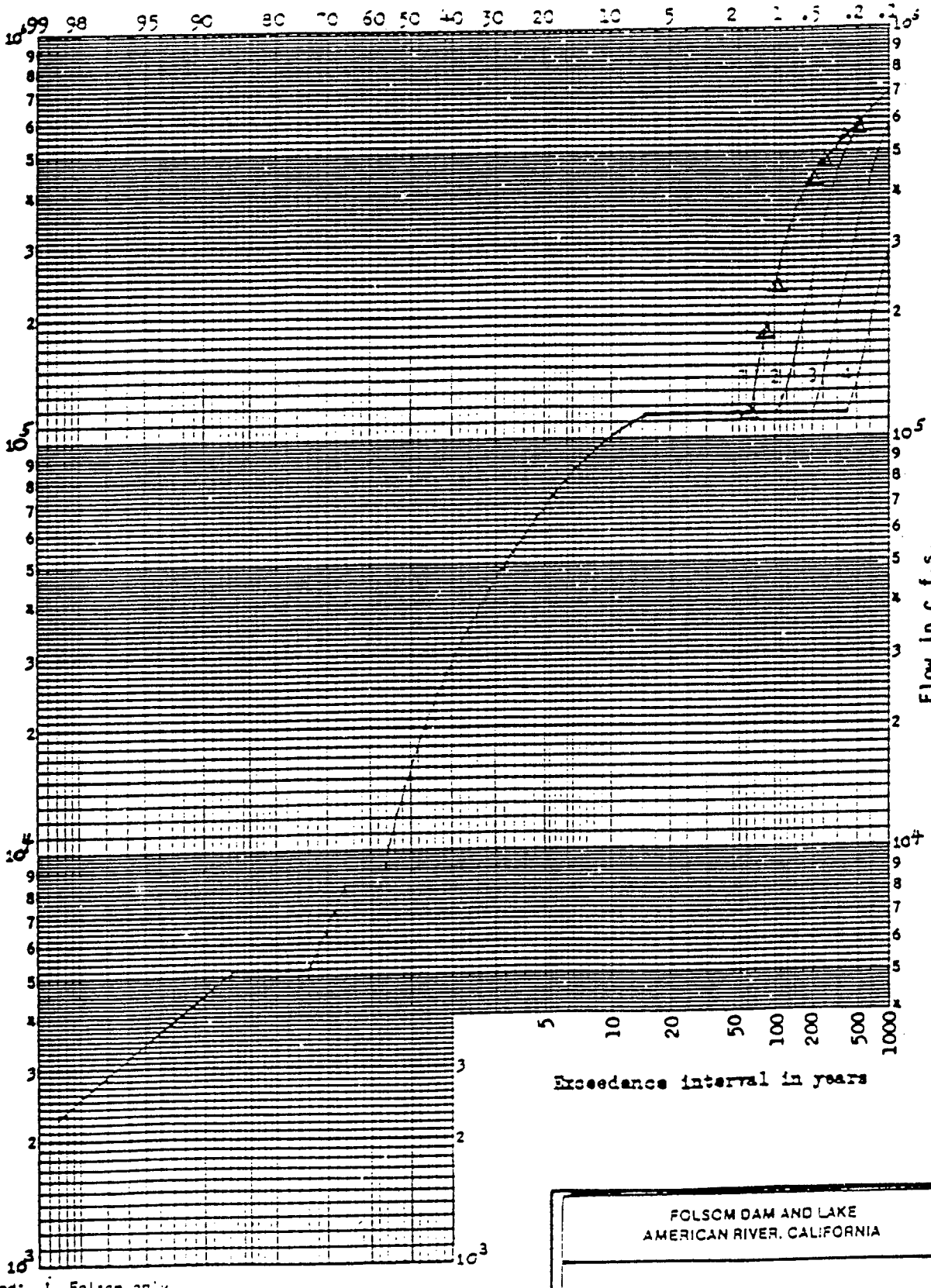
| (Benefits in $1,000) | | | |
|---|---|---|---|
| Benefit Category | Benefits For Full Basin | Benefits For Main Stem | Benefits For Natomas Last Added Increment |
| Inundation Reduction | 134,010 | 130,720 | 3,290 |
| Location | 24,000 | 0 | 24,000 |
| Savings in Flood-Proofing Costs | 170 | 170 | 0 |
| Bridge Replacement | 1,770 | 1,640 | 130 |
| Savings in Flood Insurance Costs | 6,400 | 5,620 | 780 |
| Total | 166,350 | 138,150 | 28,200 |

TABLE IV-10
AMERICAN RIVER AND NATOMAS PROJECT ELEMENTS - AS A SYSTEM 1/
FULL BASIN
($ MILLIONS)

| Item | Alternatives | | | | | |
|---|---|---|---|---|---|---|
| | 100 Yr FEMA (No Dam) 2/ | 150 Yr | 100 Yr (Dam) | 200 Yr | 400 Yr | 500 Yr |
| First Cost | | | | | | |
| American River 3/ | 96.90 | 437.10 | 421.70 | 499.80 | 592.50 | 671.20 |
| Natomas | 32.00 | 58.80 | 32.00 | 35.50 | 39.00 | 41.20 |
| Subtotal | 128.90 | 495.90 | 453.70 | 535.30 | 631.50 | 712.40 |
| Interest During Construction | 2.40 | 33.50 | 32.70 | 39.60 | 46.70 | 61.00 |
| Total Investment Cost | 131.30 | 529.40 | 486.40 | 574.90 | 678.20 | 773.40 |
| Annual Cost 4/ | | | | | | |
| Interest & Amortization | 11.49 | 46.30 | 42.62 | 50.33 | 59.40 | 67.70 |
| Operation and Maintenance | 0.10 | 0.30 | 0.20 | 0.20 | 0.20 | 0.20 |
| Total | 11.59 | 46.60 | 42.82 | 50.53 | 59.60 | 67.90 |
| Annual Benefits 4/ | | | | | | |
| Inundation Reduction | 51.68 | 101.45 | 51.68 | 134.01 | 163.40 | 169.19 |
| Location | 8.00 | 20.00 | 8.00 | 24.00 | 30.00 | 31.00 |
| Flood Proofing Cost Sav. | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 | 0.17 |
| Bridge Replacement | 0.13 | 0.26 | 1.77 | 1.77 | 1.77 | 1.77 |
| Flood Insurance | 0.00 | 6.40 | 6.40 | 6.40 | 6.40 | 6.40 |
| Total | 59.98 | 128.28 | 68.02 | 166.35 | 201.74 | 208.53 |
| Net Annual Benefits 4/ | 48.39 | 81.68 | 25.20 | 115.82 | 142.14 | 140.63 |

1/ October 1991 price levels.
2/ 85-year Corps level of flood protection.
3/ Does not include creditable expenditures to date from Auburn Dam Project.
4/ At 8-3/4 % interest for 100-year project life.

The first cost of the selected plan creditable to Natomas and exclusive of the recreation features is $40 million. The resulting average annual cost is $4.1 million. Accordingly, the net average annual flood control related economic benefit for Natomas as the last-added increment are $24.1 million ($28.2 - $4.1).




Legend:
1 Folsom only
2 100-year Auburn Dry Dam Design
3 200-year Auburn Dry Dam Design
4 400-year Auburn Dry Dam Design

Note: The project curve to the 50-year event reflects 32 years of record (1955-1986). The remaining curves are the result of hypothetical routings assuming present authorized flood operation of Folsom Dam.

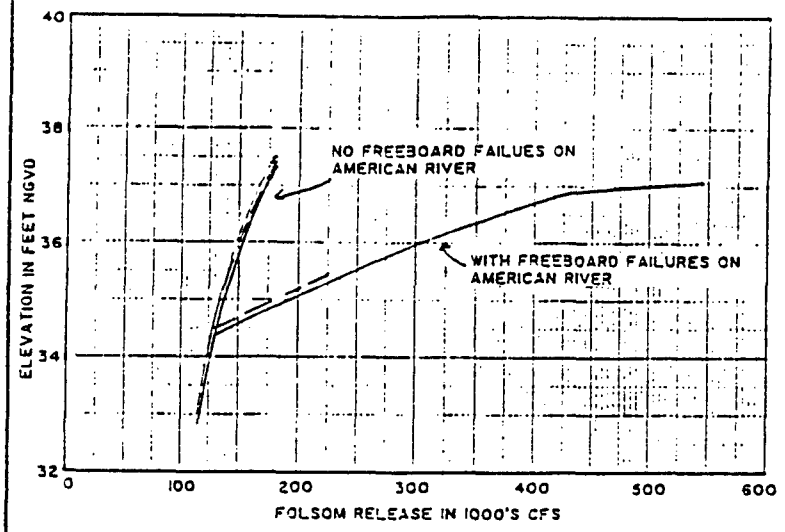
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

PEAK FLOW FREQUENCY CURVE

REGULATED CONDITIONS
AMERICAN RIVER AT FAIR OAKS

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE C-1



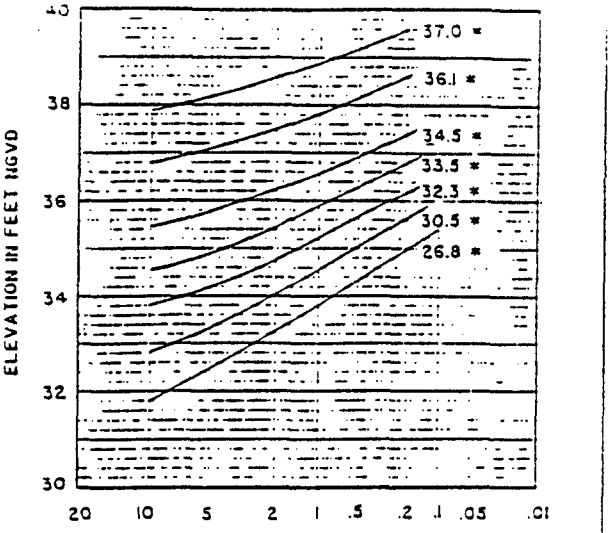

LEGEND:

100 - YEAR SACRAMENTO RIVER

200 - YEAR SACRAMENTO RIVER

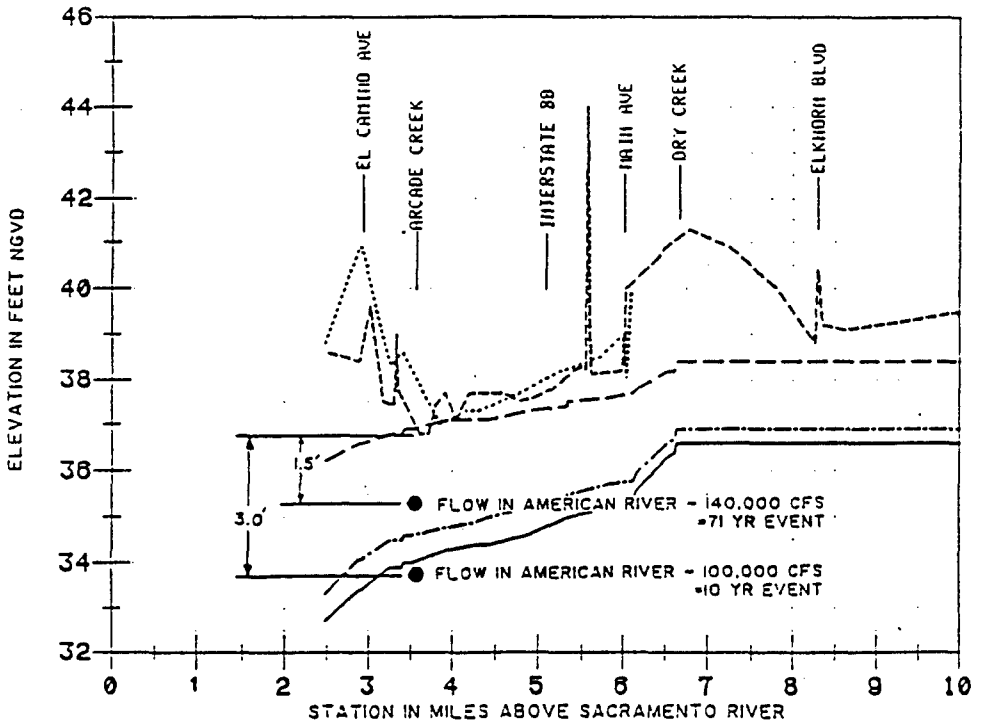
400 - YEAR SACRAMENTO RIVER

AMERICAN RIVER AT MOUTH OF NATOMAS EAST MAIN DRAINAGE CANAL (NEMDC)




* NOTE: Starting stage at mouth of NEMDC

NATOMAS EAST MAIN DRAINAGE CANAL (NEMDC) AT MOUTH OF DRY CREEK



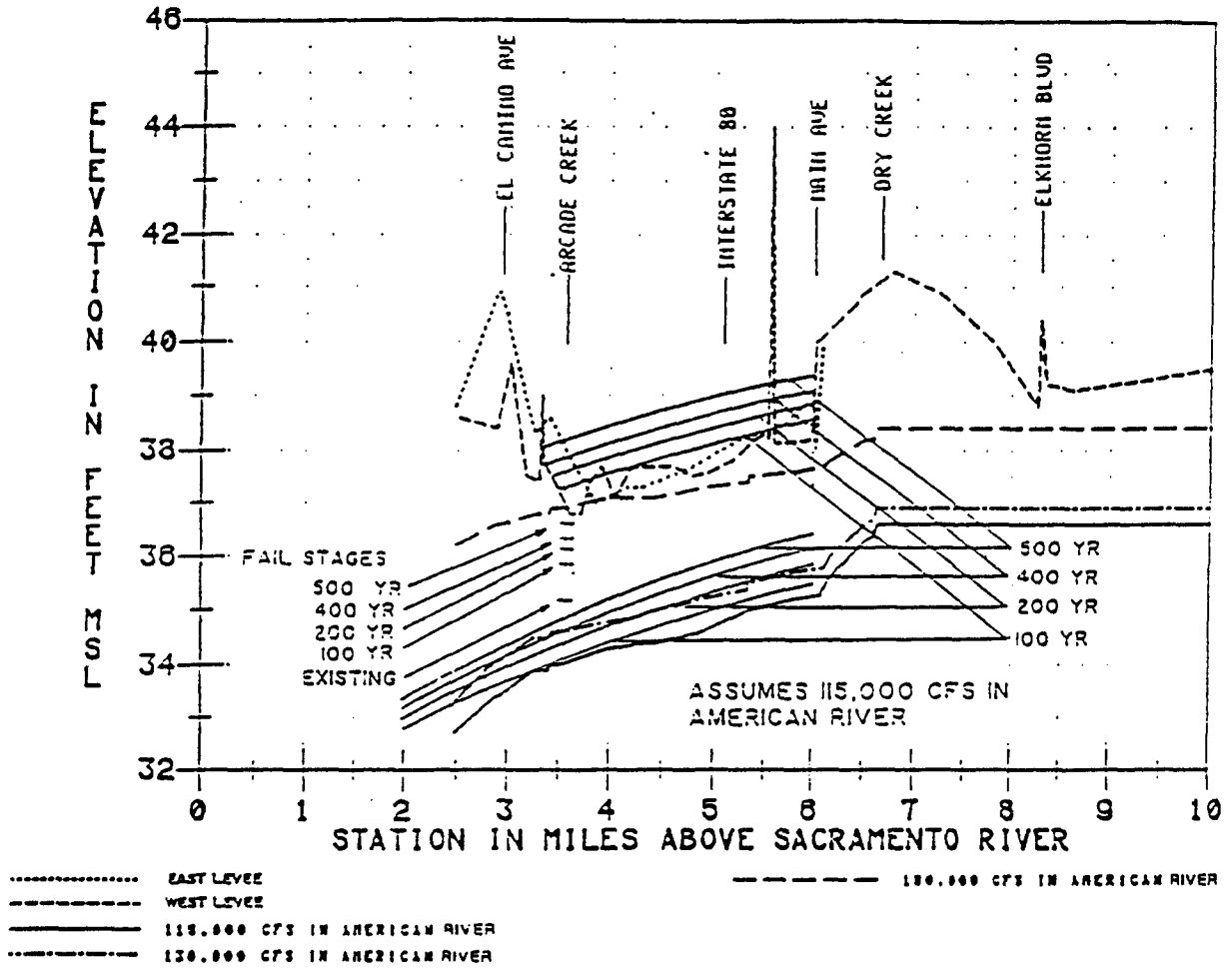

NATOMAS EAST MAIN DRAINAGE CANAL (NEMDC)

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

# FLOW - STAGE - FREQUENCY RELATIONSHIPS NATOMAS EAST MAIN DRAINAGE CANAL

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE C-2



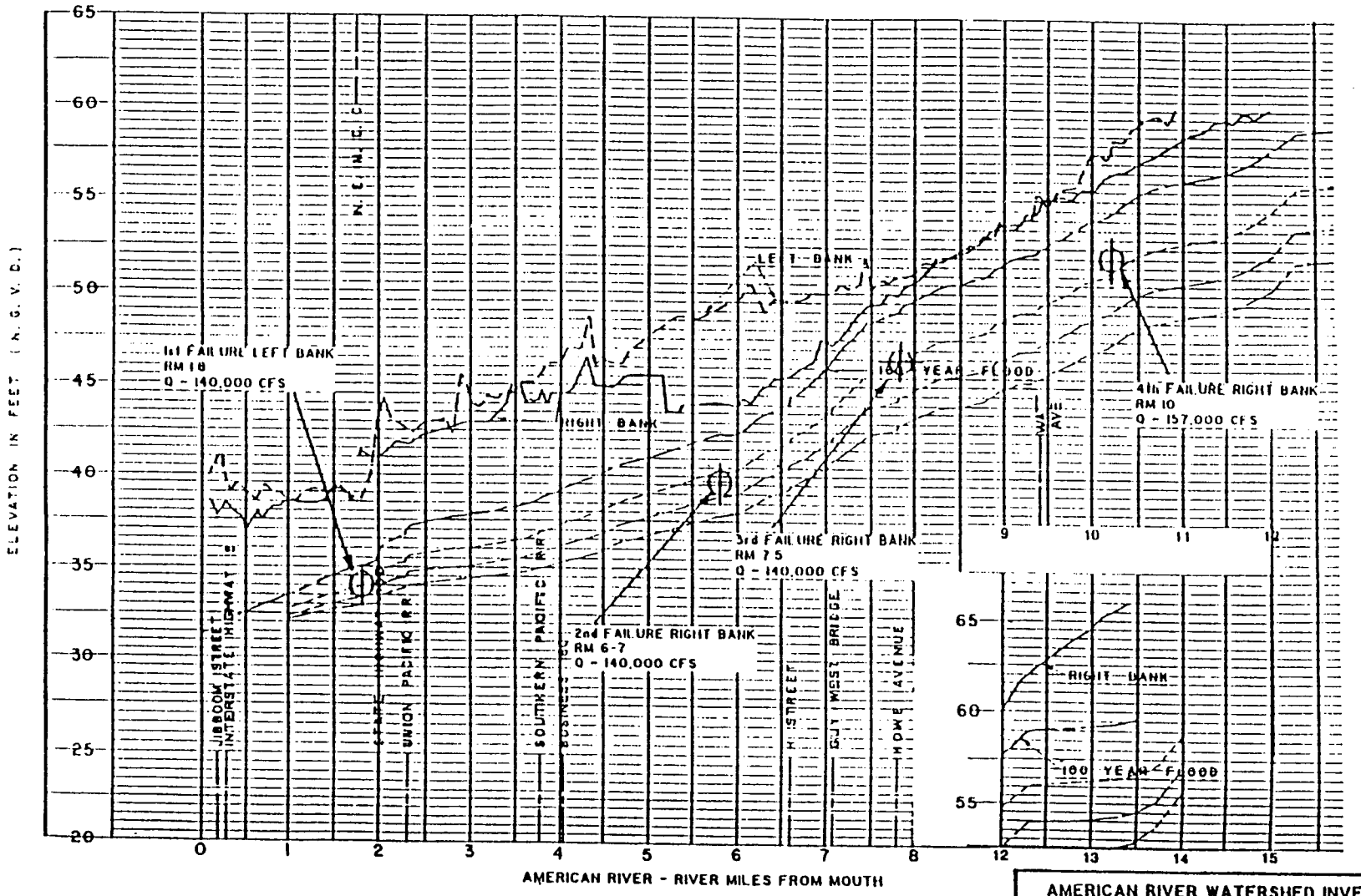

* ASSUMES 400-YEAR LEVEL OF PROTECTION ON MAIN-STEM AMERICAN RIVER (FOLSOM OUTFLOW OF 115,000 CFS FOR 100, 200, AND 400 YEAR EVENTS)

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

WITH PROJECT LEVEE FAILURE CONDITIONS-
NATOMAS EAST MAIN DRAINAGE CANAL *

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE C-3

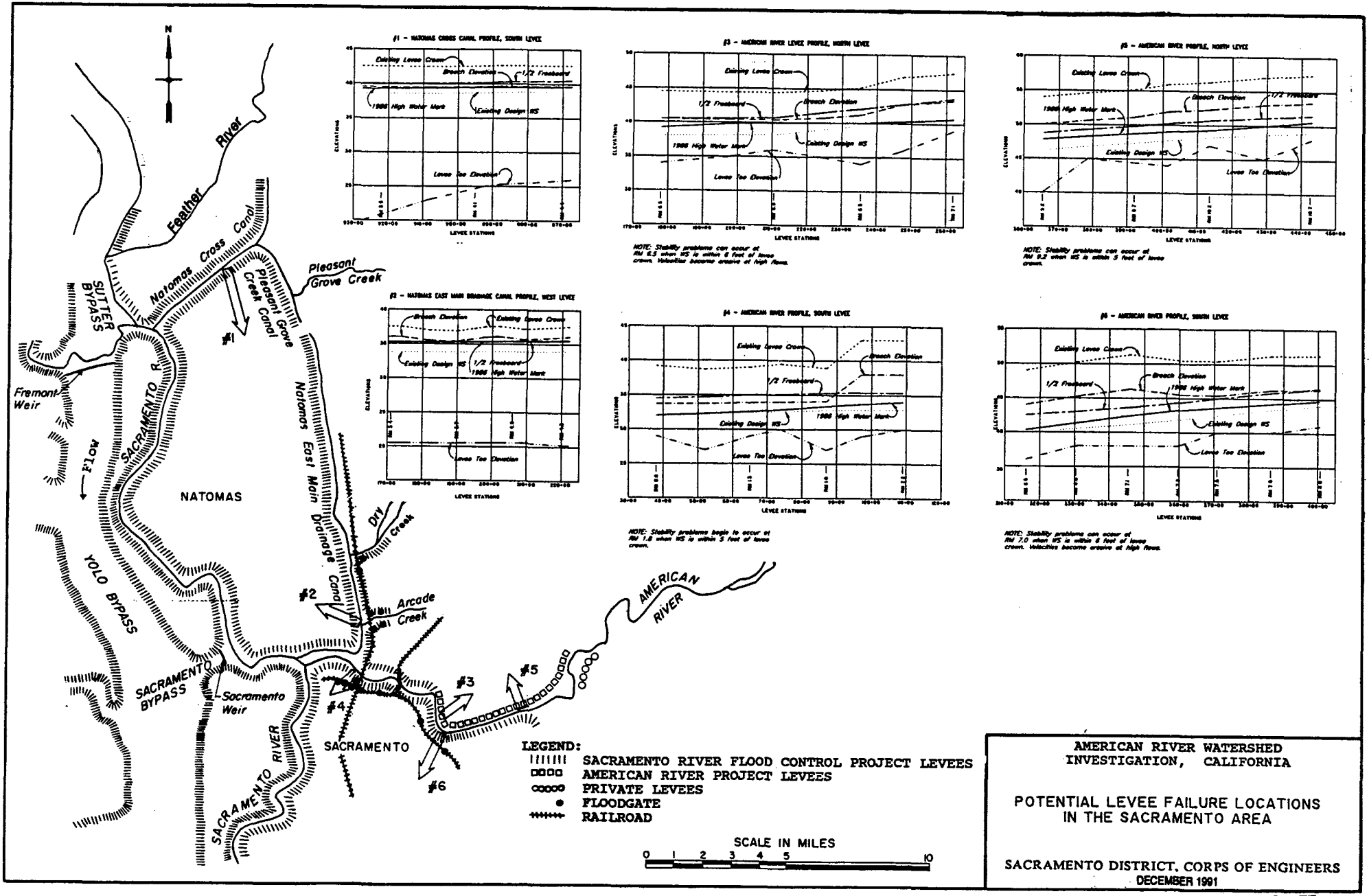



AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

# POTENTIAL LEVEE FAILURE LOCATIONS, AMERICAN RIVER

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE C-4

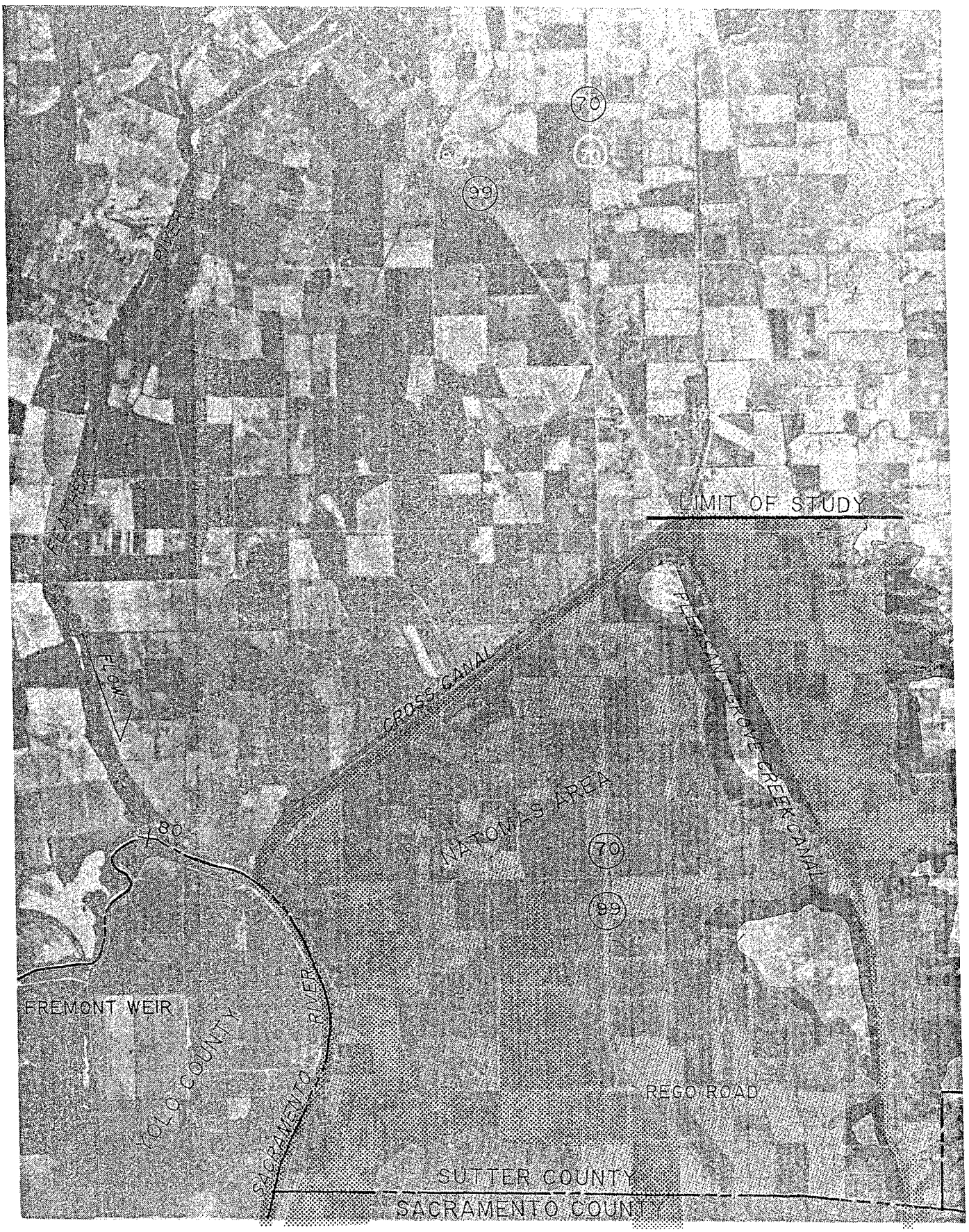


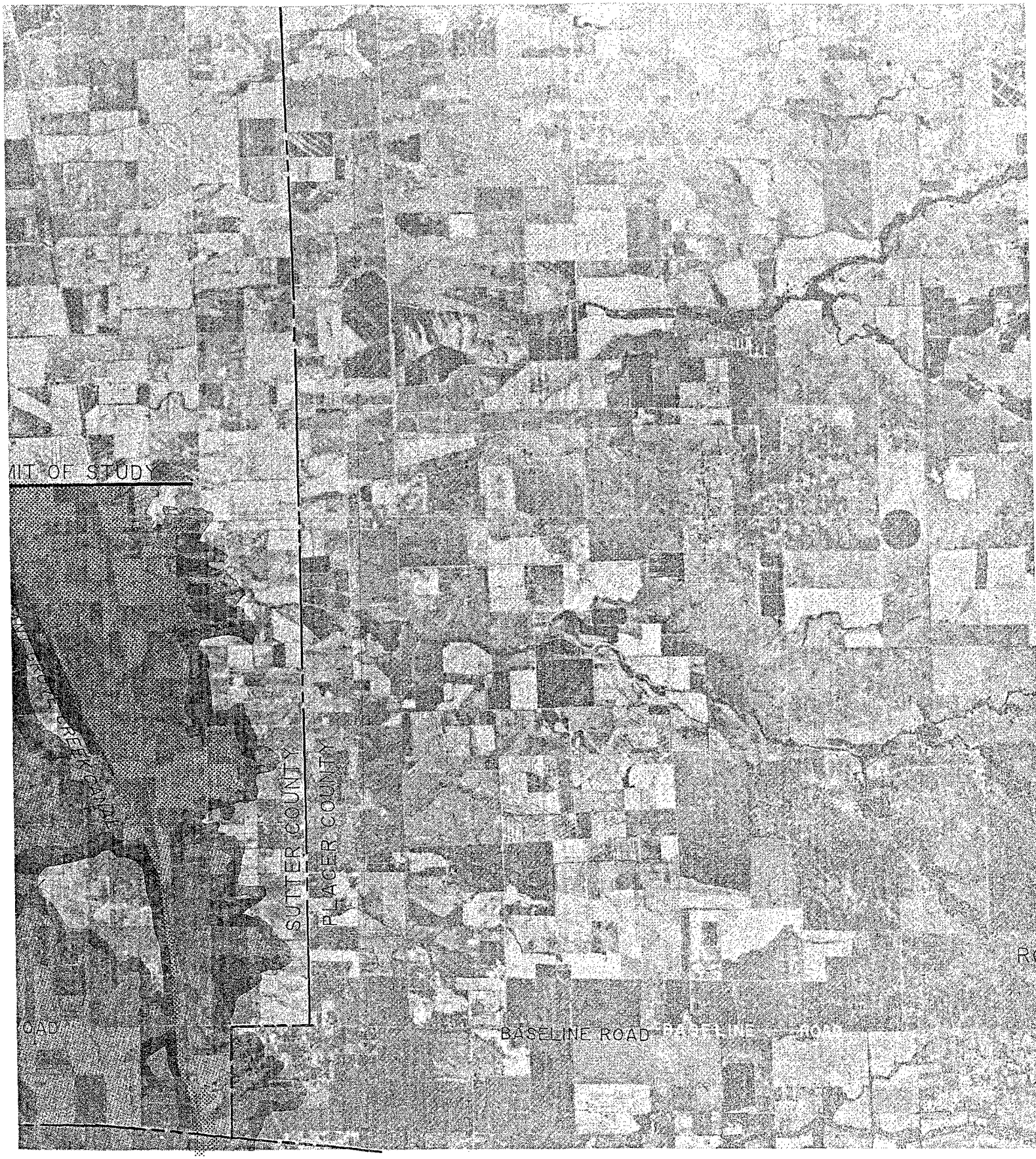

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

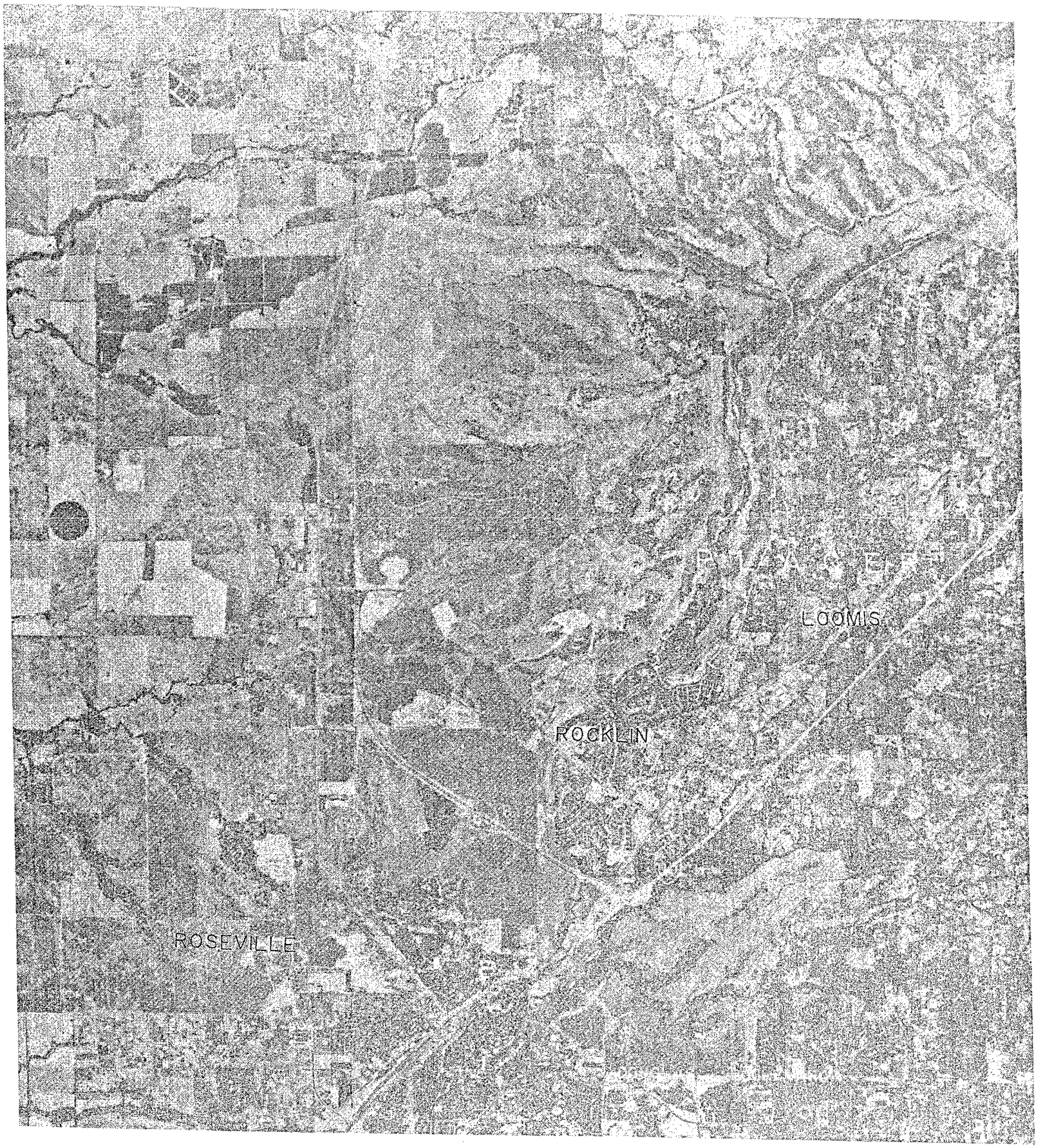
POTENTIAL LEVEE FAILURE LOCATIONS IN THE SACRAMENTO AREA

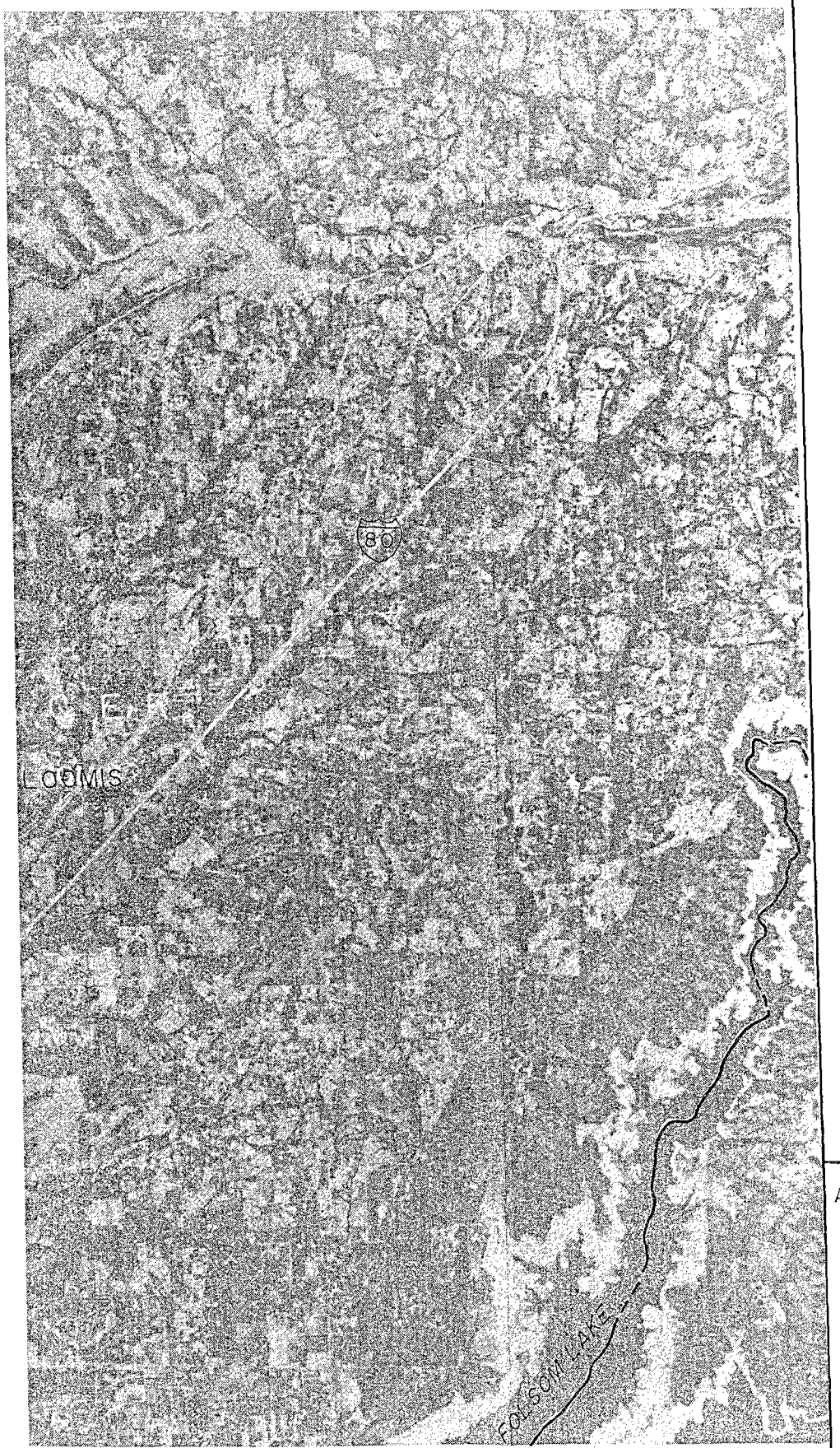
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE C-5


70
80
99
LIMIT OF STUDY
CROSS CANAL
FLOW
I-80
NATOMAS AREA
70
99
FREMONT WEIR
YOLO COUNTY
SACRAMENTO RIVER
REGO ROAD
SUTTER COUNTY
SACRAMENTO COUNTY


MIT OF STUDY
SUTTER COUNTY
PLACER COUNTY
BASELINE ROAD


LOOMIS
ROCKLIN
ROSEVILLE




LEGEND:

100 YEAR

400 YEAR

RESIDUAL FLOOD PLAIN

80 DISTANCE IN MILES

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| PLATE B |
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NOTES:

MAJOR FLOOD SOURCES, SACRAMENT AND AMERICAN RIVERS. LIMITS OF FLOODING MAY VARY DUE TO THE ACCURACY OF AVAILABLE TOPOGRAP AERIAL PHOTOGRAPHY DATED NOVEM FLOWN BY RADMAN AERIAL SURVEYS.

SCALE IN MILES

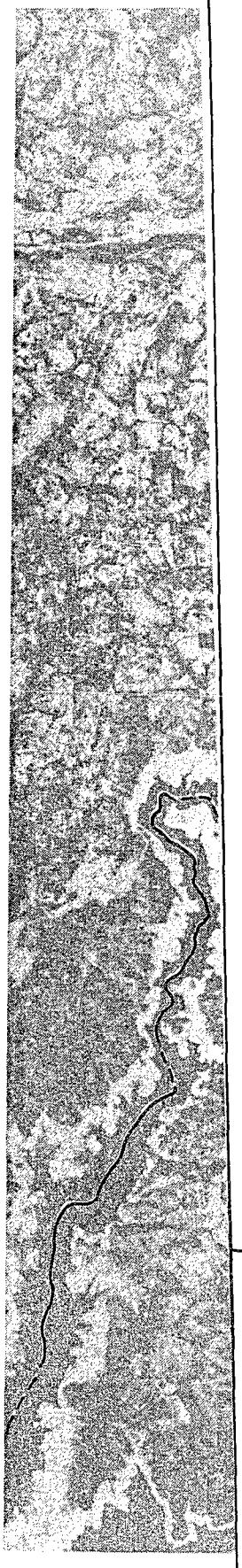
1 0 1 2

AMERICAN RIVER WATERSHED INVESTIGA
CALIFORNIA

# SACRAMENTO AREA FLOOD PLAIN MAP

SACRAMENTO DISTRICT, CORPS OF ENGI

DECEMBER 1991



LEGEND:

100 YEAR

400 YEAR

RESIDUAL FLOOD PLAIN

+80 DISTANCE IN MILES

N

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MAJOR FLOOD SOURCES, SACRAMENTO AND AMERICAN RIVERS. LIMITS OF FLOODING MAY VARY DUE TO THE ACCURACY OF AVAILABLE TOPOGRAPHY. AERIAL PHOTOGRAPHY DATED NOVEMBER 1987 FLOWN BY RADMAN AERIAL SURVEYS.

SCALE IN MILES

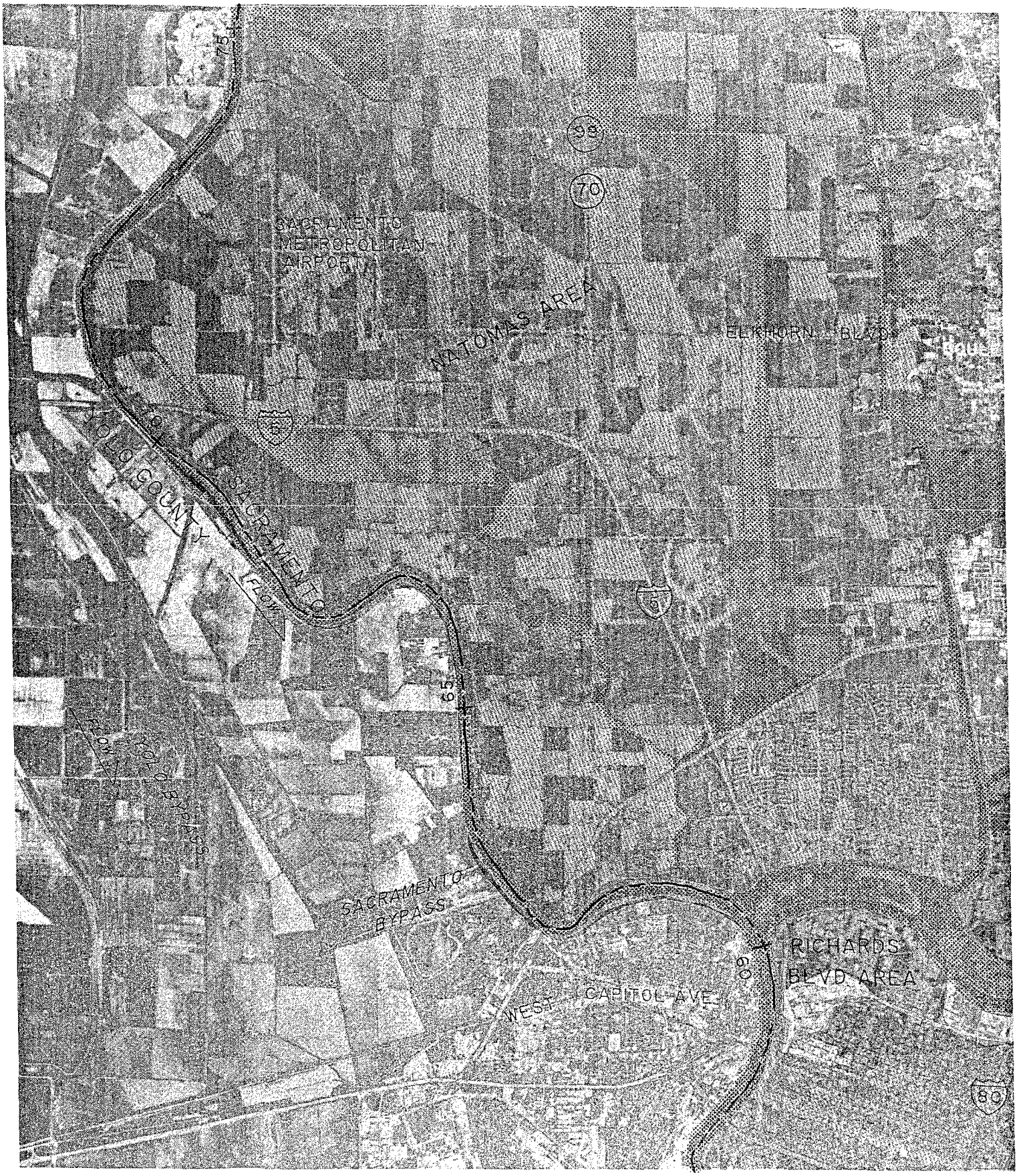
1 0 1 2

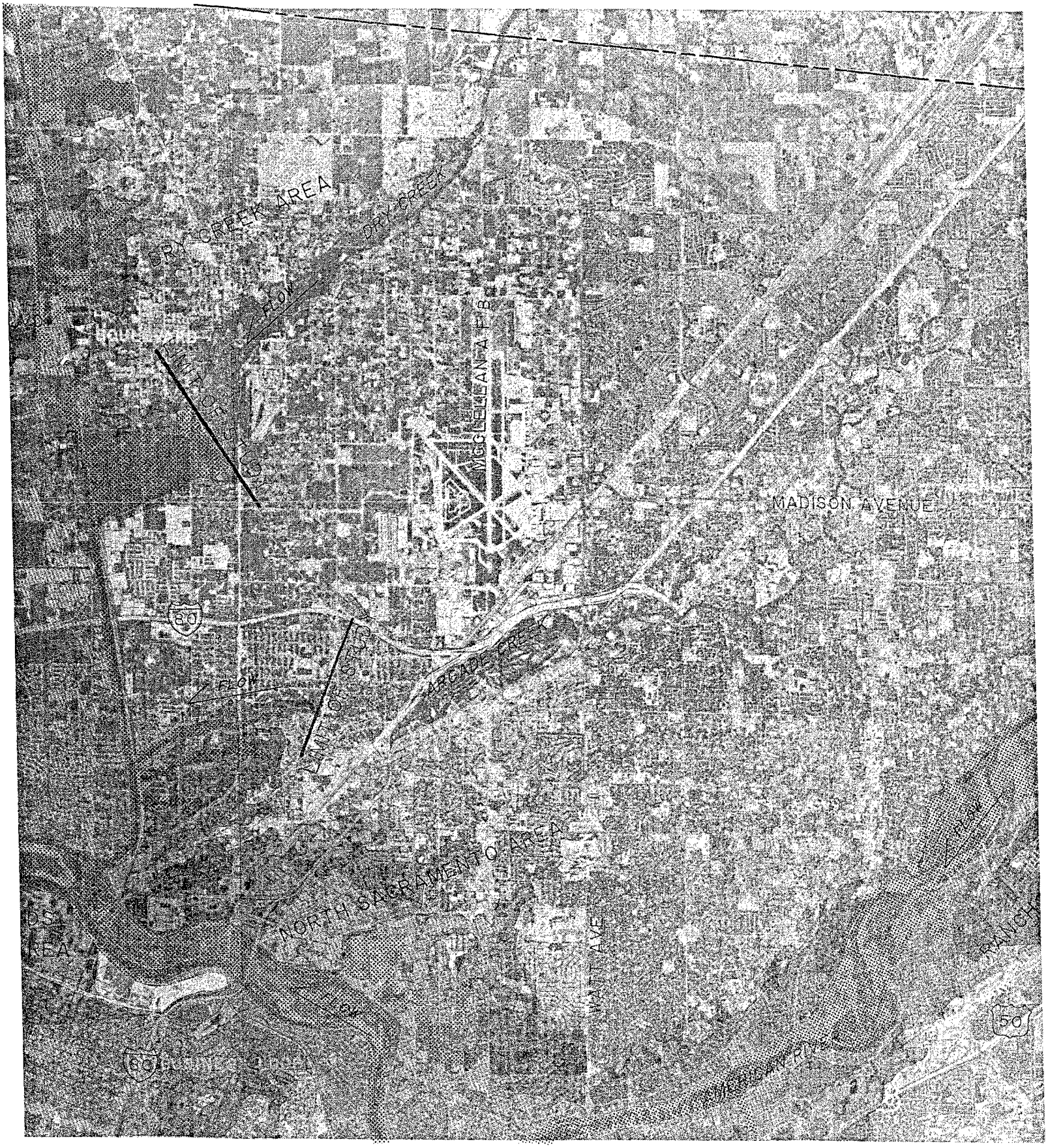
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

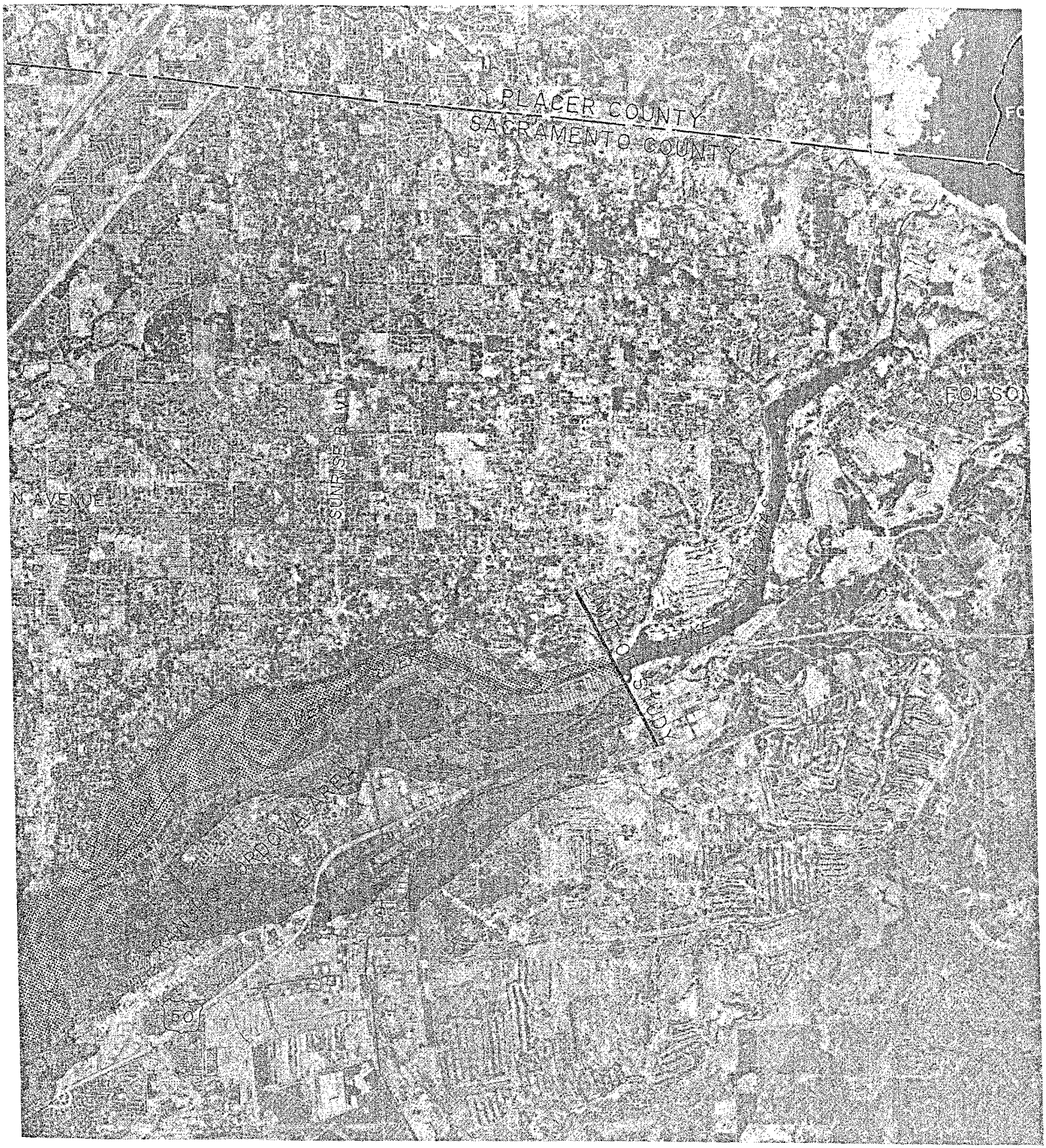
# SACRAMENTO AREA
# FLOOD PLAIN MAP

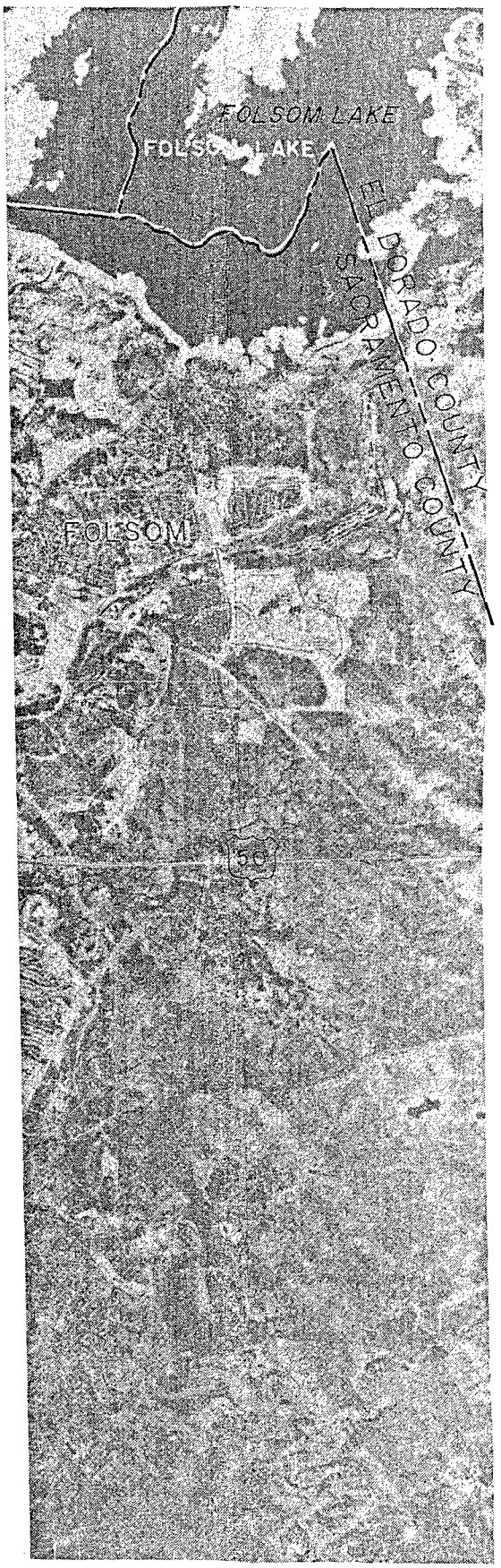
SACRAMENTO DISTRICT, CORPS OF ENGINEERS

DECEMBER 1991


SACRAMENTO METROPOLITAN AIRPORT
NATOMAS AREA
ELKHORN BLVD
80
YOLO COUNTY
SACRAMENTO RIVER
SACRAMENTO BYPASS
WEST CAPITOL AVE
RICHARDS BLVD AREA
99
70
5
80


DRY CREEK AREA
DRY CREEK
FLOW
MCCLELLAN A.F.B.
MADISON AVENUE
80
ARCADE CREEK
FLOW
LAMT
NORTH SACRAMENTO AREA
AVE
50
50


PLACER COUNTY
SACRAMENTO COUNTY
FOLSOM
N AVENUE
SUNRISE BLVD
FOLSOM LAKE
FOLSOM
ROSEVILLE
50




LEGEND:

100 YEAR

400 YEAR

RESIDUAL FLOOD PLAIN

+70 DISTANCE IN MILES

N

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NOTES:

MAJOR FLOOD SOURCES, SACRAMENTO AND AMERICAN RIVERS. LIMITS OF FLOODING MAY VARY DUE TO THE ACCURACY OF AVAILABLE TOPOGRAPHY.

AERIAL PHOTOGRAPHY DATED NOVEMBER 1987 FLOWN BY RADMAN AERIAL SURVEYS.

SCALE IN MILES

1 0 1 2

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

# SACRAMENTO AREA FLOOD PLAIN MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

DECEMBER 1991

YOLO COUNTY
SACRAMENTO DEEP WATER SHIP CHANNEL
SACRAMENTO
FLOW
SACRAMENTO EXECUTIVE AIRPORT
15
SOUTH SACRA
YOLO COUNTY
SACRAMENTO COUNTY
RIVER
5

FRUITRIDGE
ROAD
JACKSON
LIMIT OF STUDY

MATHER A.F.B.
JACKSON HIGHWAY
GRANITE LINE ROAD
DILLARD ROAD

LEGEND:

100 YEAR

400 YEAR

RESIDUAL FLOOD PLAIN

+40 DISTANCE IN MILES

N

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SCALE IN MILES

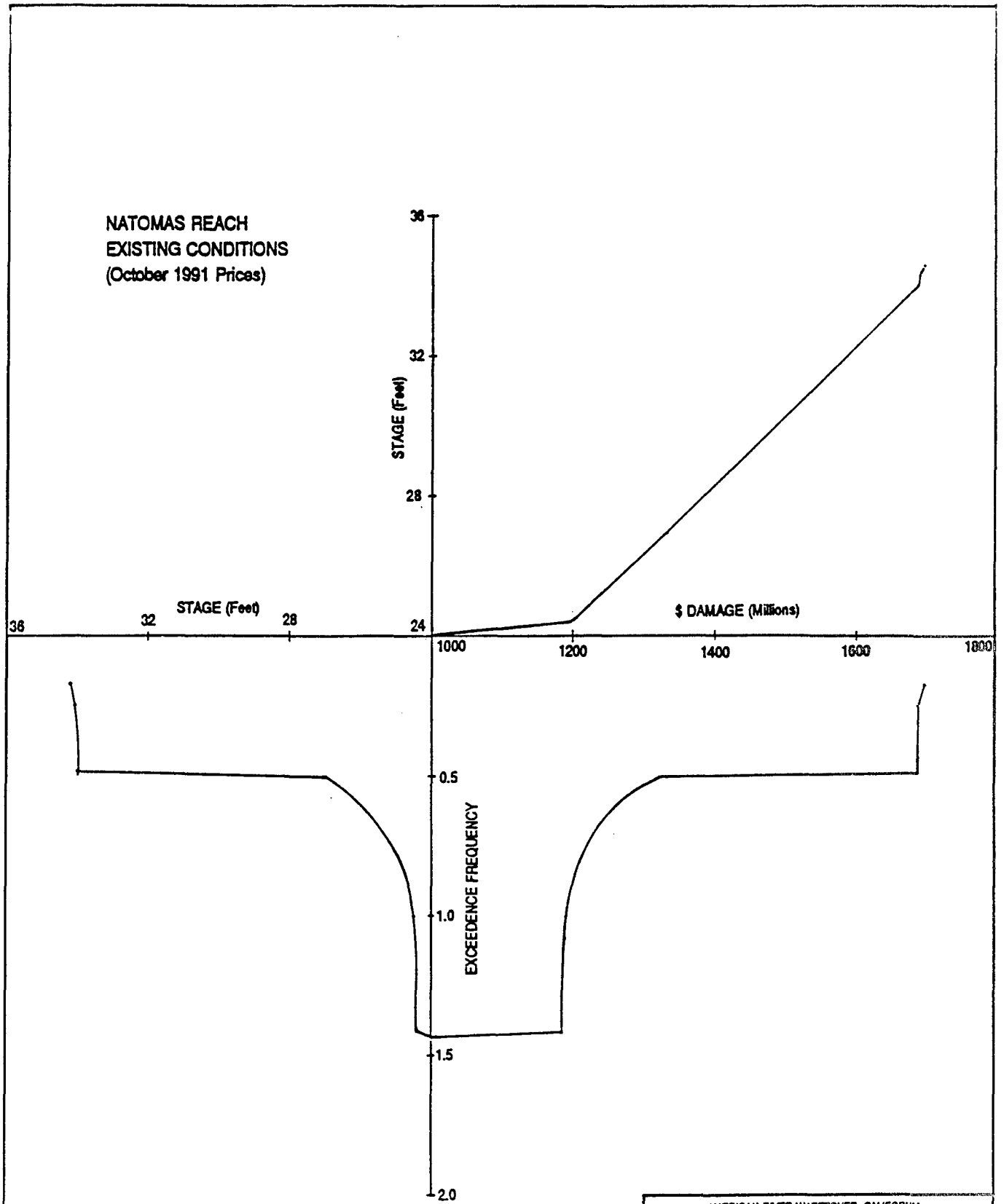
1 0 1 2

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

# SACRAMENTO AREA
# FLOOD PLAIN MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

DECEMBER 1991



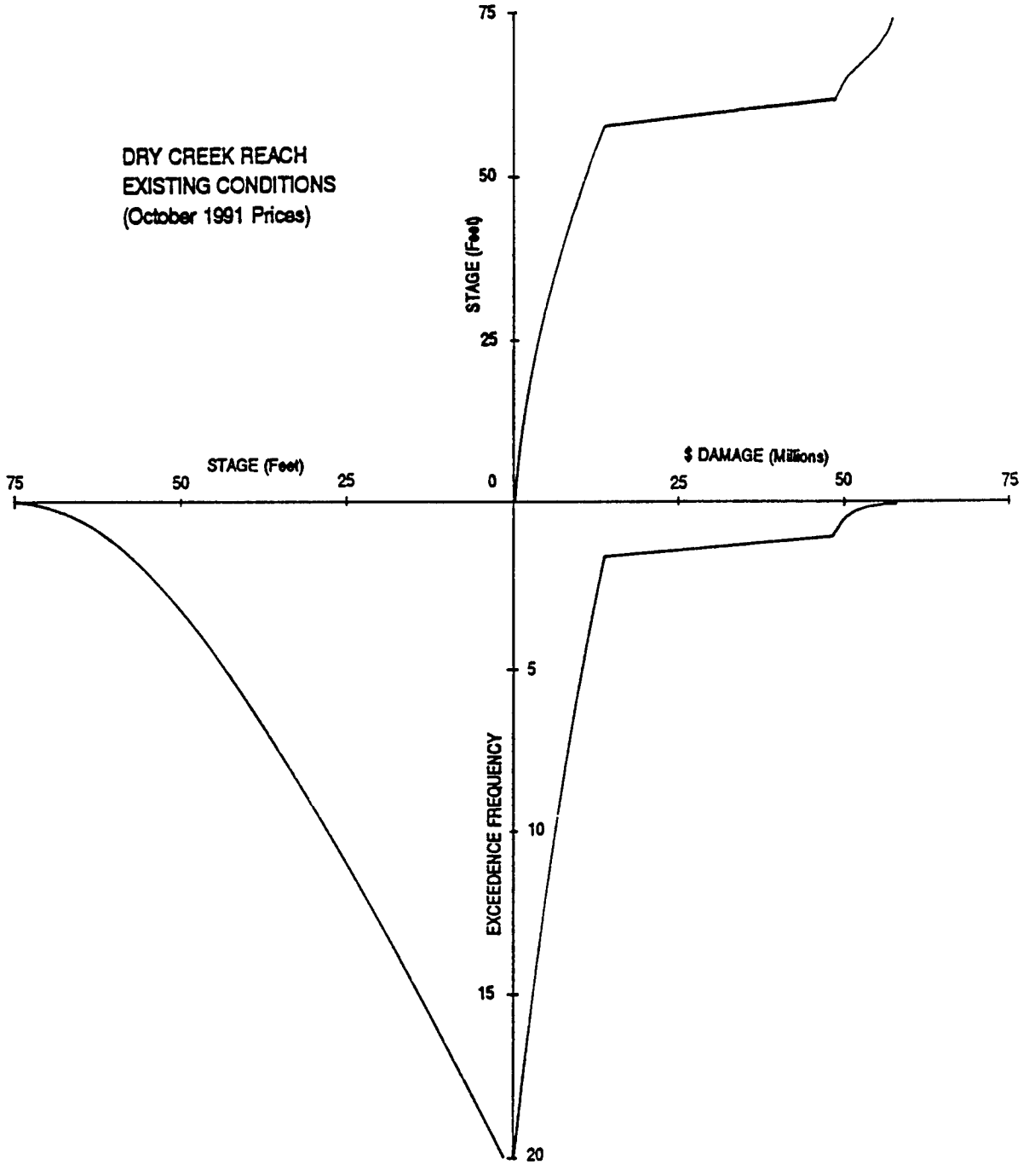

AMERICAN RIVER WATERSHED, CALIFORNIA

STAGE–FREQUENCY, STAGE–DAMAGE AND DAMAGE–FREQUENCY RELATIONSHIPS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE C–7




AMERICAN RIVER WATERSHED, CALIFORNIA

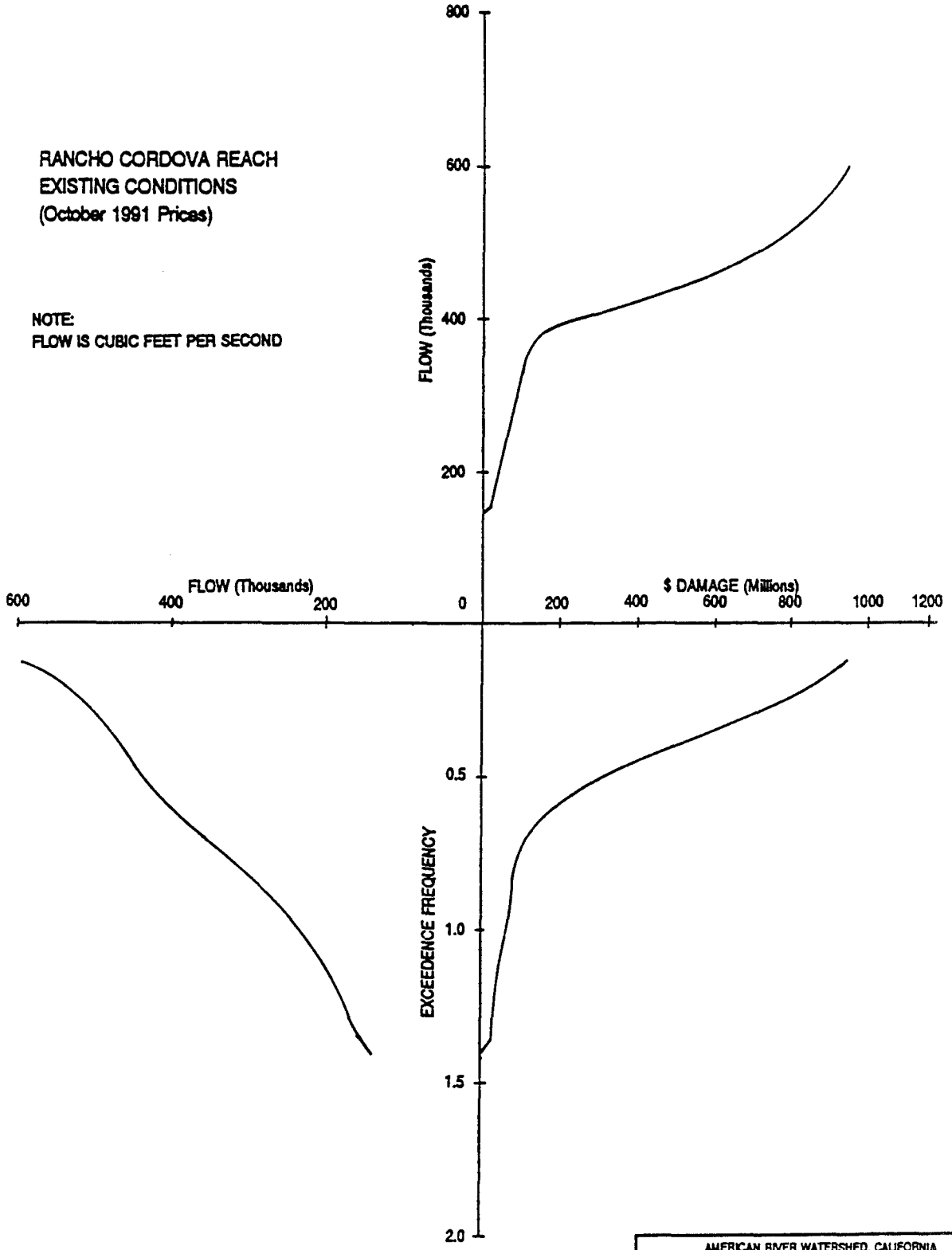
STAGE–FREQUENCY, STAGE–DAMAGE AND DAMAGE–FREQUENCY RELATIONSHIPS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
DECEMBER 1991

PLATE C–8

RANCHO CORDOVA REACH
EXISTING CONDITIONS
(October 1991 Prices)

NOTE:
FLOW IS CUBIC FEET PER SECOND




AMERICAN RIVER WATERSHED, CALIFORNIA

FLOW–FREQUENCY, FLOW–DAMAGE AND DAMAGE–FREQUENCY RELATIONSHIPS

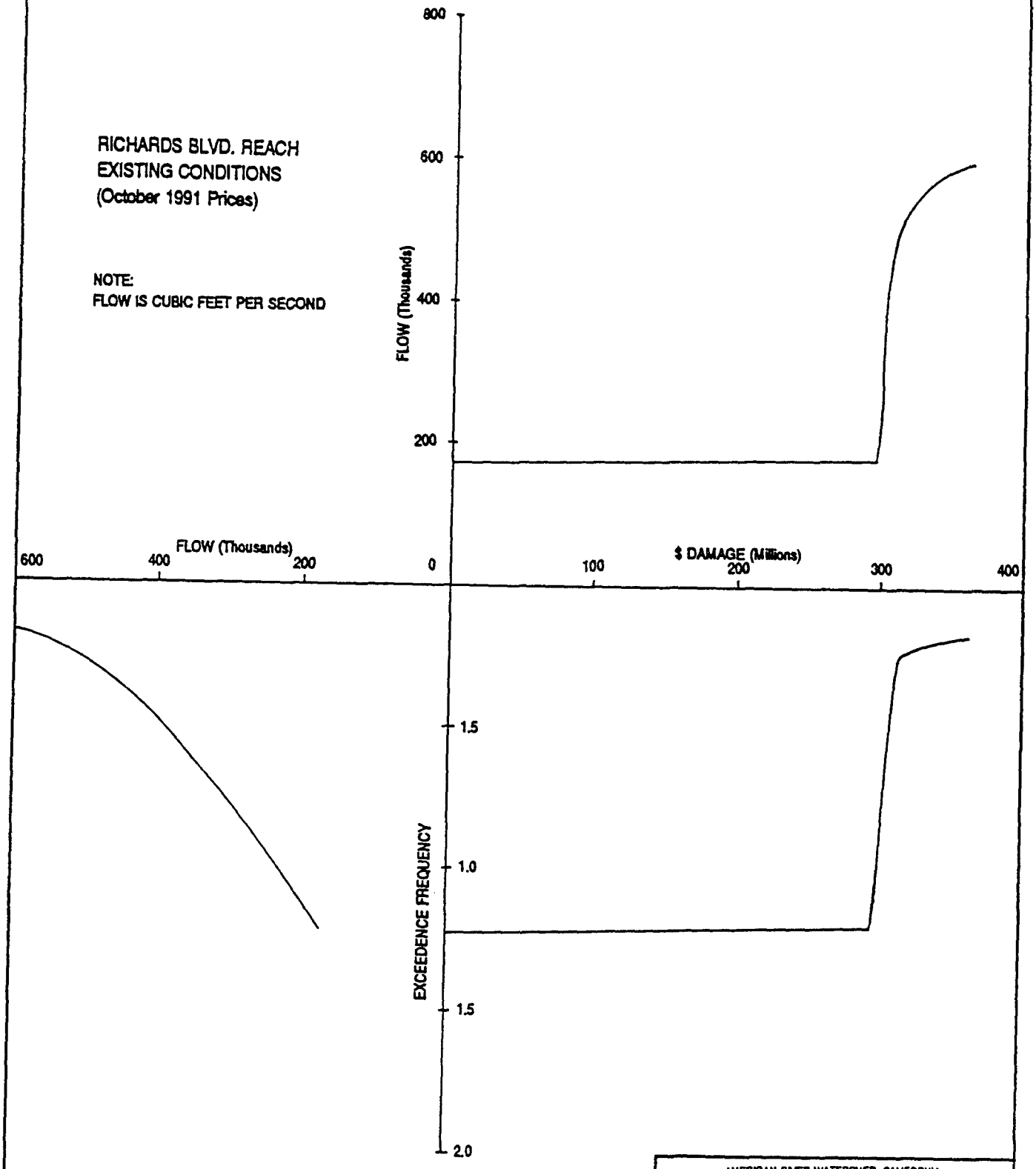
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE C–9

RICHARDS BLVD. REACH
EXISTING CONDITIONS
(October 1991 Prices)

NOTE:
FLOW IS CUBIC FEET PER SECOND




AMERICAN RIVER WATERSHED, CALIFORNIA

FLOW–FREQUENCY, FLOW–DAMAGE AND DAMAGE–FREQUENCY RELATIONSHIPS

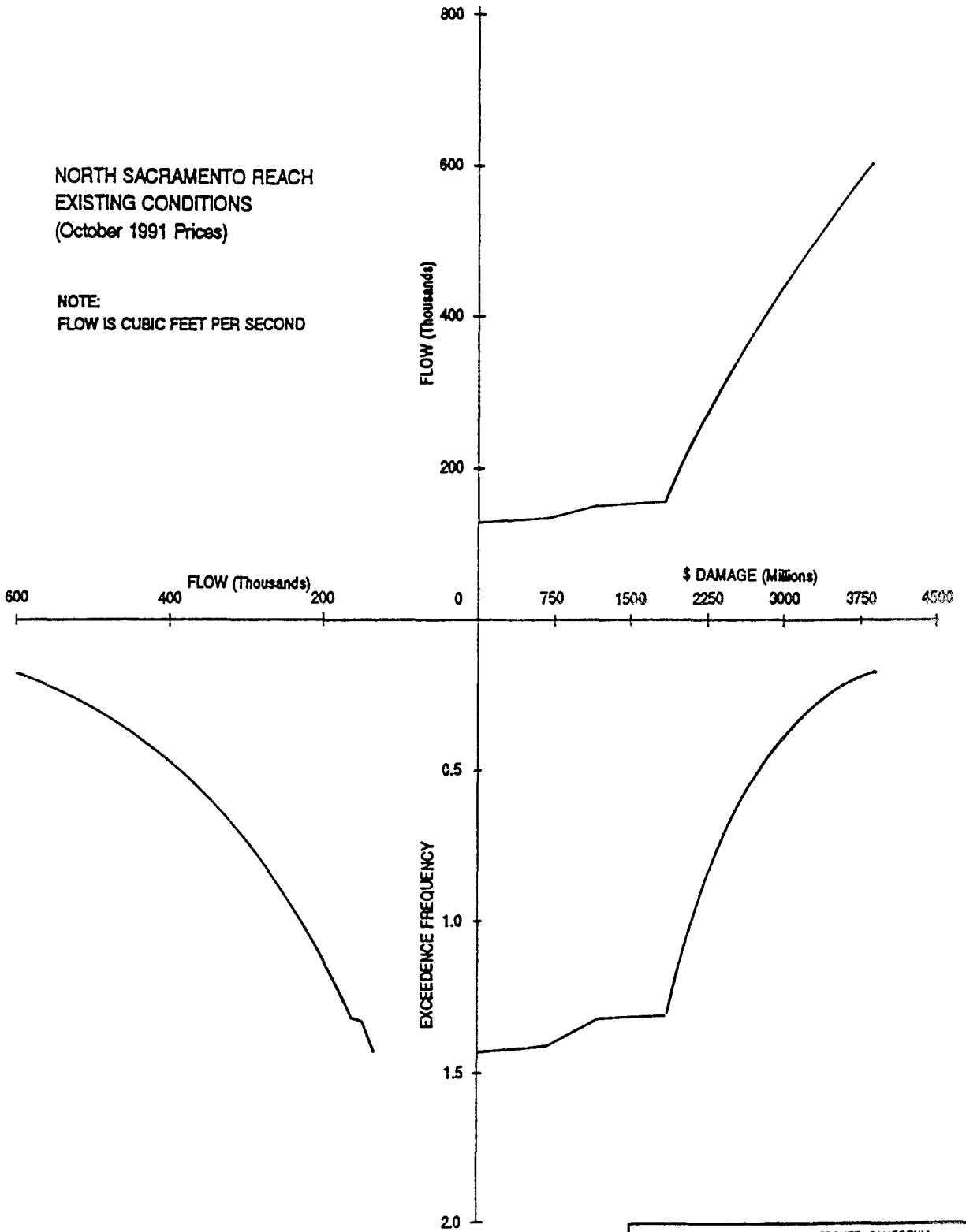
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE C–10

NORTH SACRAMENTO REACH
EXISTING CONDITIONS
(October 1991 Prices)

NOTE:
FLOW IS CUBIC FEET PER SECOND

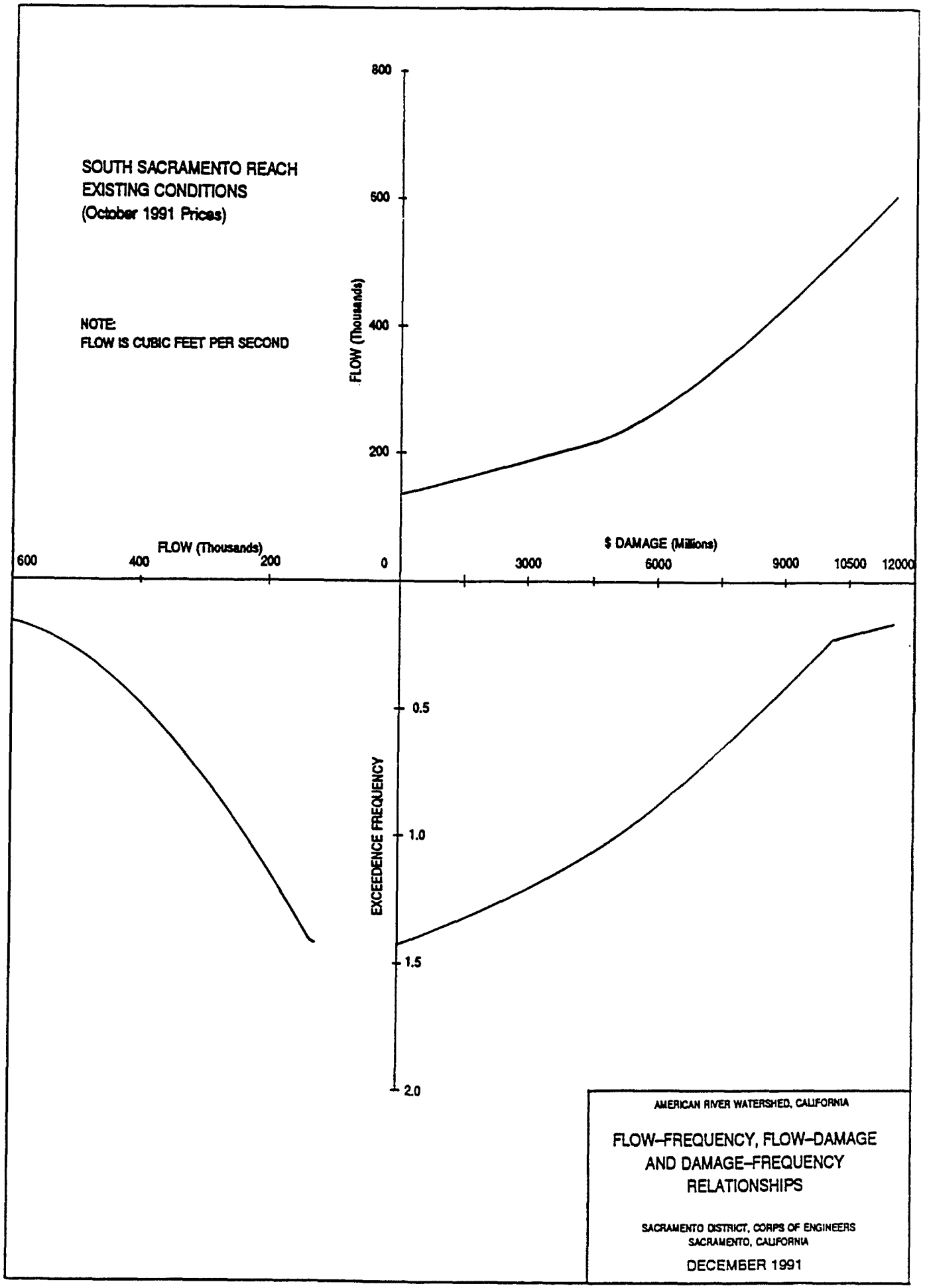



AMERICAN RIVER WATERSHED, CALIFORNIA

FLOW–FREQUENCY, FLOW–DAMAGE AND DAMAGE–FREQUENCY RELATIONSHIPS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991



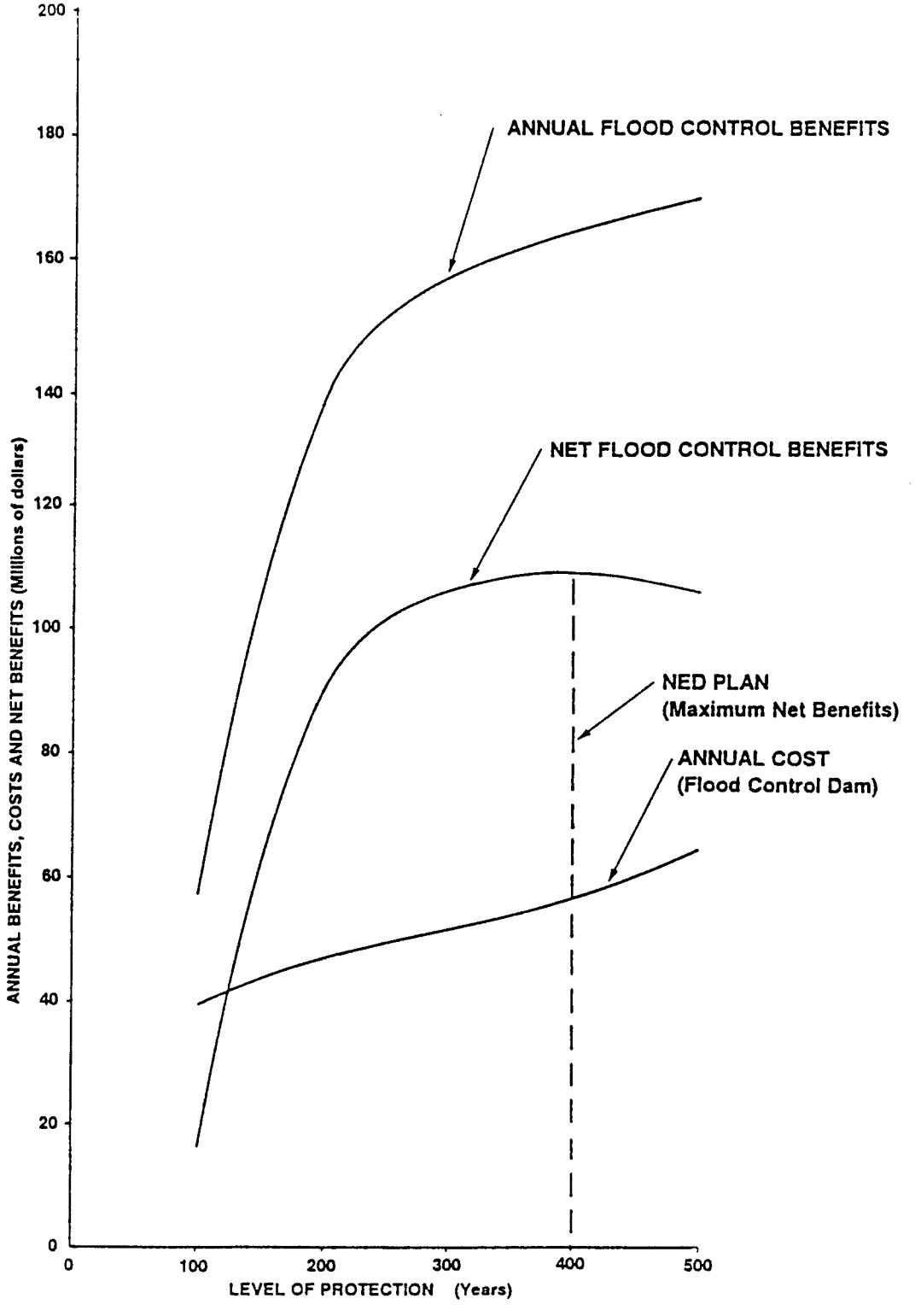

AMERICAN RIVER WATERSHED, CALIFORNIA

FLOW–FREQUENCY, FLOW–DAMAGE AND DAMAGE–FREQUENCY RELATIONSHIPS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE C–12




- OCTOBER 1991 PRICE LEVELS

-100 YEAR PROJECT LIFE AND 8-3/4 PERCENT DISCOUNT RATE

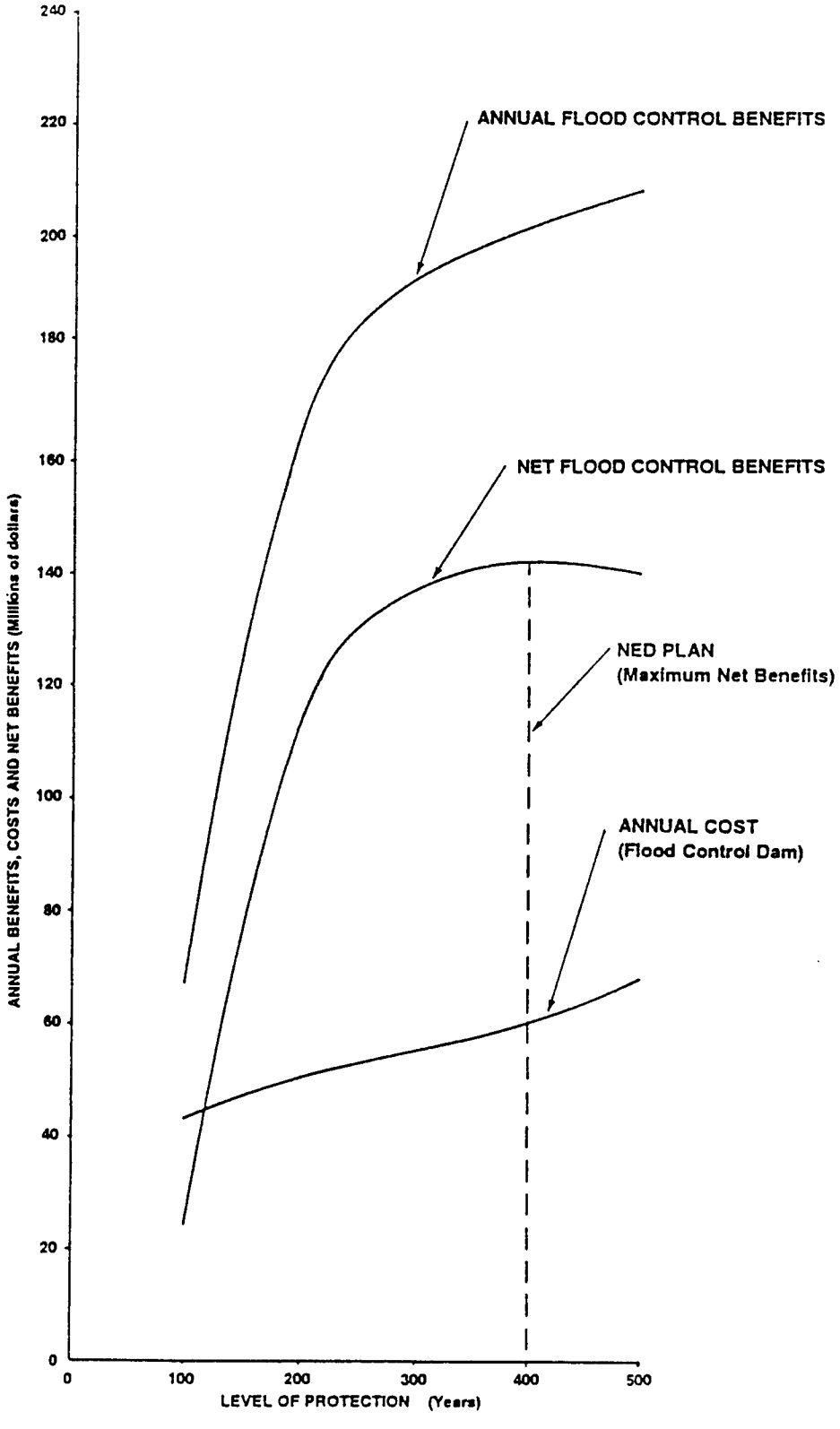
-MITIGATION COSTS FOR SECONDARY IMPACTS NOT INCLUDED

AMERICAN RIVER WATERSHED, CALIFORNIA

# MAIN STEM AMERICAN RIVER PLAN OPTIMIZATION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
DECEMBER, 1991

PLATE C-13




- OCTOBER 1991 PRICE LEVELS

-100 YEAR PROJECT LIFE AND 8-3/4 PERCENT DISCOUNT RATE

-MITIGATION COSTS FOR SECONDARY IMPACTS NOT INCLUDED

AMERICAN RIVER WATERSHED, CALIFORNIA

# FULL BASIN ALTERNATIVE PLAN OPTIMIZATION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
DECEMBER 1991

# American River Watershed Investigation, California

# APPENDIX D

## Water Supply Needs

# Appendix D

# AMERICAN RIVER BASIN WATER NEEDS

El Dorado County Service Area
Placer County Service Area
Sacramento County Service Area

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## EL DORADO COUNTY SERVICE AREA

The Department of Water Resources has conducted a reconnaissance study of water needs for El Dorado County. El Dorado Irrigation District supplied the Department with its projected shortages.

### WATER USE

The terms *water use* and *applied water use* in this report pertain to deliveries at intakes to domestic, municipal, and industrial distribution systems or at farm headgates or irrigation well heads. The term does not include surface water conveyance losses incurred from the point of diversion to the distribution system or farm headgate. Total urban and agricultural applied water use for western El Dorado County is summarized in Table D-1.

Table D-1
APPLIED WATER USE
El Dorado County
*(Acre-Feet)*

| Year | El Dorado I.D. | Georgetown Divide P.U.D.* | National Forest** | Western County Total |
|---|---|---|---|---|
| 1983 | | | | |
| Urban | 12,980 | 1,710 | 0 | 14,690 |
| Agricultural | 11,980 | 4,300 | 300 | 16,580 |
| Total | 24,960 | 6,010 | 300 | 31,270 |
| 1990 | | | | |
| Urban | 17,400 | 2,420 | 0 | 19,820 |
| Agricultural | 12,750 | 5,100 | 340 | 18,190 |
| Total | 30,150 | 7,520 | 340 | 38,010 |
| 2000 | | | | |
| Urban | 23,240 | 3,340 | 0 | 26,580 |
| Agricultural | 14,240 | 6,200 | 380 | 20,820 |
| Total | 37,480 | 9,540 | 380 | 47,400 |
| 2010 | | | | |
| Urban | 28,440 | 4,150 | 0 | 32,590 |
| Agricultural | 15,660 | 7,400 | 380 | 23,440 |
| Total | 44,100 | 11,550 | 380 | 56,030 |
| 2020 | | | | |
| Urban | 34,880 | 5,090 | 0 | 39,970 |
| Agricultural | 16,170 | 8,500 | 380 | 25,050 |
| Total | 51,050 | 13,590 | 380 | 65,020 |

* Agricultural water use in GDPUD is based on projections of untreated water sales.

** May include privately owned parcels of land.

## Urban Water Use

Urban water use, as defined by the Department of Water Resources, includes residential, commercial, industrial, and governmental use. In this report it may also include water used for irrigation on parcels less than 5 acres if treated water is being delivered for such use.

To compute urban water use, the Department of Water Resources considers population, urban land area, per capita water use, and urban water conservation. Industries that use large amounts of water are accounted for separately. Urban applied water use is calculated by multiplying the permanent population by per capita use, then adding the amount of water used by high water-use industries.

Future urban applied water use depends on numerous interrelated factors, a change in any one of which can influence the per capita water use. These factors may include implementation of water conservation measures, change in water-pricing structure, change in tax structure, preservation of open space, preferential treatment of agricultural water use, and urban density. Historically, per capita water use has trended upward, but it was assumed that, with increased effects of water conservation, the trend would level off. Therefore, per capita water use factors were presumed to remain constant from 1985 to 2020.

Results of the computations for western El Dorado County are shown in Table D-2.

## Agricultural Water Use

Agricultural water use, as defined by the Department, includes water deliveries for irrigation on parcels larger than 3 to 5 acres. The fundamental data for estimating agricultural water use are crop acreages and their corresponding crop unit water use values. Land use surveys are used to determine irrigated acreage, types of crops being grown, and how many acres are being double-cropped. Measured and theoretical values related to climate, water needs of specific crops, and irrigation efficiency are used to calculate the crop unit water use values.

To project future agricultural water use, analysts must also consider the amount of irrigable land available (land classification) and forecasts of future needs for food and fiber. The possibility for improving irrigation efficiency (conservation) is also considered. The availability and cost of water are presumed not to be a restraint to development.

An additional consideration was necessary in the Georgetown Divide Public Utility District. In recent years, ranchettes have largely replaced commercial agriculture in the area. Because the Department does not have a water use category for ranchettes, agricultural water use for Georgetown Divide PUD was estimated based on historical untreated water sales.

The existence of urban ranchettes within the EID service area is not yet sufficiently documented to allow ranchettes to be a separate category or to be projected for future use. However, water use by the larger ranchettes is included with the agricultural water use, and treated water delivered to the smaller ranchettes is reflected in urban per capita water use.

Table D-2
PRESENT AND PROJECTED URBAN WATER USE
El Dorado County

| | 1983 | 1990 | 2000 | 2010 | 2020 |
|---|---|---|---|---|---|
| **EL DORADO IRRIGATION DISTRICT** | | | | | |
| Western EID | | | | | |
| Permanent Population | 22,300 | 30,020 | 40,290 | 49,410 | 60,720 |
| Acre-feet/Capita/Year | 0.217 | 0.217 | 0.217 | 0.217 | 0.217 |
| Acre-feet/Year Subtotal | 4,840 | 6,510 | 8,740 | 10,720 | 13,180 |
| Acre-feet/Year-Industry | 50 | 70 | 90 | 110 | 140 |
| Total Urban Use *(Acre-Feet)* | 4,890 | 6,580 | 8,830 | 10,830 | 13,320 |
| Placerville and Vicinity | | | | | |
| Permanent Population | 28,540 | 38,410 | 51,530 | 63,230 | 77,710 |
| Acre-feet/Capita/Year | 0.201 | 0.201 | 0.201 | 0.201 | 0.201 |
| Acre-feet/Year Subtotal | 5,740 | 7,720 | 10,360 | 12,710 | 15,620 |
| Acre-feet/Year-Industry | 0 | 50 | 70 | 90 | 110 |
| Total Urban Use *(Acre-Feet)* | 5,740 | 7,770 | 10,430 | 12,800 | 15,730 |
| Eastern EID | | | | | |
| Permanent Population | 8,000 | 10,770 | 14,450 | 17,730 | 21,790 |
| Acre-feet/Capita/Year | 0.201 | 0.201 | 0.201 | 0.201 | 0.201 |
| Acre-feet/Year Subtotal | 1,610 | 2,160 | 2,900 | 3,560 | 4,380 |
| Acre-feet/Year-Industry | 450 | 500 | 550 | 600 | 650 |
| Total Urban Use *(Acre-Feet)* | 2,060 | 2,660 | 3,450 | 4,160 | 5,030 |
| Mosquito | | | | | |
| Permanent Population | 490 | 660 | 890 | 1,090 | 1,340 |
| Acre-feet/Capita/Year | 0.106 | 0.106 | 0.106 | 0.106 | 0.106 |
| Total Urban Use *(Acre-Feet)* | 50 | 70 | 90 | 120 | 140 |
| Latrobe | | | | | |
| Permanent Population | 250 | 330 | 440 | 540 | 670 |
| Acre-feet/Capita/Year | 0.134 | 0.134 | 0.134 | 0.134 | 0.134 |
| Total Urban Use *(Acre-Feet)* | 30 | 40 | 60 | 70 | 90 |
| Southern EID | | | | | |
| Permanent Population | 1,720 | 2,310 | 3,100 | 3,800 | 4,670 |
| Acre-feet/Capita/Year | 0.122 | 0.122 | 0.122 | 0.122 | 0.122 |
| Total Urban Use *(Acre-Feet)* | 210 | 280 | 380 | 460 | 570 |
| El Dorado Irrigation District Total | | | | | |
| Permanent Population | 61,300 | 82,500 | 110,700 | 135,800 | 166,900 |
| Seasonal Population[1] | 5,480 | 8,110 | 10,740 | 13,180 | 15,540 |
| Acre-feet/Year Subtotal | 12,480 | 16,780 | 22,530 | 27,640 | 33,980 |
| Acre-feet/Year-Industry[2] | 500 | 620 | 710 | 800 | 900 |
| Total Urban Use *(Acre-Feet)* | 12,980 | 17,400 | 23,240 | 28,440 | 34,880 |
| **GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT** | | | | | |
| Permanent Population | 6,900 | 9,900 | 13,700 | 17,100 | 21,100 |
| Seasonal Population | 800 | 1,180 | 1,570 | 1,930 | 2,270 |
| Acre-feet/Year Subtotal | 1,580 | 2,260 | 3,150 | 3,920 | 4,830 |
| Acre-feet/Year-Golf Course | 130 | 160 | 190 | 230 | 260 |
| Total Urban Use *(Acre-Feet)* | 1,710 | 2,420 | 3,340 | 4,150 | 5,090 |

1 Seasonal population data are available only for the entire service area. Per capita use includes both permanent and seasonal residents.

2 Projections reflect El Dorado County estimates in 2020.

The county's future planning should consider identifying ranchettes and determining their water use so water use can be projected for a ranchette category. According to the county, information for such projections may be available in 1990 or 1991.

## Land Use

The most recent land use surveys of El Dorado County were made in 1956-1960, 1967-1969, and 1983. Land use from the three sets of surveys is shown in Table D-3. In 1956-1960, about 9,300 acres of irrigated crops were mapped in El Dorado County. In 1967-1969, about 7,000 acres of irrigated crops were mapped. In 1983, only about 5,900 acres of irrigated crops were mapped.

Table D-3
LAND USE IN EL DORADO COUNTY
*(Acres)*

| | 1956-1960 | 1967-1969 | 1983 |
|---|---|---|---|
| Irrigated Agriculture | | | |
| General Field | 0 | 0 | 10 |
| Alfalfa | 40 | 0 | 0 |
| Pasture | 3,320 | 3,320 | 2,420 |
| Truck Crops | 40 | 200 | 320 |
| Orchard | 5,860 | 3,520 | 2,540 |
| Vineyard | 0 | 0 | 630 |
| Subtotal | 9,260 | 7,040 | 5,920 |
| Dry Farmed | 640 | 340 | 790 |
| Nonagricultural | | | |
| Urban and Recreational[1] | Not | 16,650 | 34,700 |
| Other | Available | 1,120,470 | 1,103,090 |
| TOTAL AREA | 1,144,500 | 1,144,500 | 1,144,500 |

1 Includes lawn areas outside of urban areas.

## Irrigated Crop Patterns

Forecasting development of commercial agriculture in California and, in turn, El Dorado County, involves consideration of all known factors and extrapolation of conditions that may prevail in the future.

Initial forecasts for El Dorado County, compiled as a supporting document for Bulletin 160-83, are essentially the result of regional allocations and the Crop Market Outlook Forecast. The crop pattern forecasts for this report, shown in Table D-4, are the results of adjusting these earlier forecasts to reflect trends indicated by recent land use surveys and more recent assessments of the long-term crop production outlook made by the Department. Local opinions were also solicited.

The Department of Water Resources conducted land classification surveys throughout the State during the 1950s and1960s. El Dorado County was surveyed in three different years: the Tahoe watershed in 1956, the American River watershed in 1962, and the Cosumnes/Mokelumne/

Table D-4
IRRIGATED CROP PATTERNS
El Dorado County
*(Acres)*

| Study Area | Year | Miscellaneous Field | Irrigated Pasture | Miscellaneous Truck | Deciduous Orchard | Grapes | Total |
|---|---|---|---|---|---|---|---|
| **El Dorado Irrigation District** | | | | | | | |
| Western EID | 1983 | 0 | 200 | 0 | 10 | 0 | 210 |
| | 1990 | 0 | 200 | 0 | 10 | 0 | 210 |
| | 2000 | 0 | 200 | 0 | 10 | 0 | 210 |
| | 2010 | 0 | 200 | 0 | 0 | 0 | 200 |
| | 2020 | 0 | 200 | 0 | 0 | 0 | 200 |
| Placerville and Vicinity | 1983 | 0 | 620 | 0 | 740 | 100 | 1,460 |
| | 1990 | 0 | 600 | 20 | 750 | 100 | 1,470 |
| | 2000 | 0 | 600 | 50 | 800 | 120 | 1,570 |
| | 2010 | 0 | 600 | 100 | 900 | 150 | 1,750 |
| | 2020 | 0 | 600 | 100 | 950 | 150 | 1,800 |
| Eastern EID | 1983 | 0 | 250 | 270 | 1,670 | 160 | 2,350 |
| | 1990 | 0 | 300 | 300 | 1,800 | 200 | 2,600 |
| | 2000 | 0 | 350 | 300 | 2,000 | 250 | 2,900 |
| | 2010 | 0 | 400 | 300 | 2,200 | 300 | 3,200 |
| | 2020 | 0 | 400 | 300 | 2,250 | 350 | 3,300 |
| Mosquito | 1983 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1990 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2000 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2010 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2020 | 0 | 0 | 0 | 0 | 0 | 0 |
| Latrobe | 1983 | 0 | 0 | 0 | 0 | 30 | 30 |
| | 1990 | 0 | 0 | 0 | 0 | 50 | 50 |
| | 2000 | 0 | 50 | 0 | 0 | 100 | 150 |
| | 2010 | 0 | 50 | 0 | 0 | 100 | 150 |
| | 2020 | 0 | 50 | 0 | 0 | 100 | 150 |
| Southern EID | 1983 | 0 | 30 | 0 | 10 | 320 | 360 |
| | 1990 | 0 | 30 | 0 | 10 | 450 | 490 |
| | 2000 | 0 | 50 | 50 | 10 | 550 | 660 |
| | 2010 | 0 | 80 | 80 | 10 | 650 | 820 |
| | 2020 | 0 | 100 | 100 | 10 | 700 | 910 |
| EID Total | 1983 | 0 | 1,100 | 270 | 2,430 | 610 | 4,410 |
| | 1990 | 0 | 1,130 | 320 | 2,570 | 800 | 4,820 |
| | 2000 | 0 | 1,250 | 400 | 2,820 | 1,020 | 5,490 |
| | 2010 | 0 | 1,330 | 480 | 3,110 | 1,200 | 6,120 |
| | 2020 | 0 | 1,350 | 500 | 3,210 | 1,300 | 6,360 |
| **Georgetown Divide Public Utility District**[1] | | | | | | | |
| | 1983 | 10 | 1,240 | 50 | 110 | 20 | 1,430 |
| **National Forest** | | | | | | | |
| | 1983 | 0 | 80 | 0 | 0 | 0 | 80 |
| | 1990 | 0 | 90 | 0 | 0 | 0 | 90 |
| | 2000 | 0 | 100 | 0 | 0 | 0 | 90 |
| | 2010 | 0 | 100 | 0 | 0 | 0 | 100 |
| | 2020 | 0 | 100 | 0 | 0 | 0 | 100 |

1 Projections of untreated water use for Georgetown Divide PUD were based on historical untreated water sales in lieu of projected crop pattern; therefore, future irrigated crop acreages were not evaluated.

Calaveras watershed in 1968. Data from those surveys were updated, based on land use surveys, to adjust for urban growth and to determine the 1983 level of available land for forecasting crop patterns.

The *Crop Market Outlook* is important in forecasting agricultural development because it considers economic and physical elements that influence crop production in California. The CMO is based on national population growth, per capita consumption, and exports and imports, which are then translated to California's share of the total production required to meet national demands for food and fiber. California's share of the markets for various crops is, in turn, allocated to regions of the State by considering physical and economic constraints such as availability and suitability of land, climatic conditions, land use trends, production costs, land prices, farm sizes, and other factors affecting crop production.

### Applied Water Use and Evapotranspiration of Applied Water

This section discusses the basis for the unit water use values used in translating crop acreage to present and future agricultural water use.

Water delivered at the farm headgate and applied as irrigation water is commonly referred to as *applied water* (AW). That portion of applied water that is consumed by evaporation and plant transpiration processes is referred to as *evapotranspiration of applied water* (ETAW). The rest of the applied water percolates below the root zone or runs into the drainage system.

*On farm irrigation efficiency* is the percentage of applied water that is used by and available for evapotranspiration. Irrigation efficiency, as a percentage, is computed as:

$$\text{Irrigation Efficiency} = \text{ETAW/AW} \times 100$$

This equation is based on the assumption that soil moisture storage at the beginning and end of the irrigation season reaches the same level each year; thus change in soil moisture is not reflected. *Evapotranspiration* (ET) is the total amount of water required by the crop during the growing season. It includes water consumed by vegetation for transpiration and building of plant tissue and water evaporated from adjacent soil and water surfaces. A portion of the ET requirement is met from precipitation. The term *ETAW* refers only to the portion of ET that is met by irrigation (applied water).

Average unit values for irrigation water requirement and ETAW for crops grown in the area were estimated based on information published by the University of California Cooperative Extension Service, *Irrigation Management for the Sierra Nevada Foothills of California* (1980). The estimates include consideration of:

- Elevation where most of these crops are grown.
- Whether most of the crops are grown with or without cover crops.
- Similarity of terrain and its exposure on which crops are grown.

In most instances, the average of seasonal water requirement under varying conditions was used. Estimated unit use values were compared with values in other areas of the State with similar or dissimilar environment. The comparison showed the estimates were reasonable for the area.

Estimated average unit values for evapotranspiration of applied water and applied water *(in feet)* are:

| | ETAW | Irrigation Efficiency | AW |
|---|---|---|---|
| Miscellaneous Field | 1.2 | 67 | 1.8 |
| Irrigated Pasture | 2.6 | 68 | 3.8 |
| Miscellaneous Truck | 0.6 | 86 | 0.7 |
| Deciduous Orchard | 1.9 | 68 | 2.8 |
| Grapes | 1.0 | 77 | 1.3 |

These values represent average rates and are more appropriate for assessing areawide water applications than for uses on specific farms.

In Georgetown Divide PUD it is difficult to project separately the untreated water use between agricultural water use and water needs for small parcels and ranchettes. Commercial agriculture, however, appears to be disappearing from the District. The projections of untreated water use were, therefore, largely based on information provided by Georgetown Divide PUD. Untreated water use is projected to increase by about 100 acre-feet per year. This projection is based on the assumption that cost and availability of water will not be a constraint.

Estimates of applied water use are shown in Table D-5. Estimates of evapotranspiration of applied water are shown in Table D-6.

Applied water use is expected to increase substantially between 1983 and 2020. In the EID study area, the increase would be about 4,190 acre-feet. In Georgetown Divide PUD, the increase of 4,200 acre-feet is for ranchettes and not commercial agriculture.

## WATER SUPPLY

The Sierra Nevada foothills of California seem to have an abundance of water because of the many creeks, rivers, and reservoirs, but this is generally not true. Many creeks flow full during winter and spring but are dry during summer and fall. The major rivers are in canyons and are difficult to tap for communities and agricultural lands on higher areas.

Though ground water is a minor source of water in the foothills, it plays an important role in meeting the needs of many people. Ground water basins within the county are small, have only local significance, and are limited in potential yield. Most wells are drilled in fractured rock; thus, while ground water will continue to be used locally, surface supplies will play the major role in meeting future water demands and in some areas may replace a portion of present ground water supplies.

Table D-5
AGRICULTURAL APPLIED WATER USE
El Dorado County
*(Acre-Feet)*

| Study Area | Year | Miscellaneous Field | Irrigated Pasture | Miscellaneous Truck | Deciduous Orchard | Grapes | Total |
|---|---|---|---|---|---|---|---|
| **El Dorado Irrigation District** | | | | | | | |
| Western EID | 1983 | 0 | 760 | 0 | 30 | 0 | 790 |
| | 1990 | 0 | 760 | 0 | 30 | 0 | 790 |
| | 2000 | 0 | 760 | 0 | 30 | 0 | 790 |
| | 2010 | 0 | 760 | 0 | 0 | 0 | 760 |
| | 2020 | 0 | 760 | 0 | 0 | 0 | 760 |
| Placerville and Vicinity | 1983 | 0 | 2,360 | 0 | 2,070 | 130 | 4,560 |
| | 1990 | 0 | 2,280 | 10 | 2,100 | 130 | 4,520 |
| | 2000 | 0 | 2,280 | 40 | 2,240 | 160 | 4,720 |
| | 2010 | 0 | 2,280 | 70 | 2,520 | 200 | 5,070 |
| | 2020 | 0 | 2,280 | 70 | 2,660 | 200 | 5,210 |
| Eastern EID | 1983 | 0 | 950 | 190 | 4,680 | 210 | 6,030 |
| | 1990 | 0 | 1,140 | 210 | 5,040 | 260 | 6,650 |
| | 2000 | 0 | 1,330 | 210 | 5,600 | 320 | 7,460 |
| | 2010 | 0 | 1,520 | 210 | 6,160 | 390 | 8,280 |
| | 2020 | 0 | 1,520 | 210 | 6,300 | 460 | 8,490 |
| Mosquito | 1983 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1990 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2000 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2010 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2020 | 0 | 0 | 0 | 0 | 0 | 0 |
| Latrobe | 1983 | 0 | 0 | 0 | 0 | 40 | 40 |
| | 1990 | 0 | 0 | 0 | 0 | 60 | 60 |
| | 2000 | 0 | 190 | 0 | 0 | 100 | 290 |
| | 2010 | 0 | 190 | 0 | 0 | 130 | 320 |
| | 2020 | 0 | 190 | 0 | 0 | 130 | 320 |
| Southern EID | 1983 | 0 | 110 | 0 | 30 | 420 | 560 |
| | 1990 | 0 | 110 | 0 | 30 | 590 | 730 |
| | 2000 | 0 | 190 | 40 | 30 | 720 | 980 |
| | 2010 | 0 | 300 | 60 | 30 | 840 | 1,230 |
| | 2020 | 0 | 380 | 70 | 30 | 910 | 1,390 |
| EID Total | 1983 | 0 | 4,180 | 190 | 6,810 | 800 | 11,980 |
| | 1990 | 0 | 4,290 | 220 | 7,200 | 1,040 | 12,750 |
| | 2000 | 0 | 4,750 | 290 | 7,900 | 1,300 | 14,240 |
| | 2010 | 0 | 5,050 | 340 | 8,710 | 1,560 | 15,660 |
| | 2020 | 0 | 5,130 | 350 | 8,990 | 1,700 | 16,170 |
| **Georgetown Divide Public Utility District**[1] | | | | | | | |
| | 1983 | | | | | | 4,300 |
| | 1990 | | | | | | 5,100 |
| | 2000 | | | | | | 6,200 |
| | 2010 | | | | | | 7,400 |
| | 2020 | | | | | | 8,500 |
| **National Forest** | | | | | | | |
| | 1983 | 0 | 300 | 0 | 0 | 0 | 300 |
| | 1990 | 0 | 340 | 0 | 0 | 0 | 340 |
| | 2000 | 0 | 380 | 0 | 0 | 0 | 380 |
| | 2010 | 0 | 380 | 0 | 0 | 0 | 380 |
| | 2020 | 0 | 380 | 0 | 0 | 0 | 380 |

1 For Georgetown Divide PUD, values were based on historical untreated water sales.

Table D-6
EVAPOTRANSPIRATION OF APPLIED WATER
El Dorado County
*(Acre-Feet)*

| Study Area | Year | Miscellaneous Field | Irrigated Pasture | Miscellaneous Truck | Deciduous Orchard | Grapes | Total |
|---|---|---|---|---|---|---|---|
| **El Dorado Irrigation District** | | | | | | | |
| Western EID | 1983 | 0 | 520 | 0 | 20 | 0 | 540 |
| | 1990 | 0 | 520 | 0 | 20 | 0 | 540 |
| | 2000 | 0 | 520 | 0 | 20 | 0 | 540 |
| | 2010 | 0 | 520 | 0 | 0 | 0 | 520 |
| | 2020 | 0 | 520 | 0 | 0 | 0 | 520 |
| Placerville and Vicinity | 1983 | 0 | 1,610 | 0 | 1,410 | 100 | 3,120 |
| | 1990 | 0 | 1,560 | 10 | 1,430 | 100 | 3,100 |
| | 2000 | 0 | 1,560 | 30 | 1,520 | 120 | 3,230 |
| | 2010 | 0 | 1,560 | 60 | 1,710 | 150 | 3,480 |
| | 2020 | 0 | 1,560 | 60 | 1,810 | 150 | 3,580 |
| Eastern EID | 1983 | 0 | 650 | 160 | 3,170 | 160 | 4,140 |
| | 1990 | 0 | 780 | 180 | 3,420 | 200 | 4,580 |
| | 2000 | 0 | 910 | 180 | 3,800 | 250 | 5,140 |
| | 2010 | 0 | 1,040 | 180 | 4,180 | 300 | 5,700 |
| | 2020 | 0 | 1,040 | 180 | 4,280 | 350 | 5,850 |
| Mosquito | 1983 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 1990 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2000 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2010 | 0 | 0 | 0 | 0 | 0 | 0 |
| | 2020 | 0 | 0 | 0 | 0 | 0 | 0 |
| Latrobe | 1983 | 0 | 0 | 0 | 0 | 30 | 30 |
| | 1990 | 0 | 0 | 0 | 0 | 50 | 50 |
| | 2000 | 0 | 130 | 0 | 0 | 80 | 210 |
| | 2010 | 0 | 130 | 0 | 0 | 100 | 230 |
| | 2020 | 0 | 130 | 0 | 0 | 100 | 230 |
| Southern EID | 1983 | 0 | 80 | 0 | 20 | 320 | 420 |
| | 1990 | 0 | 80 | 0 | 20 | 450 | 550 |
| | 2000 | 0 | 130 | 30 | 20 | 550 | 730 |
| | 2010 | 0 | 210 | 50 | 20 | 650 | 930 |
| | 2020 | 0 | 260 | 60 | 20 | 700 | 1,040 |
| EID Total | 1983 | 0 | 2,860 | 160 | 4,620 | 610 | 8,250 |
| | 1990 | 0 | 2,940 | 190 | 4,880 | 800 | 8,810 |
| | 2000 | 0 | 3,250 | 240 | 5,360 | 1,000 | 9,850 |
| | 2010 | 0 | 3,460 | 290 | 5,910 | 1,200 | 10,860 |
| | 2020 | 0 | 3,510 | 300 | 6,100 | 1,300 | 11,210 |
| **National Forest** | | | | | | | |
| | 1983 | 0 | 210 | 0 | 0 | 0 | 210 |
| | 1990 | 0 | 230 | 0 | 0 | 0 | 230 |
| | 2000 | 0 | 260 | 0 | 0 | 0 | 260 |
| | 2010 | 0 | 260 | 0 | 0 | 0 | 260 |
| | 2020 | 0 | 260 | 0 | 0 | 0 | 260 |

The general sources and amounts of surface and ground water supplies in the county are described below, followed by more specific discussions of water supplies for each study area.

## Water Supply Development

The first water development in El Dorado County was for mining operations that followed the Gold Rush of 1849. When hydraulic mining operations ceased, the mining ditches became conveyance systems for what is now the Pacific Gas and Electric hydroelectric power system and for meeting both agricultural and urban water supply needs. The principal systems of this kind in use today are the Georgetown Ditch, El Dorado Canal, and many of the EID distribution system ditches. Georgetown Divide PUD constructed the Stumpy Meadows Project to provide regulation of water to its service area. The U.S. Bureau of Reclamation constructed the Sly Park facilities to provide water for EID. Water supply developments are discussed in more detail under the specific study areas.

Four major public utilities and 200 minor water distributors provide water to most of El Dorado County's residents and agricultural users. Following is a discussion of major utilities within El Dorado Irrigation District and Georgetown Divide Public Utility District.

### El Dorado Irrigation District

El Dorado Irrigation District was formed in 1925 primarily to assume the obligations and assets of the El Dorado Water Company. At that time customers were supplied water through the old irrigation ditches and canals. Part of the original ditch system is still being maintained to bring water into the distribution system and, in some areas, for delivery of irrigation water. EID presently provides surface water to about one-third of the total 416,000 acres in this study area. The remaining area is served by individual wells, small farm ponds, or small local diverter systems. Table D-7 summarizes the water supply data for the EID study area.

A multipurpose district, El Dorado Irrigation District provides water service to 27,000 accounts, removes waste water from 10,000 accounts, operates Sly Park Recreation Area, and has a small hydro-electric plant on Weber Creek. Communities as diverse as urbanized El Dorado Hills and Cameron Park and rural/ residential ranches are served. Water is also wholesaled to the city of Placerville.

Primary sources of water supply for EID are Sly Park storage, El Dorado Forebay, and Folsom Lake. Sly Park Reservoir (Jenkinson Lake), was constructed in the 1950s by the U.S. Bureau of Reclamation. The capacity is 41,000 acre-feet, and the firm yield is 18,500 acre-feet.

Table D-7
WATER SUPPLY,
EL DORADO IRRIGATION DISTRICT
STUDY AREA
*(Acre-Feet)*

| Source and Facility | Water Supply |
|---|---|
| Main EID* | |
| Sly Park (USBR)[1] | 18,500 |
| El Dorado Forebay (PG&E) | 15,000 |
| Folsom Lake (USBR)[2] | 7,500 |
| Waste Water Reuse[3] | 620 |
| Total | 41,620 |
| Mosquito | |
| Ground Water | 50 |
| Total | 50 |
| Latrobe | |
| Ground Water | 60 |
| Local Surface Water[4] | 10 |
| Total | 70 |
| Southern EID | |
| Ground Water | 580 |
| Local Surface Water[4] | 190 |
| Total | 770 |

* Subareas: Western EID, Placerville and Vicinity, and Eastern EID.

1 EID firm yield.

2 Delivery capability is uncertain, but is increasing.

3 To the extent a matching use exists, the amount can increase.

4 Includes storage and diversion from farmponds and direct stream diversion when available.

El Dorado Forebay (PG&E), at Pollock Pines, is supplied water from the South Fork American River via El Dorado Canal. EID can purchase 15,000 acre-feet annually at the Forebay from PG&E.

Annually, 7,500 acre-feet of water is available from Folsom Lake (USBR). The lake is near the lowest elevation point of El Dorado County, so water used has to be pumped uphill. The average diversion is estimated to be about 2,500 acre-feet annually. Plans are being developed to increase pumping and pipeline capacities. During the 1976-1977 drought, EID's entitlement was reduced by 50 percent, to 3,775 acre-feet. A similar reduction may occur at Folsom Lake in future dry periods.

There are or have been several noncontiguous systems operated by EID: Kirkwood, Rancho Murieta, Outingdale, and Strawberry. Rancho Murieta detached from EID in 1983 and Kirkwood in 1985, so only the last two are of importance.

- Outingdale, within the Southern EID subarea, derives its water supply from the Middle Fork Cosumnes River. Use is minor and is included with urban use and supply for the subarea.

- Strawberry, within the Eastern EID subarea, derives its water supply from springs north of Highway 50 until mid-summer, then switches to direct diversion from the South Fork American River for the rest of summer. A few homes have a separate spring system. Total supply and use is very small and is included in the total for the subarea.

Two other surface water sources are available to EID:

| Source | Average Yield *(Acre-Feet)* |
|---|---|
| Weber Creek Reservoir (Weber Creek) | 1,275 |
| North Fork Ditch (North Fork Cosumnes River) | 1,770 |

The yield from these sources is negligible because of dry year low flows and lack of delivery capability.

**Georgetown Divide Public Utility District**

Georgetown Divide Public Utility District was formed in 1946 to acquire Georgetown Water Company rights, facilities, and properties to serve the Georgetown Divide area. (The facilities were finally acquired in 1959.) Georgetown Water Company and numerous predecessors held certain rights to waters of the South Fork Rubicon River and Pilot Creek. Use of the water had been established as early as 1852.

In the early 1950s, Sacramento Municipal Utility District expressed a desire to acquire Georgetown Divide PUD's rights and facilities in the upper Rubicon basin, including Loon Lake and a potential future water supply from the Rubicon River for which Georgetown Divide PUD had made application. In return, SMUD offered to provide financial assistance for planning and

construction and to assist in acquiring the necessary water rights for an alternative Georgetown Divide PUD water supply in the Pilot Creek basin, including a 20,000 acre-foot reservoir.

In April 1957, Georgetown Divide PUD and SMUD entered into an agreement for sale of the upper Rubicon facilities to SMUD. Funds from the sale and from a Public Law 984 loan were used by Georgetown Divide PUD to construct the Stumpy Meadows Project, including Stumpy Meadows Dam. The project was completed in 1962.

Table D-8 summarizes the water supply data for the Georgetown Divide PUD study area.

Table D-8
1983 WATER SUPPLY,
GEORGETOWN DIVIDE PUD
STUDY AREA
*(Acre-Feet)*

| Source and Facility | Water Supply |
|---|---|
| Stumpy Meadows (Firm Yield)* | 11,200 |
| Other | |
| Waste Water Reuse | 0 |
| Ground Water | 760 |
| Minor Tributaries | 0 |
| Total | 11,960 |

* Assumes 30 percent deficiency of untreated deliveries during a critically dry period similar to 1976-1978.

Stumpy Meadows Reservoir, with a gross storage capacity of 20,000 acre-feet, is on Pilot Creek, a tributary to the Rubicon River. The watershed has a total tributary area of 15.1 square miles, excluding a small diversion from 1.5 square miles of the Onion Creek watershed, immediately to the south. Average annual inflow from the direct tributary area is about 22,000 acre-feet.

Georgetown Divide PUD and the Department of Water Resources are preparing a study of alternative water supplies for Georgetown Divide PUD. As a part of the study, DWR has conducted operation studies to determine yield of the Stumpy Meadows project based on various deficiency criteria and water use. The firm yield of the project, including 30 percent deficiency in untreated water deliveries, was determined to be about 11,200 acre-feet per year based on the 1976-1978 critical period. Safe yield is about 10,400 acre-feet. Further information will be published in the report by Georgetown Divide PUD and DWR.

At this time, the Stumpy Meadows Project is the primary source of water for those areas now being served by Georgetown Divide PUD.

**Ground Water**

Much of El Dorado County is underlain by metamorphic and granitic rock, which is locally veneered by younger volcanic flows or alluvium. In the hard rock areas, ground water is found in fractures and along fault zones and geologic contacts. Although ground water is prevalent in hard rock areas, the amount that can be extracted at a specific site is variable and limited. Alluvium consists of unconsolidated gravel, sand, silt, and clay that was deposited by flowing water adjacent to streams and in basins. Where the alluvial deposits are thick, they can store and transmit substantial amounts of ground water. In western El Dorado County, alluvium covers only small areas and is usually too thin to provide significant ground water storage. Thus, the amount of usable ground water in alluvium is limited.

## SUPPLEMENTAL WATER NEEDS

Supplemental water needs calculated by the Department of Water Resources for El Dorado County (El Dorado Irrigation District and Georgetown Divide Public Utility District) were determined by subtracting the net water supply (supply minus losses) from the projected water use.

### El Dorado Irrigation District

The EID study area was divided into six subareas for analyses of water needs and supplies. Western EID, Placerville and Vicinity, and Eastern EID subareas are now served by the main EID system. Mosquito, Labrobe, and Southern EID are served by local surface water systems or by ground water.

No individual water balances were developed for Mosquito, Latrobe, and Southern EID, which have no formal surface water systems. The areas are so sparsely populated that potential water sources would be too numerous to be included in this general study. Each would probably have to be analyzed separately.

Table D-9 compares estimated water uses for the main EID system with available water supplies. The basic assumption is that those enclosed areas not now being served by EID but

Table D-9
WATER BALANCES,
MAIN EL DORADO IRRIGATION DISTRICT SYSTEM*
*(Acre-Feet)*

| | 1983 | 1990 | 2000 | 2010 | 2020 |
|---|---|---|---|---|---|
| **Water Requirements** | | | | | |
| Agricultural | 11,380 | 11,960 | 12,970 | 14,110 | 14,460 |
| Urban | 12,190 | 16,390 | 22,000 | 26,990 | 33,180 |
| Industrial | 500 | 620 | 710 | 800 | 900 |
| Total | 24,070 | 28,970 | 35,680 | 41,900 | 48,540 |
| **Water Supplies** | | | | | |
| Local Surface Water | | | | | |
| Folsom | 2,500 | 5,000 | 7,500 | 7,500 | 7,500 |
| Forebay-PG&E | 9,500 | 15,000 | 15,000 | 15,000 | 15,000 |
| Sly Park | 18,5000 | 18,500 | 18,500 | 18,500 | 18,500 |
| Waste Water Reclamation | 620 | 620 | 620 | 620 | 620 |
| Total | 31,120 | 39,120 | 41,620 | 41,620 | 41,620 |
| **Losses** | | | | | |
| Conveyance (Pipeline) | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 |
| Conveyance (Open Ditch) | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 |
| Unauthorized Use | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 |
| Total | 14,000 | 14,000 | 14,000 | 14,000 | 14,000 |
| **Net Water Supply** | 17,120 | 25,120 | 27,620 | 27,620 | 27,620 |
| **Surplus (+) or Shortage (–)** | – 6,950 | – 3,850 | – 8,060 | –14,280 | –20,920 |

*Main EID System consists of Western EID, Placerville and Vicinity, and Eastern EID subareas.

within the boundaries will eventually need a supplemental supply. This supply will serve new development and replace some present ground water use.

Information on losses shown on Table D-9 is taken from State Water Resources Control Board Water Right Decision 1587. Conveyance losses do not include distribution losses occurring after the farm headgate, the treatment plant, or individual meters. Table D-9 does not show a reduction in conveyance loss through 2020, although EID has an ongoing program to reduce these losses.

Net water supply was determined by subtracting losses from water supply. Surplus or shortage was determined by subtracting the net water supply from the amount of applied water. Table D-9 shows that EID already has a water shortage. Based on present operations and available water supplies, certain management actions such as mandating reduced water use during severe dry periods, reduction of ditch system losses, and installation of facilities to deliver all available water supplies will help to overcome shortages through 1990. Using more than firm yield of Sly Park Reservoir, while possible in wet years, entails the risk of increasing the severity of shortages in dry years.

Sometime after 1990, new sources of surface supply will be needed. El Dorado Irrigation District will have to identify those sources as part of its planning process.

**Georgetown Divide Public Utility District**

Future water needs in the Georgetown Divide PUD service area are assumed to be met by the district, including areas not now being served, except for part of the Kelsey area and the area east of Georgetown that is primarily U.S. Forest Service land. Analysis of Georgetown Divide PUD, by subarea, is provided in the GDPUD/DWR alternative source study.

In 1983, 45 percent of urban needs of the study area were served by ground water. By 2020, it is assumed that all urban needs, except for 15 percent of the present urban use in the Kelsey area, will be met by Georgetown Divide Public Utility District.

Water balances for Georgetown Divide PUD are shown in Table D-10. Total present and future water uses are compared with total net water supplies, consisting of Stumpy Meadows, a local project, less losses to convey water to a treatment plant or farmer's headgate. Estimates of supplies from Stumpy Meadows are based on firm yield assuming 30 percent deficiencies in untreated water deliveries in a drought as severe as in 1976 and 1977. Estimates of losses and untreated water uses are based on information provided by Georgetown Divide PUD.

Table D-10 indicates that if the projected growth in demand occurs, an additional water supply will be needed before 2000. The quantity of supplemental water needed is stated in terms of applied water. Losses to convey the supplemental supply from its source to a treatment plant or farmer's headgate must be added to estimate total water needed at a source.

Table D-10
WATER BALANCES,
GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT
*(Acre-Feet)*

| | 1983 | 1990 | 2000 | 2010 | 2020 |
|---|---|---|---|---|---|
| **Water Requirements** | | | | | |
| Untreated | 4,300 | 5,100 | 6,200 | 7,400 | 8,500 |
| Urban | 1,580 | 2,260 | 3,150 | 3,920 | 4,830 |
| Recreational | 130 | 160 | 190 | 230 | 260 |
| Total | 6,010 | 7,520 | 9,540 | 11,550 | 13,590 |
| **Water Supplies** | | | | | |
| Stumpy Meadows | 11,200 | 11,200 | 11,200 | 11,200 | 11,200 |
| Ground Water and Surface Water | 760 | 630 | 450 | 260 | 80 |
| Total | 11,960 | 11,830 | 11,650 | 11,460 | 11,280 |
| **Losses** | 3,420 | 2,350 | 2,150 | 2,150 | 2,150 |
| **Net Water Supply** | 8,540 | 9,480 | 9,500 | 9,310 | 9,130 |
| **Surplus(+) or Shortage(–)** | + 2,530 | + 1,960 | – 40 | – 2,240 | – 4,460 |

## Local Agency's Projected Needs

El Dorado County Water Agency has reviewed the Department of Water Resources' projections and has concluded that they are low. El Dorado County has provided the following statement:

> *El Dorado Irrigation District and El Dorado County Water Agency are currently studying projections of future water needs and shortages in the EID service area. During the past five years, unprecedented growth has occurred in the EID service area, averaging almost 1,500 new connections annually. This includes all connections – residential, commercial and agricultural. Assuming only residential unit usage, this would amount to an increase in demand of about 1,000 acre-feet per year. The District has been able to reduce system "losses" to at least partially compensate for this growth in demand by system repair, maintenance and improved water management. It is not anticipated that the current percentage growth rate will continue to 2020, but desirability of the area for residential use would seem to support a continuing growth pattern. As a consequence, El Dorado is concerned that DWR projections may possibly understate the true magnitude of future need and shortages and the urgency for development of supplemental water supplies.*

## PLACER COUNTY SERVICE AREA

The Department of Water Resources has conducted a reconnaissance study of water needs for the Placer County service area. Placer County Water Agency supplied information on recent water use and projected future needs. The County is updating its 1986 master plan because of recent heavy growth. The work is expected to be completed by the end of 1990.

### WATER USE

The terms *water use* and *applied water use*, as used in this report, pertain to deliveries at intakes to domestic, municipal, and industrial distribution systems or at farm headgates or irrigation well heads. The term does not include surface water conveyance losses incurred from the point of diversion to the distribution system or farm headgate. Results are summarized in Table D-11.

Table D-11
PLACER COUNTY SERVICE AREA WATER USE
*(Acre-Feet)*

| Study Areas | 1985 Urban | 1985 Agricultural | 1985 Total | 2020 Urban | 2020 Agricultural | 2020 Total |
|---|---|---|---|---|---|---|
| Western Placer | | | | | | |
| Future American River Service Area* | 2,500 | 74,210 | 76,710 | 5,240 | 78,320 | 83,560 |
| Other Potential Service Area** | 4,410 | 138,250 | 142,660 | 9,230 | 143,620 | 152,850 |
| Subtotal | 6,910 | 212,470 | 219,370 | 14,470 | 221,940 | 236,410 |
| Placer County Water Agency, Zone 1 | 15,880 | 28,420 | 44,300 | 33,260 | 28,720 | 61,980 |
| Roseville and San Juan Suburban Water District | 15,450 | 0 | 15,450 | 26,630 | 0 | 26,630 |
| Total | 38,240 | 240,880 | 279,120 | 74,360 | 250,660 | 325,020 |

* Western Roseville, County Zone 29, and Lincoln.
** South Sutter Water District, Camp Far West, Sheridan, and Nevada Irrigation District.

#### Urban Water Use

Fundamental data for estimating urban water use are population and per capita water use values. Figure D-1 shows estimates of historical and projected population for Placer County developed by the California Department of Finance. The substantial growth in the county is expected to continue, reaching 288,000 by the year 2020. The population in each study area in 1985 and 2020 was estimated by multiplying the 1980 ratio of study area population to county population by the county population for 1985 and 2020.

Per capita use of water in an area, as defined by the Department of Water Resources, is the total amount of water used divided by the permanent population. Historically, per capita water use has trended upward, but it was assumed that, with increased effects of water conservation, the trend would level off. Therefore, per capita water use factors were presumed to remain constant

from 1985 to 2020 for all study areas except San Juan Suburban Water District. Present and future water use in the study areas were estimated by multiplying estimated population for 1985 and 2020 by per capita water use. Table D-12 presents the computations.

Figure D-1
PLACER COUNTY POPULATION

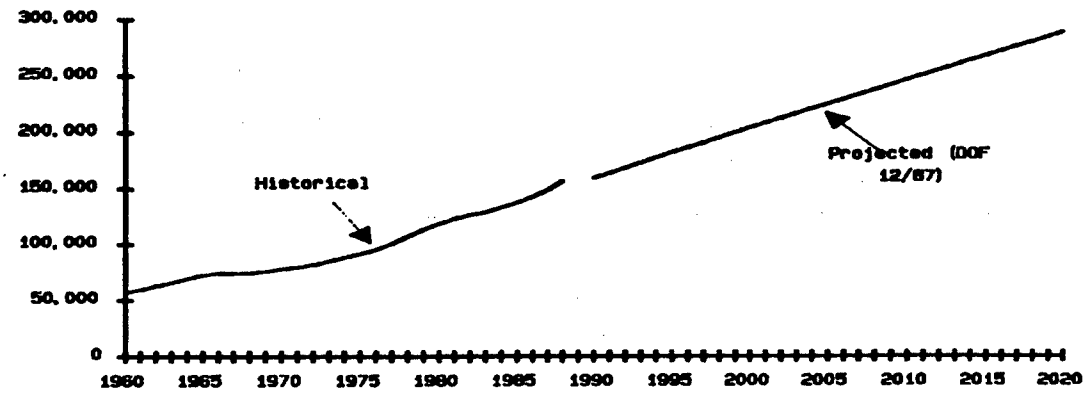



Table D-12
URBAN WATER USE
Placer County Service Area

| Study Areas | Population 1985 | Population 2020 | Per Capita Use (Acre-Feet per Capita) 1985 | Per Capita Use (Acre-Feet per Capita) 2020 | Urban Water Use (Acre-Feet) 1985 | Urban Water Use (Acre-Feet) 2020 |
|---|---|---|---|---|---|---|
| Western Placer | | | | | | |
| Future American River Service Area* | 8,170 | 17,110 | 0.306 | 0.306 | 2,500 | 5,240 |
| Other Potential Service Area** | 14,410 | 30,160 | 0.306 | 0.306 | 4,410 | 9,230 |
| Placer County Water Agency, Zone 1 | 51,900 | 108,700 | 0.306 | 0.306 | 15,880 | 33,260 |
| Roseville and San Juan Suburban Water District | 36,430 | 76,300 | 0.424 | 0.349 | 15,450 | 26,630 |

* Western Roseville, County Zone 29, and Lincoln.
** South Sutter Water District, Camp Far West, Sheridan, and Nevada Irrigation District.

## Agricultural Water Use

Fundamental data for estimating present agricultural water use are current crop acreages and unit water use values. Crop acreages are obtained from Department land use surveys that measure extent of irrigated acreage and identify types of crops being grown and other specific uses of land, such as double-cropping practices and sources of irrigation water. Unit use values are derived from analysis of data obtained over the years from direct measurements of applied water, direct measurements of soil moisture consumed by evapotranspiration, and pertinent climatic factors affecting crop water uses.

Agricultural water use is the sum of the products of the irrigated acres of the crops and their respective unit use factors. Water delivered at the farm headgate and applied as irrigation water is commonly referred to as *applied water* (AW). That portion of applied water that is consumed by evaporation and plant transpiration is referred to as the *evapotranspiration of applied water* (ETAW). The balance of the applied water percolates below the root zone and/or runs into the drainage system.

## Land Use

Future agricultural water use is projected by considering various factors affecting agriculture. Factors include historical cropping trends, impact of urban growth on agriculture, crop suitability of available land, future market outlook, competition for land by other use, irrigation and system efficiency, and water cost and other economic factors.

### Historical Agricultural Land Use

The trend in the agricultural sector in Placer County has been a decline of large-scale commercial agriculture and growth in the suburban ranchette type of use. According to the County's *1987 Agricultural Study*:

> *... 55% of all County farms are less than 10 acres in size. The smallest category of "farms", less than ten acres, grew by over 10%, while the larger categories nearly all declined. This suggests a break-up of farm properties into units that, though they still qualify as farms in this survey, are not really a part of commercial agriculture. This reflects the large number of hobby farms or rural ranchettes in the County. (pp.10-11)*

Once the land is subdivided into small parcels, it is unlikely that it will ever be returned to agricultural production (except in the suburban ranchette sense).

### Historical Cropping Patterns

Using the Agricultural Commissioner's crop acreage data in Table D-13, the trend for grain acreage was irregular from 1960 through 1981. Table D-13 also shows grain acreage high in some years, followed by low crop acreage in other years. The dramatic decline in the grain crop since 1982 corresponds with the *Set-Aside* program. This program began in 1982 and was designed to manage the returns to the farmer by controlling the number of acres planted. This trend is also supported by comparing Table D-13 with Table D-14, which shows the harvested and Set-Aside acres for grain crops on a national basis from 1975 through 1988.

Acreages for vineyard and orchard have been on decline since 1960. Land in pasture has been holding its own, although it is being divided into smaller parcels.

Figures D-2 through D-8 show the Agricultural Commissioner's data. Figure D-9 presents data concerning rice acreage for the United States, California, and Placer County. The pattern of rice acreage in Placer County is matched by those for both the State and the Nation.

Table D-13
AGRICULTURAL COMMISSIONER'S CROP ACREAGE DATA
Placer County

| | Alfalfa | Grain | Orchard | Pasture | Rice | Vineyard | Total |
|---|---|---|---|---|---|---|---|
| 1960 | 1,000 | 14,156 | 11,509 | 19,150 | 4,223 | 926 | 50,964 |
| 1961 | 1,000 | 19,020 | 9,204 | 19,500 | 3,073 | 670 | 52,467 |
| 1962 | 1,000 | 18,684 | 8,931 | 19,700 | 3,050 | 670 | 52,035 |
| 1963 | 950 | 18,483 | 8,356 | 21,000 | 2,820 | 670 | 52,279 |
| 1964 | 1,250 | 20,340 | 8,356 | 21,500 | 2,820 | 670 | 54,936 |
| 1965 | 1,500 | 20,400 | 8,389 | 22,500 | 3,560 | 670 | 57,019 |
| 1966 | 1,300 | 17,030 | 4,957 | 23,000 | 4,160 | 459 | 50,906 |
| 1967 | 1,550 | 14,730 | 4,931 | 23,500 | 4,200 | 459 | 49,370 |
| 1968 | 1,346 | 17,290 | 4,931 | 23,600 | 5,300 | 459 | 52,926 |
| 1969 | 889 | 15,330 | 5,442 | 23,700 | 5,580 | 466 | 51,407 |
| 1970 | 515 | 19,985 | 4,261 | 23,900 | 4,050 | 383 | 53,094 |
| 1971 | 2,247 | 16,660 | 4,261 | 24,900 | 4,398 | 383 | 52,849 |
| 1972 | 1,031 | 19,431 | 4,434 | 26,100 | 4,944 | 383 | 56,323 |
| 1973 | 1,340 | 14,280 | 4,441 | 27,400 | 7,020 | 383 | 54,864 |
| 1974 | 468 | 16,450 | 4,338 | 27,400 | 9,330 | 360 | 58,346 |
| 1975 | 1,195 | 22,750 | 2,875 | 27,400 | 12,000 | 296 | 66,516 |
| 1976 | 1,882 | 16,825 | 3,048 | 27,400 | 11,000 | 269 | 60,451 |
| 1977 | 1,140 | 21,685 | 2,989 | 19,500 | 8,500 | 296 | 54,110 |
| 1978 | 1,127 | 22,510 | 2,989 | 26,300 | 10,100 | 296 | 63,322 |
| 1979 | 715 | 18,900 | 2,809 | 26,800 | 16,100 | 226 | 65,550 |
| 1980 | 530 | 13,650 | 2,614 | 26,800 | 17,400 | 196 | 61,190 |
| 1981 | 500 | 13,990 | 1,913 | 26,800 | 18,000 | 126 | 61,329 |
| 1982 | 420 | 12,070 | 1,965 | 26,800 | 18,600 | 129 | 59,984 |
| 1983 | 0 | 3,183 | 1,934 | 26,800 | 8,510 | 129 | 40,556 |
| 1984 | 0 | 4,600 | 1,803 | 26,800 | 14,400 | 129 | 47,732 |
| 1985 | 0 | 4,300 | 1,812 | 26,800 | 12,900 | 126 | 45,938 |
| 1986 | 0 | 6,620 | 1,873 | 26,800 | 12,300 | 126 | 47,658 |
| 1987 | 0 | 6,100 | 2,257 | 26,800 | 12,000 | 125 | 47,282 |
| 1988 | 0 | 4,900 | 2,215 | 26,900 | 10,000 | 123 | 44,138 |

Note: Data (except 1987 and 1988) were compiled by the Giannini Foundation. Crops of minor total acres not included.

## Crop Suitability

The crop suitability assessment is split between two general land areas. The first is the lower, far western lands of the county. The second is the foothill area, generally between Auburn and Camp Far West Reservoir.

The major portion of lower western Placer County is largely composed of terrace soils. These soils typically are of the San Joaquin, Cometa, Ramona, Redding, Corning, and Fiddyment soil series, according to the USDA Soil Conservation Service *Soil Survey of Placer County, Western Part*. The effective rooting depth of these soils usually restricts crops that can be grown to shallow-rooted ones. The major crops grown are irrigated pasture, rice, wheat, and barley. The Soil Conservation Service has classified most of these soils as Class IV. (Soil capability classes range from I to VIII. Soils with capability classes of V or above have severe limitations that make them generally unsuitable for cultivation.)

Table D-14
UNITED STATES CROP ACREAGE
*(Millions of Acres)*

| | WHEAT | | BARLEY | | OATS | | RICE | |
|---|---|---|---|---|---|---|---|---|
| | Harvested | Set Aside | Harvested | Set Aside | Harvested | Set Aside | Harvested | Set Aside |
| 1975 | 69.5 | 0 | | | 13.0 | 0 | 2.8 | 0 |
| 1976 | 70.9 | 0 | | | 11.8 | 0 | 2.5 | 0 |
| 1977 | 66.7 | 0 | | | 13.5 | 0 | 2.2 | 0 |
| 1978 | 56.5 | 0 | | | 11.2 | 0 | 3.0 | 0 |
| 1979 | 62.5 | 0 | 7.5 | 0 | 9.7 | 0 | 2.9 | 0 |
| 1980 | 71.0 | 0 | 7.3 | 0 | 8.7 | 0 | 3.3 | 0 |
| 1981 | 80.6 | 0 | 9.0 | 0 | 9.4 | 0 | 3.8 | 0 |
| 1982 | 77.9 | 5.8 | 9.0 | 0.4 | 10.3 | 0.1 | 3.3 | 0.4 |
| 1983 | 61.4 | 30.0 | 9.7 | 1.1 | 9.1 | 0.3 | 2.2 | 1.7 |
| 1984 | 66.9 | 18.3 | 11.2 | 0.5 | 8.2 | 0.1 | 2.8 | 0.8 |
| 1985 | 64.7 | 18.8 | 11.6 | 0.7 | 8.2 | 0.1 | 2.5 | 1.2 |
| 1986 | 60.7 | 20.2 | 12.0 | 1.8 | 6.9 | 0.4 | 2.4 | 1.5 |
| 1987 | 55.9 | 27.9 | 10.0 | 2.9 | 6.9 | 0.8 | 2.3 | 1.5 |
| 1988 | 53.3 | 30.1 | 7.4 | 2.9 | 5.4 | 0.3 | 2.9 | 0.9 |

Note: 1988 is estimated.
Source: U.S. Department of Agriculture.

Figure D-2
ALFALFA ACREAGE IN PLACER COUNTY

Figure D-3
GRAIN ACREAGE IN PLACER COUNTY

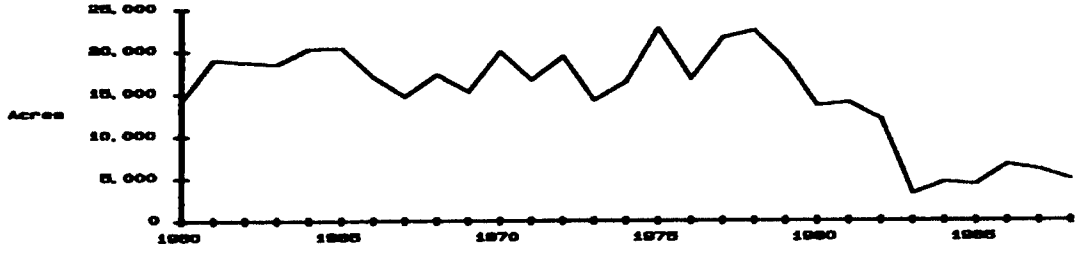


Figure D-4
ORCHARD ACREAGE IN PLACER COUNTY

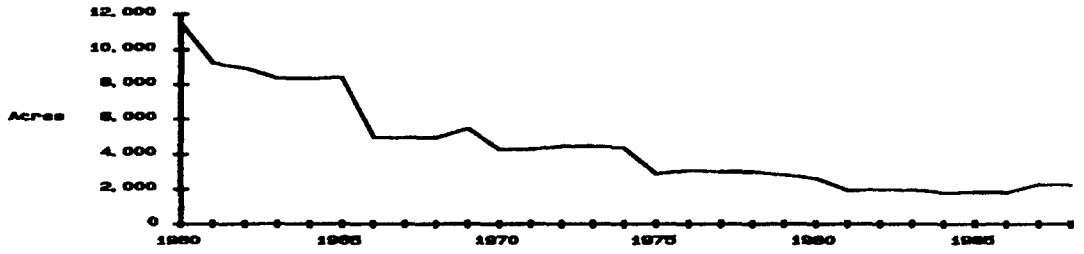



Figure D-5
IRRIGATED PASTURE ACREAGE IN PLACER COUNTY

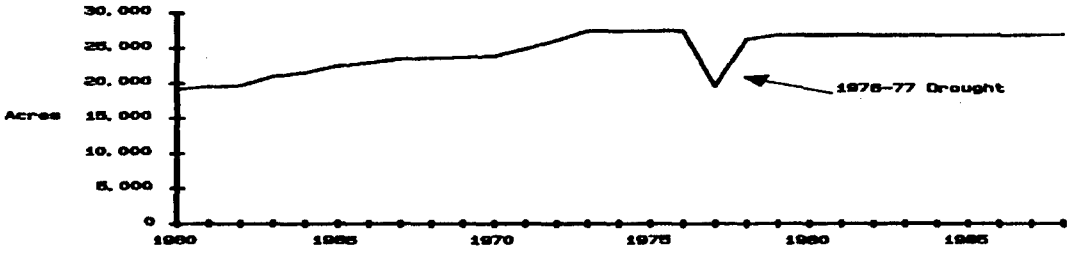



Figure D-6
RICE ACREAGE IN PLACER COUNTY

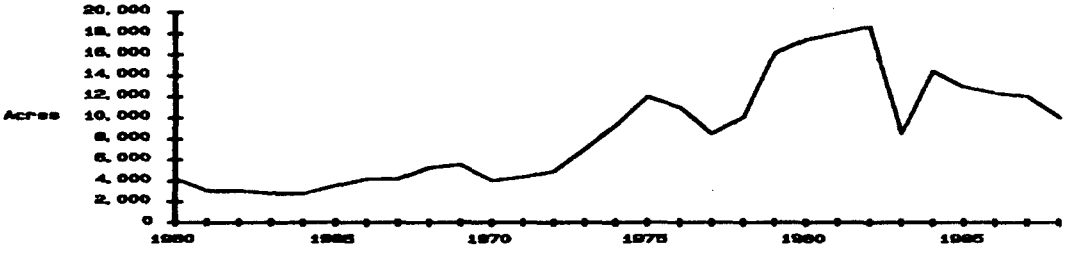


Figure D-7
VINEYARD ACREAGE IN PLACER COUNTY

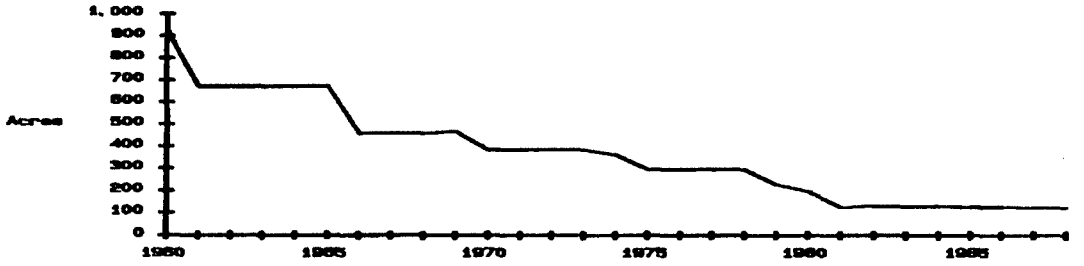



Figure D-8
TOTAL CROP ACREAGE IN PLACER COUNTY

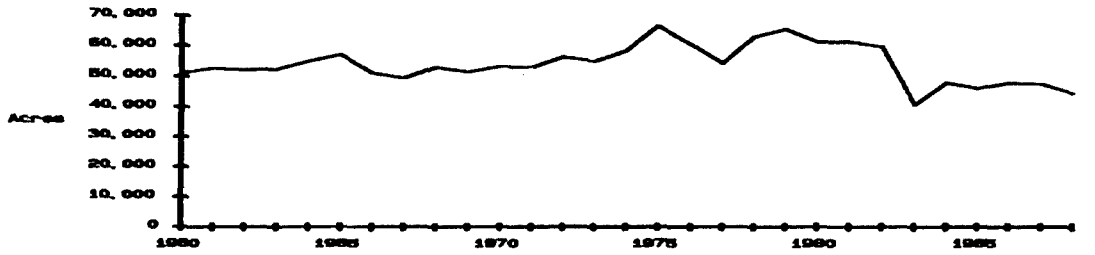
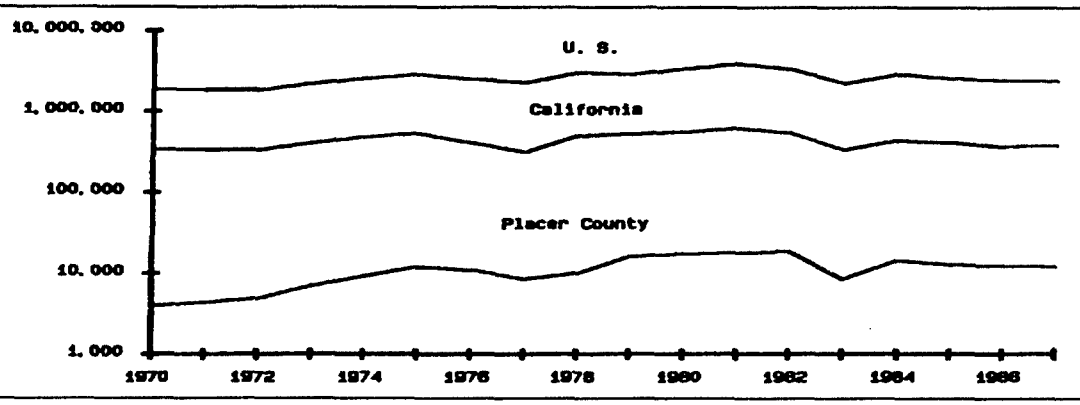



Figure D-9
COMPARISON OF RICE ACREAGE IN THE
UNITED STATES, CALIFORNIA, AND PLACER COUNTY



Much of the foothill portion of the study area is composed of soils of the Auburn, Sobrante, Caperton, and Andregg soil series mixed with occasional rock outcrops. The effective rooting depth of these soils ranges from shallow to moderate. This factor, as well as the steep slopes in some areas, limits the types of crops grown. The Soil Conservation Service rates most of these soils as Class IV and Class VI. The two major crops grown in this area are deciduous orchards and pasture.

**Future Market Outlook**

The Department of Water Resources periodically updates the Crop Market Outlook for California in providing the basis for statewide water demand projected in the Bulletin 160 series. The CMO is based on statistical trends and expert opinion of what the future in agriculture will look like. The last CMO (completed in 1985) forecast the following statewide trends for irrigated crop acreages:

| | |
|---|---|
| Alfalfa, Grain and Other Field Crops | A moderate decrease (10% to less than or equal to 25%) in irrigated acres was projected between 1981 and 2020. |
| Orchard Crops | Fruit was projected to increase slightly (less than or equal to 10%) in irrigated acres, while nuts were expected to increase substantially. |
| Pasture | A slight increase (less than or equal to 10%) was expected. |
| Rice | Projected to decrease substantially (greater than 25%) by the year 2020. |
| Vineyard | Expected to increase substantially. |

The Department of Water Resources is now updating the CMO for the next Bulletin 160, due to be published in 1992.

**Projected Cropping Pattern**

The 1985 and projected cropping patterns for Placer County service area are summarized in Table D-15. Projections in Table D-15 do not exactly follow the CMO, because the CMO is a statewide view of future cropping patterns. While providing a framework for projecting future acreages, other factors also have to be considered.

The reasoning behind projections in Table D-15 is as follows:

Table D-15
IRRIGATED CROP ACREAGES
Placer County Service Area

| | 1985 | 2020 |
|---|---|---|
| Field | 1,180 | 1,120 |
| Grain | 1,100 | 5,000 |
| Orchard | 3,300 | 3,010 |
| Pasture & Alfalfa | 25,800 | 28,550 |
| Rice | 14,400 | 17,300 |
| Truck | 270 | 280 |
| Vineyard | 200 | 200 |
| Total | 46,250 | 55,460 |

| | |
|---|---|
| Field | In 1985 the Department's land use survey recorded 700 acres of field corn and 400 acres of miscellaneous field crops, while no acres were shown in the Agricultural Commissioner's reports for these categories. It was assumed that no basic change would occur in this crop. |
| Grain | The 1,100 acres of grain shown are irrigated acres. Most of the County's grain crop is dry-farmed. While grain acreage has decreased in response to the Set-Aside program (see Table D-13), it is assumed that grain acreage will return to historical levels by 2020. |
| Orchard | It is assumed that orchard will remain the same. Significant increase is unlikely due to urbanization and to the limitation imposed by availability of soils suitable for deep-rooted crops. |
| Pasture & Alfalfa | Pasture is projected to increase slightly due to the increase in suburban ranchette land use. Alfalfa will remain the same. |
| Rice | The County's rice acreage more or less mirrors that of the State and Nation (see Figure D-9). Nothing on the national or international scene would suggest a major change in total rice acres or in the United States' share of the total market (naturally there are year to year ups and downs). It is, therefore, assumed that rice acres will continue at about the current level, with changes mainly resulting from Government program requirements and translocation from nearby rice-growing areas impacted by other competitive uses of land. |
| Truck | The Department's surveys have recorded minor acreages of truck crops, mainly melons. The expectation is that truck crops will continue to be minor. |
| Vineyard | While acres devoted to vineyards have increased dramatically in California since 1972, Placer County's vineyard acreages have fallen. It is assumed that acreage devoted to this crop will continue to be minor. |

**Present and Future Crop Water Use**

Table D-16 presents crop water use factors, crop acres, and the resulting products as well as the evapotranspiration of applied water and applied water use for the subareas in 1985. Table D-17 presents the same information for 2020. Crop water use factors presented assume no change in ETAW from now through 2020. On the other hand, the AW reflects increased irrigation efficiency for rice, pasture, alfalfa, fruit and nuts, and vineyards. Miscellaneous truck AW is increased slightly.

Table D-16
AGRICULTURAL LAND USE, EVAPOTRANSPIRATION OF APPLIED WATER, AND APPLIED WATER, 1985
Placer County Service Area

| | Grain | Rice | Field Corn | Misc. Field | Pasture & Alfalfa | Misc. Truck | Fruit & Nuts | Vine-yards | Total |
|---|---|---|---|---|---|---|---|---|---|
| Unit ETAW *(AF/Acre)* | 0.6 | 3.4 | 1.8 | 1.5 | 3.0 | 1.2 | 2.5 | 1.9 | |
| Unit AW *(AF/Acre)* | 0.9 | 6.8 | 2.6 | 2.2 | 5.1 | 1.8 | 3.7 | 2.9 | |
| West Roseville | | | | | | | | | |
| Area *(Acres)* | 0 | 500 | 0 | 0 | 1,000 | 0 | 0 | 200 | 1,700 |
| ETAW *(Acre-Feet)* | 0 | 1,700 | 0 | 0 | 3,000 | 0 | 0 | 380 | 5,080 |
| AW *(Acre-Feet)* | 0 | 3,400 | 0 | 0 | 5,100 | 0 | 0 | 580 | 9,080 |
| South Sutter | | | | | | | | | |
| Area *(Acres)* | 400 | 7,500 | 0 | 100 | 1,700 | 0 | 200 | 0 | 9,900 |
| ETAW *(Acre-Feet)* | 240 | 25,500 | 0 | 150 | 5,100 | 0 | 500 | 0 | 31,490 |
| AW *(Acre-Feet)* | 360 | 51,000 | 0 | 220 | 8,670 | 0 | 740 | 0 | 60,990 |
| Camp Far West | | | | | | | | | |
| Area *(Acres)* | 0 | 300 | 0 | 0 | 100 | 0 | 1,000 | 0 | 1,400 |
| ETAW *(Acre-Feet)* | 0 | 1,020 | 0 | 0 | 300 | 0 | 2,500 | 0 | 3,820 |
| AW *(Acre-Feet)* | 0 | 2,040 | 0 | 0 | 510 | 0 | 3,700 | 0 | 6,250 |
| Sheridan | | | | | | | | | |
| Area *(Acres)* | 100 | 200 | 0 | 0 | 300 | 0 | 300 | 0 | 900 |
| ETAW *(Acre-Feet)* | 60 | 680 | 0 | 0 | 900 | 0 | 750 | 0 | 2,390 |
| AW *(Acre-Feet)* | 90 | 1,360 | 0 | 0 | 1,530 | 0 | 1,100 | 0 | 4,090 |
| Nevada Irrigation District | | | | | | | | | |
| Area *(Acres)* | 0 | 200 | 700 | 0 | 12,100 | 100 | 500 | 0 | 13,600 |
| ETAW *(Acre-Feet)* | 0 | 680 | 1,260 | 0 | 36,300 | 120 | 1,250 | 0 | 39,610 |
| AW *(Acre-Feet)* | 0 | 1,360 | 1,820 | 0 | 61,710 | 180 | 1,850 | 0 | 66,920 |
| County Zone 29 | | | | | | | | | |
| Area *(Acres)* | 400 | 5,700 | 0 | 300 | 2,800 | 100 | 0 | 0 | 9,300 |
| ETAW *(Acre-Feet)* | 240 | 19,380 | 0 | 450 | 8,400 | 120 | 0 | 0 | 28,590 |
| AW *(Acre-Feet)* | 360 | 38,760 | 0 | 660 | 14,280 | 180 | 0 | 0 | 54,240 |
| Lincoln | | | | | | | | | |
| Area *(Acres)* | 200 | 0 | 0 | 0 | 2,100 | 0 | 0 | 0 | 2,300 |
| ETAW *(Acre-Feet)* | 120 | 0 | 0 | 0 | 6,300 | 0 | 0 | 0 | 6,420 |
| AW *(Acre-Feet)* | 180 | 0 | 0 | 0 | 10,710 | 0 | 0 | 0 | 10,890 |
| Placer County Water Agency | | | | | | | | | |
| Area *(Acres)* | 0 | 0 | 0 | 80 | 5,700 | 70 | 1,300 | 0 | 7,150 |
| ETAW *(Acre-Feet)* | 0 | 0 | 0 | 112 | 14,820 | 63 | 2,470 | 0 | 17,465 |
| AW *(Acre-Feet)* | 0 | 0 | 0 | 168 | 24,510 | 105 | 3,640 | 0 | 28,423 |
| Roseville / San Juan Suburban | | | | | | | | | |
| Area *(Acres)* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ETAW *(Acre-Feet)* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AW *(Acre-Feet)* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Service Area Total Acres | 1,100 | 14,400 | 700 | 480 | 25,800 | 270 | 3,300 | 200 | 46,250 |
| ETAW Total | 660 | 48,960 | 1,260 | 712 | 75,120 | 303 | 7,470 | 380 | 134,865 |
| AW Total | 990 | 97,920 | 1,820 | 1,048 | 127,020 | 465 | 11,040 | 580 | 240,883 |

NOTE: Unit AW values are from DAU 172 (Bulletin 160-87) except Pasture & Alfalfa, which has been lowered to represent some DAU 161 conditions.

Table D-17
AGRICULTURAL LAND USE, EVAPOTRANSPIRATION OF APPLIED WATER, AND APPLIED WATER, 2020
Placer County Service Area

| | Grain | Rice | Field Corn | Misc. Field | Pasture & Alfalfa | Misc. Truck | Fruit & Nuts | Vine-yards | Total |
|---|---|---|---|---|---|---|---|---|---|
| Unit ETAW *(AF/Acre)* | 0.6 | 3.4 | 1.8 | 1.5 | 3.0 | 1.2 | 2.5 | 1.9 | |
| Unit AW *(AF/Acre)* | 0.9 | 5.7 | 2.6 | 2.2 | 4.9 | 1.7 | 3.6 | 2.7 | |
| West Roseville | | | | | | | | | |
| Area *(Acres)* | 0 | 500 | 0 | 0 | 1,000 | 0 | 0 | 200 | 1,700 |
| ETAW *(Acre-Feet)* | 0 | 1,700 | 0 | 0 | 3,000 | 0 | 0 | 380 | 5,080 |
| AW *(Acre-Feet)* | 0 | 2,850 | 0 | 0 | 4,900 | 0 | 0 | 540 | 8,290 |
| South Sutter | | | | | | | | | |
| Area *(Acres)* | 1,000 | 9,000 | 0 | 100 | 1,900 | 0 | 200 | 0 | 12,200 |
| ETAW *(Acre-Feet)* | 600 | 30,600 | 0 | 150 | 5,700 | 0 | 500 | 0 | 37,550 |
| AW *(Acre-Feet)* | 900 | 51,300 | 0 | 220 | 9,310 | 0 | 720 | 0 | 62,450 |
| Camp Far West | | | | | | | | | |
| Area *(Acres)* | 0 | 300 | 0 | 0 | 100 | 0 | 1,000 | 0 | 1,400 |
| ETAW *(Acre-Feet)* | 0 | 1,020 | 0 | 0 | 300 | 0 | 2,500 | 0 | 3,820 |
| AW *(Acre-Feet)* | 0 | 1,710 | 0 | 0 | 490 | 0 | 3,600 | 0 | 5,800 |
| Sheridan | | | | | | | | | |
| Area *(Acres)* | 200 | 250 | 0 | 0 | 350 | 0 | 300 | 0 | 1,100 |
| ETAW *(Acre-Feet)* | 120 | 850 | 0 | 0 | 1,050 | 0 | 750 | 0 | 2,770 |
| AW *(Acre-Feet)* | 180 | 1,425 | 0 | 0 | 1,715 | 0 | 1,080 | 0 | 4,400 |
| Nevada Irrigation District | | | | | | | | | |
| Area *(Acres)* | 100 | 250 | 650 | 0 | 13,500 | 100 | 400 | 0 | 15,000 |
| ETAW *(Acre-Feet)* | 60 | 850 | 1,170 | 0 | 40,500 | 120 | 1,000 | 0 | 43,700 |
| AW *(Ac-Feet)* | 90 | 1,425 | 1,690 | 0 | 66,150 | 170 | 1,440 | 0 | 70,965 |
| County Zone 29 | | | | | | | | | |
| Area *(Acres)* | 3,300 | 7,000 | 0 | 300 | 3,200 | 100 | 0 | 0 | 13,900 |
| ETAW *(Acre-Feet)* | 1,980 | 23,800 | 0 | 450 | 9,600 | 120 | 0 | 0 | 35,950 |
| AW *(Acre-Feet)* | 2,970 | 39,900 | 0 | 660 | 15,680 | 170 | 0 | 0 | 59,380 |
| Lincoln | | | | | | | | | |
| Area *(Acres)* | 400 | 0 | 0 | 0 | 2,100 | 0 | 0 | 0 | 2,500 |
| ETAW *(Acre-Feet)* | 240 | 0 | 0 | 0 | 6,300 | 0 | 0 | 0 | 6,540 |
| AW *(Acre-Feet)* | 360 | 0 | 0 | 0 | 10,290 | 0 | 0 | 0 | 10,650 |
| Placer County Water Agency | | | | | | | | | |
| Area *(Acres)* | 0 | 0 | 0 | 70 | 6,400 | 80 | 1,110 | 0 | 7,660 |
| ETAW *(Acre-Feet)* | 0 | 0 | 0 | 98 | 16,640 | 72 | 2,109 | 0 | 18,919 |
| AW *(Acre-Feet)* | 0 | 0 | 0 | 133 | 25,600 | 104 | 2,886 | 0 | 28,723 |
| Roseville / San Juan Suburban | | | | | | | | | |
| Area *(Acres)* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| ETAW *(Acre-Feet)* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| AW *(Acre-Feet)* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Service Area Total Acres | 5,000 | 17,300 | 650 | 470 | 28,550 | 280 | 3,010 | 200 | 55,460 |
| ETAW Total | 3,000 | 58,820 | 1,170 | 698 | 83,090 | 312 | 6,859 | 380 | 154,329 |
| AW Total | 4,500 | 98,610 | 1,690 | 1,013 | 134,135 | 444 | 9,726 | 540 | 250,658 |

NOTE: Unit AW values are from DAU 172 (Bulletin 160-87) except Pasture & Alfalfa, which has been lowered to represent some DAU 161 conditions.

In summary, the 1985 irrigation water uses are 134,900 acre-feet for ETAW and 240,900 acre-feet for AW. These are expected to increase to 154,300 acre-feet ETAW and 250,700 acre-feet AW by 2020. The difference between the ETAW and AW indicates:

» The quantity of water that returns to or contributes to ground water recharge, and/or

» The quantity of water that is available for reuse in another study area, and/or

» The quantity of water that leaves the area as agricultural drainage water.

**Water Cost**

Future irrigated crop acreage in Placer County service area was projected assuming irrigation water cost would be about $20 per acre-foot at the farmer's headgate. This is based on an estimated average cost of pumping ground water in that area. The Department of Water Resources has recently detected some evidence that ground water levels in southwestern Placer County are declining. However, neither the availability nor the cost of water is assumed to be a major factor in determining the level of agricultural activity in Placer County. The primary factors affecting crop acreage, in the Department's opinion, are market prices, demand, government programs, demographics, and soil suitability.

**Impact of Urban Growth on Agriculture**

The county has experienced extensive urban and suburban growth over the last couple of decades. Much of the growth has been along Interstate 80, and much of it has been on land once used for orchards. However, the growth is now moving westward and is of both the urban and suburban type.

It is difficult for urban and agricultural land uses to coexist because, among other reasons, higher urban land values tend to shift land uses. Also, the division of the land into small parcels, as is characteristic of suburban land uses, essentially precludes the development of commercial agriculture in that area. Of course, with that suburban development comes some small-acreage growth in crops such as fruits and nuts, but that will not offset the general decline in commercial agriculture.

**Summary of Water Use Estimates**

In the Department's view, the general historical trend in Placer County is growth of the urban sector and decline of the agricultural sector. There will be a small increase in the 2020 projected crop acreage of some crops, but no return to the peak crop acreages reported at 66,500 acres in the 1975 Placer County Agricultural Commissioner's report. The western portion of the county, it appears, will remain agricultural longest, although even that area is facing developmental pressures.

Principal crops in the county will continue to be grain, pasture, and rice, although no major increase above historical levels is expected. This conclusion is assumed to hold whether or not the

source of water is changed from ground water to surface water. The reason for this conclusion is that demographic and economic considerations (other than water) are believed to be the primary factors in this area.

No major change in cropping pattern is likely because soils in the area are best suited for shallow-rooted crops.

### Local Agencies' Water Use Estimates

Placer County Water Agency supplied the Department of Water Resources with a copy of its June 13, 1989, memorandum, containing projections of total water needs through 2020. The Agency made the following assumptions and projections:

- » No changes would be made in its contractual obligation.
- » Total agency water needs in 2020 were projected to be 286,000 acre-feet (156,000 for Zone 1 plus 130,000 for contracts).
- » A delivery system will be built to deliver American River water to the place of use.

To compare Placer County Water Agency projected water needs with those of the Department of Water Resources, conveyance losses were subtracted from the Agency's figures. For western Placer County future American River service area, Placer County Water Agency stated that all water available for the area would be used. Therefore, 2020 needs were assumed equal to the total water supply of 156,000 acre-feet (see discussion on water supply, below). For Zone 1, Placer County Water Agency estimated 2020 demand to be 156,000 acre-feet per year at the point of diversion. With 30 percent ditch losses and 15 percent operational losses subtracted, the at-site demand becomes 110,000 acre-feet. City of Roseville and San Juan Suburban Water District both stated that by 2020 they would be using their entire entitlement of 67,000 acre-feet. With 8 percent conveyance losses subtracted, the 2020 demand becomes 62,000 acre-feet.

In a letter dated April 10, 1990, to the Department of Water Resources, Placer County Water Agency indicated that the area is probably developing much more rapidly than projected by the Department of Finance, and the agency disagreed with the projected water needs contained in this report.

## WATER SUPPLY

Water supply for the Placer County service area is summarized in Table D-18. Placer County service area's water supply comes from three sources: the American River, the Bear River and Yuba River diversions, and ground water.

### Surface Water

At this time, there is no system to deliver American River water to western Placer County. When a system is constructed, water will be diverted from the American River based on water rights and a contract with the U.S. Bureau of Reclamation. In a letter dated February 23, 1962,

Table D-18
WATER SUPPLY
Placer County Service Area
*(Acre-Feet)*

| | American River | | | Other Than American River | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Surface Water | Losses | Net* Supply | Surface Water | Losses | *Net Supply | Reuse | Ground Water | **Total |
| Western Placer | | | | | | | | | |
| Future American River | | | | | | | | | |
| Service Areas | 95,000 | 14,000 | 81,000 | ***2,000 | 0 | 2,000 | 33,000 | 40,000 | 156,000 |
| Other Potential | | | | | | | | | |
| Service Areas | 0 | 0 | 0 | 102,000 | 15,000 | 87,000 | 16,000 | 27,000 | 130,000 |
| Subtotal | 95,000 | 14,000 | 81,000 | 104,000 | 15,000 | 89,000 | 49,000 | 67,000 | 286,000 |
| Placer County Water | | | | | | | | | |
| Agency, Zone 1 | 107,000 | 11,000 | 96,000 | ***98,000 | 44,000 | 54,000 | 0 | 0 | 150,000 |
| Roseville / | | | | | | | | | |
| San Juan Suburban | 67,000 | 5,000 | 62,0000 | 0 | 0 | 0 | 0 | 0 | 62,000 |
| Total | 269,000 | 30,000 | 239,000 | 202,000 | 59,000 | 143,000 | 49,000 | 67,000 | 498,000 |

* Surface Water minus Losses.
** Net Surface Water (American and Other Than American) plus Reuse plus Ground Water.
*** PG&E water for Zone 1 (98,000 accre-feet) and Lincoln (2,000 acre-feet).

Placer County Water Agency and the Bureau of Reclamation agreed that the Agency could divert up to 120,000 acre-feet annually from the American River, assuming the State granted the Agency a permit to do so. The State issued the necessary permits on November 21, 1962, in its Water Right Decision 1104. Decision 1104 stated that water would be pumped from the reservoir behind the Auburn diversion dam into a 3-mile tunnel and released into Auburn Ravine for use in western Placer County. The Bureau also agreed to sell the Agency up to 117,000 acre-feet of additional water annually.

A portion of Placer County Water Agency's 237,000 acre-feet diverted from the American River is delivered to southern Placer County by San Juan Suburban Water District from Folsom Reservoir. The maximum amount currently under contract is 25,000 acre-feet. The city of Roseville has rights to divert up to 32,000 acre-feet of American River water from Folsom Reservoir and a contract with Placer County Water Agency for 10,000 acre-feet, so Roseville and San Juan Suburban Water District can divert up to 67,000 acre-feet.

Placer County agencies are diverting water from the Bear River and Yuba River systems totaling 192,000 acre-feet. Of this amount, 102,000 acre-feet comes from Camp Far West Reservoir and Nevada Irrigation District, and up to 100,000 acre-feet is purchased from Pacific Gas and Electric Company.

Losses for the PG&E water system are estimates obtained from Placer County Water Agency. The conveyance losses consist of ditch losses (30 percent) and operational losses (15 percent). Operational losses are a combination of distribution system leakage, hillside irrigation, and small users who purchase water year round but use it only during summer. Placer County conveyance losses for the American River water system were obtained from Placer County Water Agency and Placer County Department of Public Works. Estimated conveyance losses for Placer County are:

| | |
|---|---|
| » Western Placer | 15 percent |
| » Zone 1 | 10 percent |
| » Roseville-San Juan Suburban | 8 percent |

The conveyance losses are subtracted from the surface water supply (Table D-18).

**Ground Water**

The ground water safe yield for western Placer County was reported in State Water Resources Bulletin 10 (1955) as 20,000 acre-feet. The Western Placer County Water Supply Investigation by Boyle Engineering (1989) shows that safe yield is about 58,000 acre-feet per year. Because of the large difference between the 1955 DWR estimate and the 1989 Boyle Engineering estimate, DWR recently reestimated ground water safe yield and safe pumpage for the study area using the *water budget* method. This method is based on the assumption that the present pumpage rate in the study area equals the long-term recharge rate.

The water budget calculation shows a safe yield of about 53,000 acre-feet per year and safe pumpage of about 67,000 acre-feet per year. The present safe yield estimate of the ground water is higher than that previously estimated because of the greater amount of surface irrigation in the study area, which contributes to ground water recharge.

Current ground water pumpage exceeds the safe pumpage amount in some areas. Well hydrographs for the area west of Roseville and south of Lincoln show that ground water levels have not recovered following the 1976-1977 drought. A more detailed ground water study is needed to refine the safe yield and safe pumpage. The study should also include parts of Sacramento and Sutter counties where overdraft has been identified.

## SUPPLEMENTAL WATER NEEDS

The 2020 supplemental water needs calculated by the Department of Water Resources for Placer County service area (Table D-19) were determined by taking the water use from Table D-11 and subtracting the water supply from Table D-18. The difference is the shortage or surplus. If the difference is negative, additional supply is needed. Supplemental needs based on Placer County Water Agency's use projections are also shown.

The Department of Water Resources projects that in 2020 Placer County service area will have a surplus of about 173,000 acre-feet. The major problem appears to be the method of delivering the American River water to western Placer County. The County is studying alternative methods.

Table D-19
2020 SUPPLEMENTAL WATER NEEDS
Placer County Service Area
*(Acre-Feet)*

*Department of Water Resources*

| | Use | Supply | Surplus (+) or Supplemental Need (–) |
|---|---|---|---|
| Western Placer | | | |
| Future American River Service Area | 83,000 | 156,000 | + 73,000 |
| Other Potential Service Area | 153,000 | 130,000 | – 23,000 |
| Placer County Water Agency, Zone 1 | 62,000 | 150,000 | + 88,000 |
| Roseville / San Juan Suburban | 27,000 | 62,000 | + 35,000 |
| Total | 325,000 | 498,000 | +173,000 |
| Total If Water Transfer Does Not Occur | | | – 23,000 |

*Placer County Water Agency*

| | Use | Supply | Surplus (+) or Supplemental Need (–) |
|---|---|---|---|
| Western Placer | | | |
| Future American River Service Area | 156,000 | 156,000 | 0 |
| Other Potential Service Area | – | – | – |
| Placer County Water Agency, Zone 1 | 110,000 | 150,000 | + 40,000 |
| Roseville / San Juan Suburban | 62,000 | 62,000 | 0 |
| Total | 328,000 | 368,000 | + 40,000 |

## SACRAMENTO COUNTY SERVICE AREA

The Department of Water Resources conducted a reconnaissance study of water needs for the Sacramento County service area. The agricultural area included in the study is only that portion within the Folsom-South service area. It excludes the Natomas and Delta areas.

### Water Use

The terms *water use* and *applied water use*, as used in this report, pertain to deliveries at intakes to domestic, municipal, and industrial distribution systems or at farm headgates or irrigation well heads. The term does not include surface water conveyance losses incurred from the point of diversion to the distribution system or farm headgate. Present and future water needs are summarized in Table D-20. Sacramento County projected its water needs to 2015 (page D-36). To provide values for comparison, the Department of Water Resources calculated 2015 needs as the mid-point between 2010 and 2020 needs.

Table D-20
DEPARTMENT OF WATER RESOURCES ESTIMATES OF
SACRAMENTO COUNTY SERVICE AREA WATER USE
*(Acre-Feet)*

| | 1985 | | | | |
|---|---|---|---|---|---|
| | Rural Residential | Agri-cultural | Urban | Industrial | Total |
| North-Northeast | 0 | 0 | 118,000 | 2,000 | 120,000 |
| Sacramento City | 0 | 0 | 163,000 | 12,000 | 175,000 |
| Folsom-South | 2,000 | 304,000 | 26,000 | 4,000 | 336,000 |
| County Total | 2,000 | 304,000 | 307,000 | 18,000 | 631,000 |

| | 2015 | | | | |
|---|---|---|---|---|---|
| | Rural Residential | Agri-cultural | Urban | Industrial | Total |
| North-Northeast | 0 | 0 | 161,000 | 2,000 | 163,000 |
| Sacramento City | 0 | 0 | 263,000 | 12,000 | 275,000 |
| Folsom-South | 3,000 | 320,000 | 72,000 | 4,000 | 399,000 |
| County Total | 3,000 | 320,000 | 496,000 | 18,000 | 837,000 |

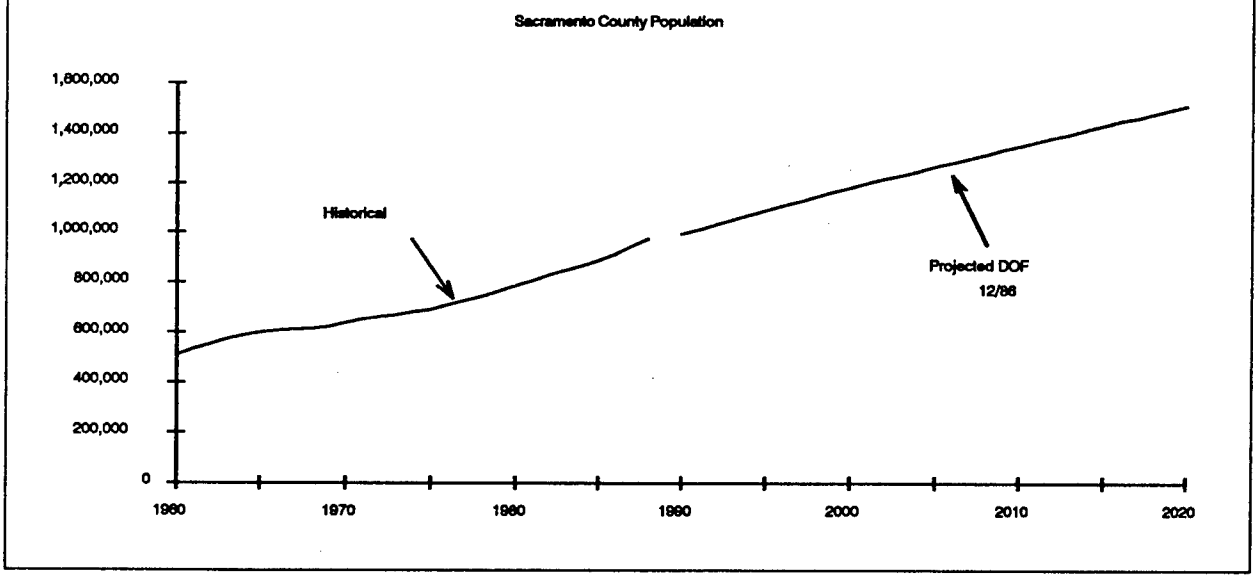
| | 2020 | | | | |
|---|---|---|---|---|---|
| | Rural Residential | Agri-cultural | Urban | Industrial | Total |
| North-Northeast | 0 | 0 | 168,000 | 2,000 | 170,000 |
| Sacramento City | 0 | 0 | 277,000 | 12,000 | 289,000 |
| Folsom-South | 3,000 | 323,000 | 79,000 | 4,000 | 409,000 |
| County Total | 3,000 | 323,000 | 524,000 | 18,000 | 868,000 |

Department of Water Resources projections show that total water use will increase from about 631,000 acre-feet in 1985 to 868,000 acre-feet by 2020. This increase is from agricultural uses increasing from 304,000 to 323,000 acre-feet and urban uses (including rural residential and self-served industries) increasing from 327,000 to 545,000 acre-feet.

**Urban Water Use**

Fundamental data for estimating urban water use are population and per capita water use values. Figure D-10 shows estimates of historical and projected population for Sacramento County developed by the California Department of Finance. The substantial growth in the county is expected to continue, reaching 1,500,000 by the year 2020. The population in each study area in 1985 and 2020 was estimated by prorating the county population based on the 1980 distribution.

Figure D-10
SACRAMENTO COUNTY POPULATION




Per capita use of water in an area, as defined by the Department of Water Resources, is the total amount of water used divided by the permanent population. Historically, per capita water use has trended upward, but it was assumed that, with the increased effects of water conservation, the trend would level off. Per capita water use factors were presumed to remain constant from 1985 to 2020. Present and future water use in the study areas were estimated by multiplying estimated population for 1985 and 2020 by per capita water use. Table D-21 presents the computations.

Large industrial water use is self-supplied and is mostly for military use. Other industrial water use that was not large enough to significantly affect the per capita use values was included in the per capita computations. Large industrial use was assumed to remain constant.

Table D-21
MUNICIPAL AND INDUSTRIAL WATER USE
Sacramento County

| | North-Northeast | Sacramento City | Folsom-South | County Total |
|---|---|---|---|---|
| **Population** | | | | |
| 1980 | 282,000 | 429,000 | 51,000 | 762,000 |
| 1985* | 314,000 | 490,000 | 69,000 | 872,000 |
| 1990 | 345,000 | 551,000 | 87,000 | 983,000 |
| 2000 | 381,000 | 657,000 | 135,000 | 1,173,000 |
| 2010 | 413,000 | 747,000 | 175,000 | 1,335,000 |
| 2015 | 430,000 | 789,000 | 192,500 | 1,411,500 |
| 2020 | 447,000 | 831,000 | 210,000 | 1,488,000 |
| **Per Capita Use** *(Acre-Feet per Year)* | | | | |
| 1985-2020 | 0.375 | 0.333 | 0.375 | |
| **Urban Use**** *(Acre-Feet)* | | | | |
| 1985 | 118,000 | 163,000 | 26,000 | 307,000 |
| 1990 | 129,000 | 183,000 | 33,000 | 346,000 |
| 2000 | 143,000 | 219,000 | 51,000 | 412,000 |
| 2010 | 155,000 | 249,000 | 66,000 | 469,000 |
| 2015 | 161,500 | 263,000 | 72,500 | 496,500 |
| 2020 | 168,000 | 277,000 | 79,000 | 524,000 |
| **Large Self-Served Industrial Use** *(Acre-Feet)* | | | | |
| 1985-2020 | 2,000 | 12,000 | 4,000 | 18,000 |
| **Total Municipal and Industrial Use** *(Acre-Feet)* | | | | |
| 1985 | 120,000 | 175,000 | 30,000 | 325,000 |
| 1990 | 132,000 | 195,000 | 36,000 | 364,000 |
| 2000 | 145,000 | 231,000 | 54,000 | 430,000 |
| 2010 | 157,000 | 261,000 | 69,000 | 487,000 |
| 2015 | 163,000 | 275,000 | 76,000 | 512,000 |
| 2020 | 170,000 | 289,000 | 83,000 | 542,000 |

* Population for 1985 calculated as mid-point between 1980 and 1990.
** Does not include large, self-served industries.

## Agricultural Water Use

Fundamental data for estimating present agricultural water use are current crop acreages and unit water use values. Crop acreages are obtained from Department land use surveys that measure extent of irrigated acreage and identify types of crops being grown and other specific uses of land, such as double-cropping practices and sources of irrigation water. Unit use values are derived from analysis of data obtained over the years from direct measurements of applied water, direct measurements of soil moisture consumed by evapotranspiration, and pertinent climatic factors affecting crop water uses.

Agricultural water use is the sum of the products of the irrigated acres of the crops and their respective unit use factors. Water delivered at the farm headgate and applied as irrigation

water is commonly referred to as *applied water* (AW). That portion of applied water that is consumed by evaporation and plant transpiration is referred to as the *evapotranspiration of applied water* (ETAW). The balance of the applied water percolates below the root zone or runs into the drainage system.

**Land Use**

Future agricultural water use is projected by considering various factors affecting agriculture. Factors include historical cropping trends, impact of urban growth on agriculture, crop suitability of available land, future market outlook, competition for land by other use, irrigation and system efficiency, and water cost and other economic factors.

To estimate future land use, the Department of Water Resources analyzes data from DWR reports dealing with water use,[1][2][3][4] data from past Sacramento County Agricultural Commissioner's reports, types of crops encroached upon by urbanization (determined from land use photographs), DWR land use surveys and land classification data, and agricultural use potential from soil surveys. Projected acreages are based on evaluation of this information, with emphasis on the Crop Market Outlook study.

The *Crop Market Outlook* is important in forecasting agricultural development because it considers economic and physical elements that influence crop production in California. The CMO is based on national population growth, per capita consumption, and exports and imports, which are then translated to California's share of the total production required to meet national demands for food and fiber. California's share of the markets for various crops is, in turn, allocated to regions of the State by considering physical and economic constraints such as availability and suitability of land, climatic conditions, land use trends, production costs, land prices, farm sizes, and other factors affecting crop production.

As a starting point, 1984 land use acreages were used. Projections to 2020 were based on the following:

- Increases in land used for irrigated pasture, truck crops, fruit and nuts, and grapes were based on the CMO study.
- The slight increase in acreage of grain and field crops was based on a continuation of small increases in acreages in the Folsom-South service area between the 1974 and 1984 DWR land use surveys.
- Sufficient irrigable soil types exist to develop more irrigated crop land to meet predicted demand.
- Some irrigated pasture land will be developed from non-irrigated range land (mapped as native vegetation) near the Folsom-South Canal.

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1 Department of Water Resources. *Water Action Plan for the Folsom-South Service Area*. 1980.

2 Department of Water Resources. *The California Water Plan: Projected Use and Available Water Supply to 2010, Bulletin 160-83*. 1983.

3 Department of Water Resources. *California Water: Looking to the Future, Bulletin 160-87*. 1987.

4 Department of Water Resources. *Draft California Market Outlook Study*. Division of Planning. December 1985.

- Some irrigated agriculture will occur on rural residential ranchettes.
- Rice acreage will not change. This was based on CMO statewide demand figures dropping, but local production assumed to remain constant. Recent county changes have been too erratic to be considered a permanent trend.
- Urbanization will not substantially reduce irrigated agricultural land, but urban uses will be expanded on idle land near existing development.
- Overall local demand for crops will not decrease.
- County population will increase according to Department of Finance projections.
- Water for agriculture will cost about $20 per acre-foot, the approximate cost of ground water pumpage.

**Present and Future Crop Water Use**

Table D-22 presents the annual agricultural and rural residential water use for the Folsom-South service area. Agricultural water use in Table D-22 is divided into evapotranspiration of applied water *(ETAW)* and applied water *(AW)* use. Evapotranspiration of applied water use is the amount of irrigation water needed for agricultural plant growth. Agricultural applied water use is the amount of water applied to satisfy both plant needs and on-farm distribution system losses.

Agricultural water use in 1984 accounted for 90 percent of the total use. However, its proportion goes down to 79 percent in 2020. Overall agricultural use increases from 304,000 to 323,000 acre-feet, or 6 percent.

Total urban use is composed of urban and rural residential (suburban). Urban use is based solely on population, while rural residential is based on area. Rural residential use is the irrigated use above normal urban use, typically that water used in large gardens and small pastures.

Table D-23 shows the acreages used in determining agricultural and rural residential use. Agricultural water use is estimated by multiplying the unit water values (Table D-22) by irrigated agricultural acreages (Table D-23). Irrigated pasture and field crops make up the largest acreage, at 72 percent of the 86,000 acres of irrigated agricultural land. Table D-23 also shows urban and remaining land. Remaining land includes idle, fallow, native vegetation, and other non-irrigated areas.

By 2020, the total net irrigable land available for agricultural use is projected to be 110,000 acres. This was derived by superimposing projected 2020 urban and rural residential areas onto land classification maps generated from the 1969 DWR land classification survey. Potential urban and rural residential growth areas were delineated in coordination with the Sacramento County Planning Department. Urbanized acreage has been excluded from the irrigable land base.

**Local Agency's Water Use Estimates**

*Sacramento County Water Agency Water Plan Supplement – 1989* was used to summarize local needs. Water needs for the entire Natomas subarea and the rice acreage of the Sacramento

Table D-22
ANNUAL EVAPOTRANSPIRATION OF APPLIED WATER AND APPLIED WATER USE, FOLSOM-SOUTH SERVICE AREA
Sacramento County
*(Acre-Feet)*

| | Unit Use *(AF/Acre)* | 1984 | 1990 | 2000 | 2010 | 2020 |
|---|---|---|---|---|---|---|
| **Evapotranspiration of Applied Water (ETAW)** | | | | | | |
| AGRICULTURAL | | | | | | |
| Grain | 0.8 | 6,500 | 6,600 | 6,600 | 6,700 | 6,800 |
| Rice | 3.6 | 21,700 | 21,700 | 21,700 | 21,600 | 21,600 |
| Sugar Beets | 2.7 | 3,700 | 3,900 | 4,300 | 4,700 | 5,100 |
| Other Field Crops | 1.3 | 29,300 | 29,400 | 29,600 | 29,700 | 29,900 |
| Alfalfa | 3.0 | 9,000 | 9,000 | 9,000 | 9,000 | 9,000 |
| Pasture | 3.2 | 125,800 | 127,300 | 129,600 | 132,000 | 134,400 |
| Tomatoes | 2.1 | 1,800 | 1,800 | 1,900 | 2,000 | 2,100 |
| Other Truck Crops | 1.1 | 1,400 | 1,400 | 1,500 | 1,600 | 1,700 |
| Fruits and Nuts | 2.6 | 2,100 | 2,200 | 2,300 | 2,500 | 2,600 |
| Vineyards | 1.9 | 5,100 | 5,300 | 5,700 | 6,100 | 6,500 |
| Total Agricultural | | 206,300 | 208,500 | 212,200 | 215,900 | 219,600 |
| RURAL RESIDENTIAL | 0.4 | 1,000 | 1,100 | 1,400 | 1,700 | 2,000 |
| **Applied Water (AW)** | | | | | | |
| | Unit Use *(AF/Acre)* | 1984 | 1990 | 2000 | 2010 | 2020 |
| AGRICULTURAL | | | | | | |
| Grain | 1.0 | 8,200 | 8,200 | 8,300 | 8,400 | 8,500 |
| Rice | 6.7 | 40,400 | 40,400 | 40,300 | 40,300 | 40,200 |
| Sugar Beets | 3.4 | 4,700 | 5,000 | 5,500 | 6,000 | 6,500 |
| Other Field Crops | 2.1 | 47,400 | 47,500 | 47,800 | 48,000 | 48,300 |
| Alfalfa | 4.1 | 12,200 | 12,300 | 12,300 | 12,300 | 12,300 |
| Pasture | 4.5 | 176,900 | 179,000 | 182,300 | 185,600 | 189,000 |
| Tomatoes | 3.2 | 2,700 | 2,800 | 2,900 | 3,100 | 3,200 |
| Other Truck Crops | 1.8 | 2,200 | 2,300 | 2,400 | 2,600 | 2,700 |
| Fruits and Nuts | 3.4 | 2,700 | 2,800 | 3,000 | 3,200 | 3,400 |
| Vineyards | 2.6 | 6,900 | 7,200 | 7,800 | 8,300 | 8,800 |
| Total Agricultural | | 304,300 | 307,400 | 312,600 | 317,700 | 322,900 |
| RURAL RESIDENTIAL | 0.6 | 1,400 | 1,700 | 2,100 | 2,600 | 3,000 |

North subarea were subtracted from the projected water needs shown in Table 3.14 of that report because it was assumed that in the future this area would not be supplied from the American River. Sacramento County's water use in 2015 for areas served by the American River, therefore, are *(in acre-feet)*:

| | Agricultural | Municipal & Industrial | Total |
|---|---|---|---|
| North-Northeast | 11,000 | 181,000 | 192,000 |
| Sacramento City | 16,000 | 228,000 | 244,000 |
| Folsom-South | 287,000 | 88,000 | 375,000 |
| Total | 314,000 | 497,000 | 811,000 |

Table D-23
ANNUAL LAND USE IN THE FOLSOM-SOUTH SERVICE AREA
Sacramento County
*(Acres)*

| | 1984 | 1990 | 2000 | 2010 | 2020 |
|---|---|---|---|---|---|
| AGRICULTURAL | | | | | |
| Grain | 8,200 | 8,200 | 8,300 | 8,400 | 8,500 |
| Rice | 6,000 | 6,000 | 6,000 | 6,000 | 6,000 |
| Sugar Beets | 1,400 | 1,500 | 1,600 | 1,800 | 1,900 |
| Other Field Crops | 22,600 | 22,600 | 22,800 | 22,900 | 23,000 |
| Alfalfa | 3,000 | 3,000 | 3,000 | 3,000 | 3,000 |
| Pasture | 39,300 | 39,800 | 40,500 | 41,200 | 42,000 |
| Tomatoes | 800 | 900 | 900 | 1,000 | 1,000 |
| Other Truck Crops | 1,200 | 1,300 | 1,400 | 1,400 | 1,500 |
| Fruits and Nuts | 800 | 800 | 900 | 900 | 1,000 |
| Vineyards | 2,700 | 2,800 | 3,000 | 2,200 | 3,400 |
| Total Agricultural | 86,000 | 86,900 | 88,300 | 89,800 | 91,300 |
| URBAN AND RURAL RESIDENTIAL | | | | | |
| Urban | 16,500 | 18,900 | 22,900 | 26,900 | 31,000 |
| Rural Residential | 2,400 | 2,800 | 3,500 | 4,300 | 5,000 |
| Total Urban and Rural Residential | 18,800 | 21,700 | 26,500 | 31,200 | 36,000 |
| REMAINING LAND | 110,800 | 107,100 | 100,800 | 94,600 | 88,300 |
| TOTAL AREA | 216,000 | 216,000 | 216,000 | 216,000 | 216,000 |

## WATER SUPPLY

Water supply for the Sacramento County service area is shown in Table D-24. The service area's water supply comes from four sources: Sacramento River, American River, Cosumnes River, and ground water. The values were compiled from local planners, the U.S. Bureau of Reclamation, and the Department of Water Resources. The numbers are based on present water rights and water contracts and do not include uncommitted Bureau of Reclamation water supply. Some of these amounts depend on construction of water delivery systems and amending current water rights and contracts.

Table D-24
WATER SUPPLY
Sacramento County Service Area
*(Acre-Feet)*

| | American River | | | Other Than American River | | | | |
|---|---|---|---|---|---|---|---|---|
| Service Area | Surface Water | Losses | Net Supply | Surface Water | Losses | Net Supply | Ground Water | Total |
| North-Northeast | 95,000 | 5,000 | 90,000 | 0 | 0 | 0 | 41,000 | 131,000 |
| Sacramento City | 230,000 | 12,000 | 218,000 | 82,000 | 4,000 | 78,000 | 73,000 | 369,000 |
| Folsom-South | 0 | 0 | 0 | 2,000 | 0 | 2,000 | 223,000 | 225,000 |
| Total | 325,000 | 17,000 | 308,000 | 84,000 | 4,000 | 80,000 | 337,000 | 725,000 |

## Surface Water

At this time, the City of Sacramento is the only agency in the service area diverting water from the Sacramento River. The city has water rights to divert up to 82,000 acre-feet per year from the Sacramento River. The city also has water rights to divert up to 245,000 acre-feet per year from the American River.

The American River supply is subject to a buildup schedule included in the city's contract and the allowable diversion in 2015 is 189,000 acre-feet with the ultimate diversion of 245,000 acre-feet in 2030. The contract also states that if before 2030 the city finds that accelerated growth has increased its water requirement to greater than the schedule, the amount of water to be furnished each year can be advanced. The city is also contractually obligated to make 15,000 acre-feet annually of its American River water entitlement available to the Sacramento Municipal Utility District for use outside the city's place of use. Based on this, the American River water assumed to be available to the City of Sacramento in 2015 is 230,000 acre-feet (245,000 minus 15,000).

Other agencies divert water from the American River at various points to supply the North-Northeast subarea. San Juan Suburban Water District, City of Folsom, and Folsom Prison divert from Folsom Lake under water rights and contracts with the Bureau of Reclamation. Carmichael Water District and Arcade Water District divert from the American River based on water rights. The total amount available for diversion to the North-Northeast subarea by these agencies is up to 95,000 acre-feet per year.

About 2,000 acre-feet is diverted from the Cosumnes River by the Omochumne-Hartnell Water District, based on water rights. This supply is generally classified as intermittent.

Conveyance losses are subtracted from the surface water supply. The difference is the net surface water supply. Sacramento County losses, taken from *Sacramento County Water Agency Water Plan Supplement — 1989*[1], use a 5 percent factor for conveyance losses.

## Ground Water

All subareas receive a portion of their water supply from ground water. The estimated safe yield (safe pumpage) of the North-Northeast subarea is 41,000 acre-feet[2], for the City of Sacramento is 73,000 acre-feet, and for the Folsom-South subarea is 223,000 acre-feet[3]. The Folsom-South subarea receives most of its water supply from ground water, and the ground water basin has been overdrafted for several years.

Ground water quality varies throughout Sacramento County. The City of Sacramento believes that, because of iron and manganese present in its ground water, the safe yield should be reduced by half, to about 37,000 acre-feet. The city is now conducting a study to verify this information. Until the study is completed, the safe yield will be considered to be 73,000 acre-feet.

---

1 Sacramento County, *Sacramento County Water Agency Water Plan Supplement — 1989*. Table 3.1. December 1989.

2 Estimates taken from material submitted by Sacramento County Water Agency to State Water Resources Control Board Bay/Delta Hearings (July 1987).

3 Department of Water Resources, *Water Action Plan for the Folsom-South Service Area,* Central District, 1980.

## SUPPLEMENTAL WATER NEEDS

The 2015 supplemental water needs projected by the Department of Water Resources for Sacramento County service area (Table D-25) were determined by taking the water supply from Table D-24 and subtracting the water use from Table D-20. The difference is the shortage or surplus. If the difference is negative, additional supply is needed. Sacramento County's projected water use was taken from the Water Agency's *Water Plan Update.*

Table D-25
2015 SUPPLEMENTAL WATER NEEDS
Sacramento County Service Area
*(Acre-Feet)*

*Department of Water Resources*

| | Use | Supply | Surplus (+) or Supplemental Need (–) |
|---|---|---|---|
| North-Northeast | 163,000 | 131,000 | – 32,000 |
| Sacramento City | 275,000 | 369,000 | + 94,000 |
| Folsom-South | 399,000 | 225,000 | – 174,000 |
| Total | 837,000 | 725,000 | *– 206,000 |

*Sacramento County Water Agency*

| | Use | Supply | Surplus (+) or Supplemental Need (–) |
|---|---|---|---|
| North-Northeast | 192,000 | 158,000 | – 34,000 |
| Sacramento City | 244,000 | 370,000 | + 126,000 |
| Folsom-South | 375,000 | 216,000 | – 159,000 |
| Total | 811,000 | 744,000 | **– 193,000 |

* If the City of Sacramento transfers its 94,000-acre-foot surplus to Sacramento County, the county's supplemental need will be 112,000 acre-feet by 2015.
** If the City of Sacramento transfers its 126,000-acre-foot surplus to Sacramento County, the county's supplemental need will be 67,000 acre-feet by 2015.

Sacramento County's water issues were stated in an April 10, 1990, memorandum from Sacramento County, City of Sacramento, and Boyle Engineering Corporation, as follows:

> *The issue of water supply to Sacramento County has been a complicated one and is becoming even more so. Clearly additional surface water will be needed to balance current groundwater overdraft and meet future water needs; there are uncertainties in contracting for water from the Bureau of Reclamation; water from current entitlements may be available only if contracts and permits can be amended; and the water needs*

*and availability of water supplies for Sacramento County beyond 2015 must also be addressed.*

Sacramento County is projected to have a supplemental need for about 206,000 acre-feet of water in 2015. The county has been studying a combination of the following actions to meet these supplemental needs:

» A contract with the Bureau of Reclamation.

» Full use of existing water supplies.

» Water conservation.

Examples of alternatives being considered under each of these actions are described below.

**Contracts with the Bureau of Reclamation for Central Valley Project Water**

A contract with the Bureau of Reclamation would involve purchase of both firm and intermittent CVP water, delivered from the American River and/or the Sacramento River, to meet the long-term water supply needs of the county. It would also require implementation of a conjunctive use ground water program. Contracting efforts have been stalled the past few years because of opposition from interests that believe the Central Valley Project must fully mitigate fish and wildlife impacts.

Other uncertainties related to the amount of water available to the Central Valley Project include:

» A future decision by the State Water Resources Control Board after its review of water rights on the American River. This decision could revise the instream flow requirement in the Bureau's permit.

» The Board's Bay/Delta estuary proceedings, which are now underway.

Sacramento County has indicated that if the amount of CVP water available for new contracts is reduced to the point that insufficient uncontracted CVP water is available to meet Sacramento County's water supply needs, then the county may, after reviewing all options, take the position to exercise its area-of-origin water rights. Under area-of-origin protection, Section 11460 of the Water Code states:

*... a watershed or area wherein water originates, or an area immediately adjacent thereto which can conveniently be supplied with water therefrom, shall not be deprived by the department directly or indirectly of the prior right to all of the water reasonably required to adequately supply the beneficial needs of the watershed, area, or any of the inhabitants or property owners therein.*

**Full Use of Existing Supplies**

To fully utilize existing water supplies, Sacramento County could use water that would be surplus to the needs of the City of Sacramento and others with entitlements that are greater than their current need. Department of Water Resources studies show a surplus of 94,000 acre-feet in 2015. The city could extend its service area or could allocate its surplus to the county. Other sources of existing water are Sacramento Municipal Utility District's unused, contractual entitlement for CVP water and reclaimed waste water.

**Water Conservation**

Additional water conservation measures could be used to further reduce the need for additional water. Installing meters and charging according to the amount of water delivered could be such a measure. Additional information on water rates is published in the Department's *Water Conservation Guidebook No. 9.*

The Sacramento County Water Agency's *Water Plan Supplement – 1989* assumes a residential metering program in the county would result in a 20 percent decrease in water consumption. The amount of water saved would depend on the type of metering program implemented. One program could be to require meters for new construction and when property is resold. If all new construction and resold property were metered between 1990 and 2015, savings could amount to about 30,000 acre-feet per year by 2015.

# American River Watershed Investigation, California

# APPENDIX E

## Land Use

AMERICAN RIVER WATERSHED
INVESTIGATION, CALIFORNIA

APPENDIX E

LAND USE
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# APPENDIX - LAND USE

1. Introduction. - This Appendix supplements Chapter 4, Land Use, and contains tables that describe existing and projected future land use conditions in the American River Watershed Investigation (ARWI) study area under "without" and "with" project conditions. Tables E-1 and E-4 contain detailed analysis of future land use conditions under without and with project conditions for Natomas and Lower American River. It should be noted that Tables E-1 and E-4 show different sub-area delineations for Natomas. The sub-areas in the aforementioned tables were based on Community Plans and Sacramento City and South Sutter County General Plans. Natomas has been divided into the following sub-areas: City Community Plan Areas, Unincorporated North Natomas, and South Sutter County. This latter division of Natomas is in accordance with impact analysis addressed in other chapters and appendices.

TABLE E-1. Natomas/Lower American River – Without Project

*North Sacramento*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 310 | 445 | 135 | 3325 | 4760 | 1425 | 35 | 50 | 15 | 45 | 45 | 0 | 371 | 600 | 229 |
| 1992 | 310 | 471 | 161 | 3325 | 4770 | 1435 | 35 | 55 | 20 | 45 | 46 | 1 | 371 | 558 | 187 |
| 2000 | 310 | 510 | 200 | 3325 | 4862 | 1527 | 35 | 100 | 65 | 45 | 51 | 6 | 371 | 377 | 6 |
| 2010 | 310 | 510 | 200 | 3325 | 4862 | 1527 | 35 | 100 | 65 | 45 | 57 | 12 | 371 | 371 | 0 |
| 2100 | 310 | 510 | 200 | 3325 | 4862 | 1527 | 35 | 100 | 65 | 45 | 57 | 12 | 371 | 371 | 0 |

*South Sacramento*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 1930 | 2570 | 640 | 19070 | 28530 | 9460 | 300 | 400 | 100 | 3675 | 4295 | 620 | 5095 | 8205 | 3110 |
| 1992 | 1930 | 2620 | 690 | 19290 | 29365 | 10075 | 436 | 664 | 228 | 3675 | 4295 | 620 | 4739 | 7056 | 2317 |
| 2000 | 1940 | 2821 | 881 | 20169 | 32070 | 11901 | 978 | 1720 | 742 | 3675 | 4295 | 620 | 3308 | 3094 | -214 |
| 2010 | 1950 | 3072 | 1122 | 21268 | 32070 | 10802 | 1655 | 3041 | 1386 | 3675 | 4295 | 620 | 1522 | 1522 | 0 |
| 2100 | 1950 | 3072 | 1122 | 21268 | 32070 | 10802 | 1655 | 3041 | 1386 | 3675 | 4295 | 620 | 1522 | 1522 | 0 |

*South Natomas Community Plan*

ACRES

| *Time* | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 271 | 271 | 0 | 1666 | 1666 | 0 | 0 | 0 | 0 | 581 | 581 | 0 | 1550 | 1550 | 0 |
| 1992 | 329 | 329 | 0 | 1666 | 1666 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 1430 | 1430 | 0 |
| 2000 | 329 | 329 | 0 | 1666 | 1666 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 1430 | 1430 | 0 |
| 2010 | 329 | 329 | 0 | 1666 | 1666 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 1430 | 1430 | 0 |
| 2100 | 329 | 329 | 0 | 1666 | 1666 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 1430 | 1430 | 0 |

*North Natomas Community Plan*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| *1990* | 167 | 167 | 0 | 26 | 26 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 8332 | 8332 | 0 |
| 1992 | 167 | 167 | 0 | 26 | 26 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 8332 | 8332 | 0 |
| 2000 | 167 | 167 | 0 | 26 | 26 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 8332 | 8332 | 0 |
| 2010 | 167 | 167 | 0 | 26 | 26 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 8332 | 8332 | 0 |
| 2100 | 167 | 167 | 0 | 26 | 26 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 8332 | 8332 | 0 |

TABLE E-1. (cont.)

*South Sutter County*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |
| *1992* | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |
| *2000* | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |
| 2010 | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |
| 2100 | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |

*Dry Creek*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| 1992 | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| 2000 | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| *2010* | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| *2100* | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |

*Rancho Cordova*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 10 | 104 | 94 | 150 | 1483 | 1333 | 0 | 20 | 20 | 60 | 60 | 0 | 250 | 2533 | 2283 |
| 1992 | 10 | 104 | 94 | 150 | 1483 | 1333 | 0 | 20 | 20 | 60 | 60 | 0 | 250 | 2533 | 2283 |
| 2000 | 22 | 171 | 149 | 150 | 1528 | 1378 | 11 | 38 | 27 | 60 | 60 | 0 | 227 | 2415 | 2188 |
| 2010 | 22 | 171 | 149 | 150 | 1528 | 1378 | 11 | 232 | 221 | 60 | 60 | 0 | 227 | 2203 | 1976 |
| 2100 | 22 | 171 | 149 | 150 | 1528 | 1378 | 11 | 232 | 221 | 60 | 60 | 0 | 227 | 2203 | 1976 |

*Total*

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 2943 | 3812 | 869 | 26847 | 39075 | 12228 | 569 | 704 | 135 | 5271 | 5891 | 620 | 33618 | 39240 | 5622 |
| 1992 | 3001 | 3946 | 945 | 27067 | 39920 | 12853 | 705 | 973 | 268 | 5333 | 5954 | 621 | 32942 | 37729 | 4787 |
| 2000 | 3023 | 4253 | 1230 | 27946 | 42762 | 14816 | 1258 | 2092 | 834 | 5333 | 5959 | 626 | 31488 | 33468 | 1980 |
| 2010 | 3033 | 4504 | 1471 | 29045 | 42762 | 13717 | 1935 | 3607 | 1672 | 5333 | 5965 | 632 | 29702 | 31678 | 1976 |
| 2100 | 3033 | 4504 | 1471 | 29045 | 42762 | 13717 | 1935 | 3607 | 1672 | 5333 | 5965 | 632 | 29702 | 31678 | 1976 |

## Table E-2. Natomas Area - Without Project, Maximum Growth Scenario

| TOTAL ACREAGE - 54,882 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natomas Sub-Areas | Commercial/Industrial | | | Residential | | | Public | | | All Urban Uses Combined | | | Acriculture/Vacant | | |
| | 1992 | 2100 | DIFF | 1992 | 2100 | DIFF | 1992 | 2100 | DIFF | 1992 | 2100 | DIFF | 1992 | 22100 | DIFF |
| City Community Plan Areas | 515 | 915 | 400 | 1,692 | 1,692 | 0 | 853 | 853 | 0 | 3,060 | 3,460 | 400 | 8,182 | 7,782 | -400 |
| Unincorporated North Natomas | 180 | 4,925 | 4,745 | 180 | 180 | 0 | 2,860 | 3,253 | 393 | 3,220 | 8,358 | 5,138 | 23,378 | 18,240 | -5,138 |
| South Sutter County | 390 | 3,528 | 3,138 | 390 | 7,094 | 6,704 | 200 | 1,332 | 1,132 | 980 | 11,954 | 10,974 | 16,062 | 5,088 | -10,974 |
| TOTAL | 1,085 | 9,368 | 8,283 | 2,262 | 8,966 | 6,704 | 3,913 | 5,438 | 1,525 | 7,260 | 23,772 | 16,512 | 47,622 | 31,110 | -16,512 |

**Table E-3. Upper American River Area - Population Projections Under Without Project Conditions**

| | Sub-areas | | | | | | |
|---|---|---|---|---|---|---|---|
| Year | Auburn | Cool-Pilot Hill | Green-wood | Garden Valley | George-town | Lotus-Coloma | Total |
| 1990 | 31,000 | 2,830 | 940 | 2,070 | 2,850 | 1,600 | 41,29 |
| 1995 | 37,200 | 3,750 | 1,246 | 2,588 | 3,766 | 2,000 | 50,65 |
| 2000 | 43,710 | 4,670 | 1,504 | 3,002 | 4,560 | 2,320 | 59,76 |
| 2010 | 58,134 | 6,226 | 1,974 | 3,830 | 6,128 | 2,960 | 79,25 |
| 2020 | 58,134 | 7,783 | 2,350 | 4,554 | 7,553 | 3,520 | 83,53 |
| 2030 | 58,134 | 9,339 | 2,726 | 5,279 | 8,978 | 4,080 | 88,53 |
| 2040 | 58,134 | 10,754 | 3,008 | 5,796 | 9,053 | 4,480 | 82,24 |
| 2050 | 58,134 | 11,886 | 3,290 | 6,314 | 10,973 | 4,880 | 95,47 |

Table E–4. Natomas/Lower American River – With Project

*North Sacramento*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 310 | 445 | 135 | 3325 | 4760 | 1435 | 35 | 50 | 15 | 45 | 45 | 0 | 371 | 600 | 229 |
| 1992 | 310 | 460 | 150 | 3325 | 4770 | 1445 | 35 | 55 | 20 | 45 | 46 | 1 | 371 | 569 | 198 |
| 2000 | 310 | 482 | 172 | 3325 | 4810 | 1485 | 35 | 100 | 40 | 45 | 51 | 6 | 371 | 457 | 86 |
| 2010 | 310 | 510 | 200 | 3325 | 4862 | 1537 | 35 | 100 | 65 | 45 | 57 | 12 | 371 | 371 | 0 |
| 2100 | 310 | 510 | 200 | 3325 | 4862 | 1537 | 35 | 100 | 65 | 45 | 57 | 12 | 371 | 371 | 0 |

*South Sacramento*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 1930 | 2570 | 640 | 19070 | 28530 | 9460 | 300 | 400 | 100 | 3675 | 4295 | 620 | 5095 | 8205 | 3110 |
| 1992 | 1978 | 2634 | 656 | 19396 | 29022 | 9626 | 436 | 664 | 228 | 3675 | 4295 | 620 | 4585 | 7385 | 2800 |
| 2000 | 2168 | 2892 | 724 | 20702 | 30990 | 10288 | 978 | 1720 | 742 | 3675 | 4295 | 620 | 2547 | 4103 | 1556 |
| 2010 | 2405 | 3214 | 809 | 22335 | 33450 | 11115 | 1655 | 3041 | 1386 | 3675 | 4328 | 653 | 0 | 0 | 0 |
| 2100 | 2405 | 3214 | 809 | 22335 | 33450 | 11115 | 1655 | 3041 | 1386 | 3675 | 4328 | 653 | 0 | 0 | 0 |

*South Natomas Community Plan*

ACRES

| *Time* | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 271 | 271 | 0 | 1666 | 1666 | 0 | 0 | 0 | 0 | 581 | 581 | 0 | 1550 | 1550 | 0 |
| 1992 | 329 | 329 | 0 | 1666 | 1666 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 1470 | 1470 | 0 |
| 2000 | 463 | 463 | 0 | 2167 | 2167 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 748 | 748 | 0 |
| 2010 | 668 | 668 | 0 | 2382 | 2382 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 271 | 271 | 0 |
| 2100 | 668 | 668 | 0 | 2382 | 2382 | 0 | 0 | 0 | 0 | 643 | 643 | 0 | 271 | 271 | 0 |

*North Natomas Community Plan*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| *1990* | 167 | 167 | 0 | 26 | 26 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 8332 | 8332 | 0 |
| 1992 | 167 | 167 | 0 | 26 | 26 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 8332 | 8332 | 0 |
| 2000 | 1500 | 1500 | 0 | 1242 | 1242 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 5702 | 5702 | 0 |
| 2010 | 3796 | 3796 | 0 | 2625 | 2625 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 1830 | 1830 | 0 |
| 2100 | 3796 | 3796 | 0 | 2625 | 2625 | 0 | 19 | 19 | 0 | 210 | 210 | 0 | 1830 | 1830 | 0 |

Table E–4. (cont.)

*South Sutter County*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |
| *1992* | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |
| *2000* | 195 | 195 | 0 | 390 | 390 | 0 | 195 | 195 | 0 | 200 | 200 | 0 | 15020 | 15020 | 0 |
| 2010 | 325 | 325 | 0 | 850 | 850 | 0 | 325 | 325 | 0 | 200 | 200 | 0 | 14180 | 14180 | 0 |
| 2100 | 325 | 325 | 0 | 850 | 850 | 0 | 325 | 325 | 0 | 200 | 200 | 0 | 14180 | 14180 | 0 |

*Dry Creek*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| 1992 | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| 2000 | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| *2010* | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |
| *2100* | 60 | 60 | 0 | 2220 | 2220 | 0 | 20 | 20 | 0 | 500 | 500 | 0 | 3000 | 3000 | 0 |

*Rancho Cordova*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 10 | 104 | 94 | 150 | 1483 | 1333 | 0 | 20 | 20 | 60 | 60 | 0 | 250 | 2533 | 2283 |
| 1992 | 10 | 104 | 94 | 150 | 1483 | 1333 | 0 | 20 | 20 | 60 | 60 | 0 | 250 | 2533 | 2283 |
| 2000 | 22 | 171 | 149 | 150 | 1528 | 1378 | 11 | 38 | 27 | 60 | 60 | 0 | 227 | 2415 | 2188 |
| 2010 | 22 | 171 | 149 | 150 | 1528 | 1378 | 11 | 232 | 221 | 60 | 60 | 0 | 227 | 2203 | 1976 |
| 2100 | 22 | 171 | 149 | 150 | 1528 | 1378 | 11 | 232 | 221 | 60 | 60 | 0 | 227 | 2203 | 1976 |

*Total*

ACRES

| Time | Commercial | | | Residential | | | Industrial | | | Public | | | Agric./Vacant | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF | 100 | 400 | DIFF |
| 1990 | 2943 | 3812 | 869 | 26847 | 39075 | 12228 | 569 | 704 | 135 | 5271 | 5891 | 620 | 33618 | 39240 | 5622 |
| 1992 | 3049 | 3949 | 900 | 27173 | 39577 | 12404 | 705 | 973 | 268 | 5333 | 5954 | 621 | 33028 | 38309 | 5281 |
| 2000 | 4718 | 5763 | 1045 | 30196 | 43347 | 13151 | 1258 | 2092 | 834 | 5333 | 5959 | 626 | 27615 | 31445 | 3830 |
| 2010 | 7586 | 8744 | 1158 | 33887 | 47917 | 14030 | 2065 | 3737 | 1672 | 5333 | 5998 | 665 | 19879 | 21855 | 1976 |
| 2100 | 7586 | 8744 | 1158 | 33887 | 47917 | 14030 | 2065 | 3737 | 1672 | 5333 | 5998 | 665 | 19879 | 21855 | 1976 |

## Table E-5. Natomas Area - With Project, Modified Local Plan Scenario

| TOTAL ACREAGE - 54,882 | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Natomas Sub-Areas | Commercial/Industrial | | | Residential | | | Public | | | All Urban Uses Combined | | | Acriculture/Vacant | | |
| | 1992 | 2100 | DIFF | 1992 | 2100 | DIFF | 1992 | 2100 | DIFF | 1992 | 2100 | DIFF | 1992 | 2100 | DIFF |
| City Community Plan Areas | 515 | 3,177 | 2,662 | 1,692 | 5,007 | 3,315 | 853 | 853 | 0 | 3,060 | 9,037 | 5,977 | 8,182 | 2,205 | 5,977 |
| Unincorporated North Natomas | 180 | 3,499 | 3,319 | 180 | 3,346 | 3,166 | 2,860 | 3,253 | 393 | 3,220 | 10,098 | 6,878 | 23,378 | 16,500 | 6,878 |
| South Sutter County | 390 | 3,528 | 3,138 | 390 | 7,094 | 6,704 | 200 | 1,332 | 1,132 | 980 | 11,954 | 10,974 | 16,062 | 5,088 | 10,974 |
| TOTAL | 1,085 | 10,204 | 9,119 | 2,262 | 15,447 | 13,185 | 3,913 | 5,438 | 1,525 | 7,260 | 31,089 | 23,829 | 47,622 | 23,793 | 23,829 |



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