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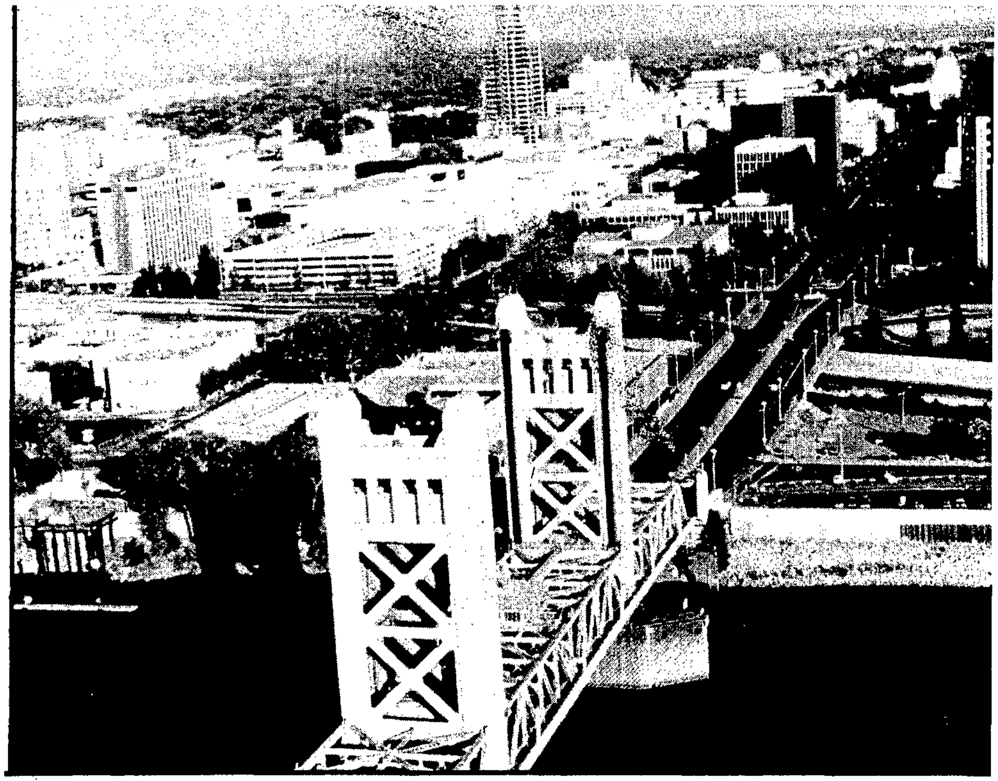
US Army Corps of Engineers
Sacramento District
South Pacific Division

The Reclamation Board
State of California



American River Watershed Investigation California

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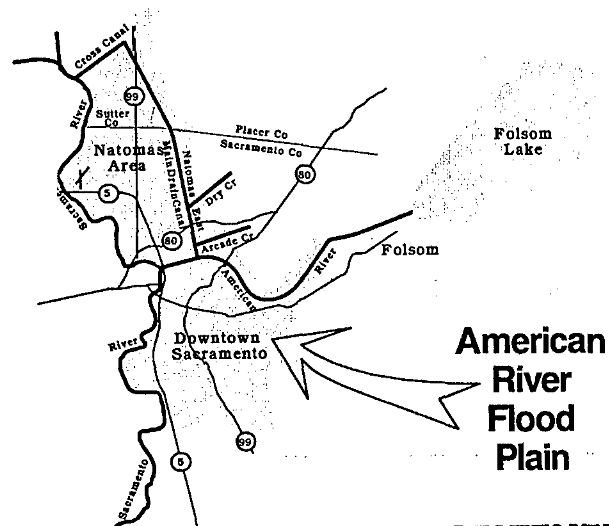

Feasibility Report

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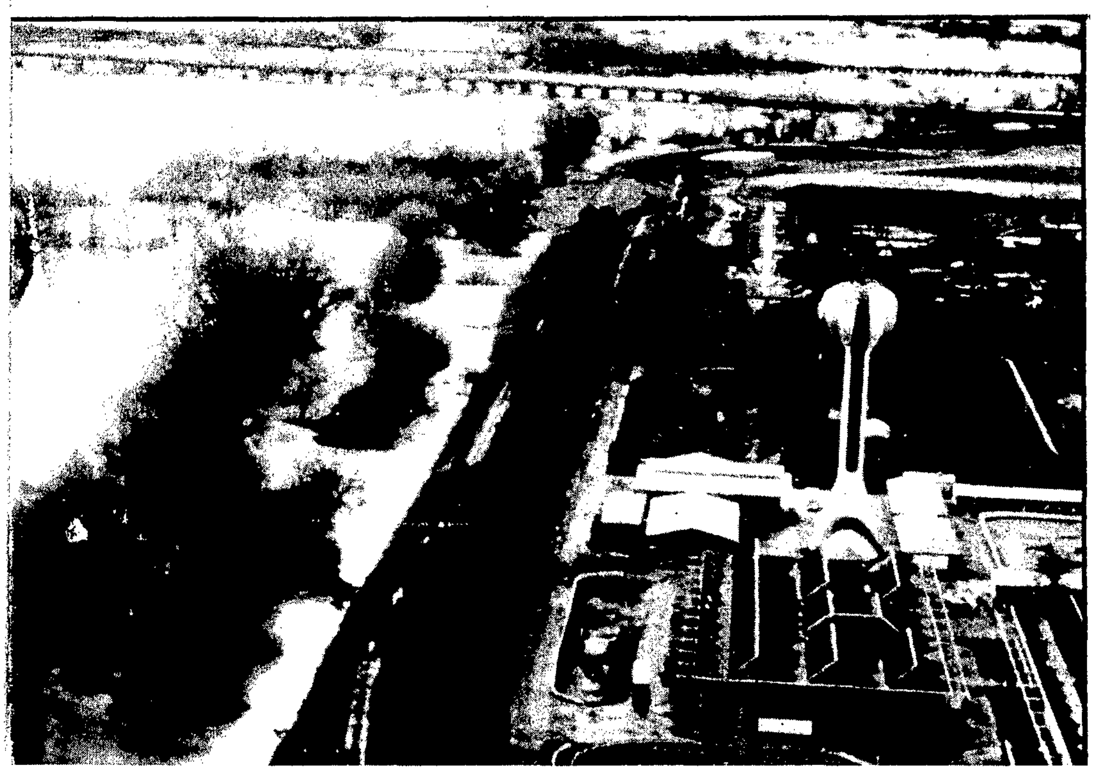


Part I
Main Report

Part II
Environmental Impact Statement / Environmental Impact Report

BEST AVAILABLE COPY

DECEMBER 1991

CESPD-PD-P (December 1991) (1105) 1st End Mr. Frentzen/tjm/
415-705-1637
SUBJECT: American River Watershed Investigation, California - Final Feasibility Report and Environmental Impact Statement/ Environmental Impact Report

DA, South Pacific Division, Corps of Engineers, 630 Sansome St., Room 720, San Francisco, CA 94111-2206 10 February 1992

FOR CDR USACE (CEWRC-WLR), Kingman Building, Fort Belvoir, VA 22060

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

ROGER F. YANKOUPE
Brigadier General, U.S. Army
Commanding

US Army Corps
of Engineers
Sacramento District
South Pacific Division

The Reclamation Board
State of California

American River Watershed Investigation, California

FEASIBILITY REPORT

Part I Main Report
Part II Environmental Impact Statement/ Environmental Impact Report

DECEMBER 1991

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

EXECUTIVE SUMMARY

This feasibility report presents the results of studies on flooding problems along the American and Sacramento Rivers in the greater Sacramento area. It identifies a selected plan to resolve these problems. The report includes a main report and an environmental impact statement/environmental impact report. Public and agency comments have been solicited on a draft report and have been used to develop a selected plan.

Study Authorization

The basic authority for the study is the Flood Control Act of 1962 (Public Law 87-874). Additional authority is contained in the Fiscal Year 1987 Appropriations Act and the Fiscal Year 1988 Continuing Appropriations Act. These acts instruct the Corps of Engineers (Corps) to:

- Study alternative means for flood control in the American River watershed, in Natomas, and in the lower Dry Creek watershed.
- Assume that the multipurpose Auburn Dam, as previously authorized, will not be constructed.
- Evaluate incidental water, power, and recreation benefits as they relate to a peak-flow flood control facility on the North Fork American River upstream from Folsom Dam.
- Analyze current projected water demands for the American River basin.

Flood Problem

In February 1986, major storms in northern California caused record floodflows in the American River basin and significant flood damage. River stages encroached into the levee freeboard at many locations. Had the storms lasted even a few hours longer, major sections of levee likely would have failed, resulting in possible loss of life and billions of dollars in damage.

Recent studies have shown that large floodflows in the American River may occur much more often than previously believed and that a serious flood threat exists. Prior to studies made following the February 1986 record floodflows, the existing flood control system was thought to provide protection greater than 120 years. The system is now estimated to provide significantly less than 100-year protection. Nearly 390,000 people live in the 400-year flood plain, which contains about $37 billion in damageable property.

Studies completed in 1988 for the Federal Emergency Management Agency (FEMA) concluded that much of the Sacramento urban area is within the 100-year flood plain. Normally this designation would require certain restrictions on development under the National Flood Insurance Program. However, the Sacramento area is temporarily exempt from implementing such restrictions. When the exemption expires in November 1992 and restrictions are implemented, urban growth in the Sacramento area could be significantly affected.

Related Water Resource Needs

Flood control, water supply and recreation are significant water-related needs in the American River basin. Studies conducted by the State of California (State), with input from local agencies and the U.S. Bureau of Reclamation, show that Sacramento and El Dorado Counties will need additional water supplies in the future. Also, additional recreational opportunities are needed in the rapidly growing Sacramento area.

Response

Efforts to increase the level of flood protection in the Sacramento area are being accomplished in three phases:

- Restore the structural integrity of the existing levee system in the near term.

- Identify interim measures to help provide a 100-year (FEMA) level of flood protection until a long-term solution can be agreed upon and implemented.

- Provide a long-term solution to the flood problem in the Sacramento area.

The American River Watershed Investigation is a main element of the third phase.

As a result of the flood threat and in accordance with the authority, the State and the Corps initiated a feasibility study of the American River basin in July 1988. The study cost is shared equally between the Federal Government and the State, which is the non-Federal sponsor. Participating with the State as local sponsor is the Sacramento Area Flood Control Agency (SAFCA), which represents the City and County of Sacramento, Sutter County, Reclamation District 1000, and the American River Flood Control District. Construction of a project authorized by Congress would require a non-Federal contribution of at least 25 percent of the project cost, in accordance with the cost-sharing provisions of the Water Resource Development Act of 1986 (Public Law 99-662).

Flood Control Alternatives

A wide variety of flood control measures were considered to provide flood protection to Sacramento. Some of these measures were found to be infeasible due to technical, economic, or environmental constraints. The following measures were retained for the development of alternative plans:

- Increase the flood control storage space in Folsom Reservoir.

- Increase the channel capacity of the lower American River with levee and channel improvements.

- Lower the spillway at Folsom Dam.

- Construct a flood control detention dam near Auburn.

- Construct levee and channel improvements in and around Natomas.

These measures were combined in various ways into 27 alternatives to provide different levels of protection. From the 27, 6 were selected for more detailed evaluation based on environmental, economic, public health and safety, and acceptability considerations. Three of the six alternatives would provide 100-year (FEMA) protection (equivalent to an 85-year level as defined by the Corps), and the other three would provide 150-, 200-, or 400-year protection. A no-action alternative serves as the baseline for evaluation of the six action alternatives. Major features of each alternative are listed below. Although each alternative would result in some adverse impacts to environmental resources, each includes features to offset, to the extent possible, those impacts.

<u>No Action</u>

Under this alternative, the Federal Government would take no action toward implementing a specific flood control plan. The flood threat would continue.

100-Year (FEMA) Levee Alternative

Major features of this alternative include:

- Maintain the flood control storage space in Folsom Reservoir at the current 400,000 acre-feet.
- Increase the objective release from Folsom Dam from the current 115,000 cubic feet per second (cfs) to 145,000 cfs.
- Construct levee and channel improvements in the lower American River to convey the increased objective release.
- Lengthen the Sacramento Weir, widen the Sacramento Bypass, and raise levees at various locations along the Yolo Bypass to accommodate the increased objective release.
- Construct levee, channel, and related flood control improvements at several locations around Natomas and along lower Dry Creek.
- Construct a 3,000 acre-foot detention basin in northeastern Natomas.
- Construct pedestrian/bicycle and equestrian trails on project features along the Natomas East Main Drainage Canal (NEMDC) in Natomas.

Work required to convey 145,000 cfs in the lower American River would entail constructing slurry walls, installing toe drains, constructing new levees, raising levees, and riprapping banks and levees.

Increased flows in the lower American River would affect vegetation, wildlife, and recreation values in the lower river. Adverse impacts of this and the other action alternatives in Natomas would be fairly minimal since most of the levee modification would be on existing levees. This alternative would leave a significant flood threat to existing and future populations from flood events greater than 100-year (FEMA) frequency.

100-Year (FEMA) Storage Alternative

Major features of this alternative include:

- Increase the flood control space in Folsom Reservoir from 400,000 to 590,000 acre-feet by reallocation from the water supply and hydropower generation purposes.

- Maintain the objective release from Folsom Dam at 115,000 cfs.

- Construct levee, channel, and related flood control improvements at several locations around Natomas and along lower Dry Creek.

- Construct a 3,000-acre-foot detention basin in northeastern Natomas.

- Construct pedestrian/bicycle and equestrian trails on project features along the NEMDC in Natomas.

A permanent increase in the seasonal flood control space in Folsom Reservoir would reduce the potential for Folsom (part of the Federal Central Valley Project (CVP)) to provide water supply and hydropower benefits. It would also reduce recreation in the reservoir and along the lower American River and adversely affect environmental resources along the lower river. In addition, a significant flood threat would still remain from flood events larger than 100-year (FEMA) frequency.

<u>100-Year (FEMA) Levee/Storage and Spillway Alternative</u>

Major features of this alternative include:

- Increase the flood control space in Folsom Reservoir to 470,000 acre-feet.

- Lower the spillway at Folsom Dam by 15 feet.

- Increase the objective release from Folsom Dam to 130,000 cfs.

- Construct levee and channel improvements in the lower American River to convey the increased objective release.

- Lengthen the Sacramento Weir, widen the Sacramento Bypass, and raise levees at various locations along the Yolo Bypass to accommodate the increased objective release.

- Construct levee, channel, and related flood control improvements at several locations around Natomas and along lower Dry Creek.

- Construct a 3,000-acre-foot detention basin in northeastern Natomas.

- Construct pedestrian/bicycle and equestrian trails on project features along the NEMDC in Natomas.

A permanent increase in the flood control space in Folsom Reservoir and an increase in the channel capacity downstream would result in reduced water supply, hydropower, and recreation in the reservoir as well as adverse environmental impacts along the lower American River. A significant flood threat would remain from flood events larger than 100-year (FEMA) frequency.

<u>150-Year Protection</u>

An alternative to provide a 150-year level of protection was evaluated because it would provide the greatest level of protection possible without construction of flood control detention facilities upstream from Folsom Reservoir. Major features of this alternative include:

- Increase the flood storage space in Folsom Reservoir to 650,000 acre-feet.

- Lower the spillway at Folsom Dam by 15 feet.

- Increase the objective release from Folsom Dam to 180,000 cfs.

- Construct levee and channel improvements in the lower American River to convey the increased objective release.

- Lengthen the Sacramento Weir, widen the Sacramento Bypass, and raise levees at various locations along the Yolo Bypass to accommodate the increased objective release.

- Construct levee, channel, and related flood control improvements at several locations around Natomas and along lower Dry Creek.

- Construct a 3,000-acre-foot detention basin in northeastern Natomas.

- Construct pedestrian/bicycle and equestrian trails on project features along the NEMDC in Natomas.

The permanent increase in the flood control space in Folsom Reservoir and the increase in the channel capacity downstream would result in reduced water supply yield and hydropower to the CVP, reduced recreation in the reservoir, and adverse environmental impacts along the lower American River and in Natomas.

200-Year Protection

Major features of this alternative include:

- Construct a 545,000-acre-foot-capacity flood detention facility on the North Fork American River near Auburn.
- Construct levee, channel, and related flood control improvements at several locations around Natomas and along lower Dry Creek (similar to the 100-year (FEMA) storage alternative).
- Maintain the existing flood control storage space in Folsom Reservoir and the objective release from Folsom Dam.
- Construct pedestrian/bicycle and equestrian trails on project features along the NEMDC in Natomas.

An upstream detention facility would have no adverse impact on existing water supplies or hydropower generation of the CVP. It would, however, have some adverse impacts on environmental resources in the detention dam area primarily due to infrequent inundation.

400-Year Protection

Major features of this alternative include:

- Construct an 894,000-acre-foot-capacity flood detention facility on the North Fork American River near Auburn.
- Construct levee, channel, and related flood control improvements at several locations around Natomas and along lower Dry Creek (similar to the 100-year (FEMA) storage alternative).
- Maintain the existing flood control storage space in Folsom Reservoir and the objective release from Folsom Dam.
- Construct pedestrian/bicycle and equestrian trails on project features along the NEMDC in Natomas.

This alternative would have slightly less adverse environmental impacts than the 200-year alternative. This is primarily because (1) features in Natomas are mostly the same as the 200-year alternative, and (2) while the maximum flood detention area would be greater, fluctuations in water surfaces would be slower, thereby reducing the risk of sloughing. Also, the risk of flooding and associated adverse impacts in the flood plain would be less.

Comparison of Alternatives

The Federal objective in water resources planning is to contribute to national economic development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes, applicable executive orders, and other planning requirements.

The major features, estimates of first and annual costs, and likely advantages and disadvantages of each of the alternatives are summarized in Table I. Based on detailed evaluation of the alternatives, the 400-year protection alternative was (1) determined to best satisfy NED criteria, (2) determined to satisfy requirements of Section 404 of the Federal Clean Water Act, and (3) identified in the draft feasibility report as the Tentatively Selected Plan. However, after public review of the draft feasibility report, the non-Federal sponsor requested that the 200-year alternative be selected rather than the 400-year. The main reasons for this selection are:

- The 200-year alternative provides a high level of flood protection to much of the Sacramento area.

- Although the 400-year alternative best meets the Federal water resource planning objective and is the NED plan, the 200-year alternative provides significant net economic benefits.

- For highly urbanized areas such as Sacramento, a flood control detention facility is preferred over levees. Reliance on high levees for flood protection in Sacramento is considered inherently less safe than an upstream detention dam.

- Lower levels of flood protection (especially the 100-year (FEMA) level) have the potential to result in greater loss of life than higher protection level alternatives or the no action plan. This is because development would continue to occur in the flood plain with implementation of the minimum FEMA level protection while this minimal increased level of protection would not be substantially more than the existing conditions.

- The 200-year alternative would neither advance nor impede future options for developing water and power facilities.

- The State has indicated that the 200-year alternative is their preferred plan because (1) it fully meets their criterion of a minimum level of flood protection for Sacramento, (2) has more widespread community support than the 400-year plan, and (3) is more affordable than the 400-year plan.

- The State and SAFCA have indicated their intent to share in the cost of the selected plan.

Selected Plan

Primary features of the selected plan, the 200-year alternative, are shown on Plate I and are summarized below:

<u>Flood Control</u>

<u>Auburn Area</u>

- Construct a concrete gravity dam 425 feet high with a detention capacity of 545,000 acre-feet on the North Fork American River near Auburn.

- Acquire about 6,030 acres of lands (primarily in flowage easement) in the detention area. (See environmental mitigation below for other lands.)

- Replace State Highway 49 and Ponderosa Way in project area.

<u>Natomas Area</u>

- Construct levee improvements at several locations along the NEMDC, Pleasant Grove Creek Canal, Natomas Cross Canal, lower Arcade and Dry Creeks, and Sankey Road.

- Construct a levee on the north side of Dry Creek near the NEMDC.

- Replace the Main Avenue bridge.

- Construct a gated pump station in the NEMDC at Dry Creek.

- Construct a 3,000-acre-foot flood detention basin in the northeast corner of Natomas.

- Construct a 3,000-cfs channel and culvert along the NEMDC and under the Union Pacific Railroad.

Recreation

- Construct pedestrian/biking and equestrian trails along areas in Natomas where levees would be modified.

Environmental Mitigation

Main Stem American River

- Acquire and manage 5,385 acres along the South Fork of the American River and, as part of operation and maintenance, conduct an adaptive management plan in the detention dam area (replace vegetation in possible sloughing zones and remove potential sedimention in channel as appropriate) to replace fish, wildife, and vegetation in the detention dam area.

- Within the 5,385 acres on the South Fork, 2,700 acres (based on the most severe set of assumptions) will be managed for impacts to valley elderberry longhorn beetle in the detention dam area.

- Data recovery and preservation of historic, pre-historic, and paleontological sites in the detention dam area.

Natomas Area

- Acquire and manage 280 acres near Sutter and Sacramento County line for construction impacts to wildlife and vegetation.

- Limit construction season for instream work to avoid impacts to anadromous fisheries.

- Data recovery and preservation for historic and pre-historic sites.

- Non-Federal sponsor will develop and implement a long-term mitigation program for growth inducing impacts in the flood plain.

- Plant trees at selected location along recreation trails.

State Highway 49 Replacement

The selected plan includes replacement of State Highway 49. As determined by the Corps, replacement will be in-kind and include one main bridge, several smaller bridges, and modifications to bridge approaches. The State, as the non-Federal sponsor, is responsible for this relocation. The proposed replacement will be reviewed by the California Transportation Commission. Given the long-term needs of the State to consider a major relocation of the highway in the Auburn area, route adoption studies will be required to analyze alternatives. As part of this process, additional environmental analysis will be done. The route adoption studies will be undertaken and funded by the State, likely in cooperation with the U.S. Department of Transportation and in coordination with the Corps. If the State subsequently selects another alternative that has a higher cost than the Corps' in-kind replacement, this subsequent alternative will be treated as a betterment.

Benefits and Costs

The selected plan, in conjunction with Folsom Reservoir and other existing flood control facilities, would provide a 200-year level of flood protection to the Sacramento area. This includes Natomas and much of the lower reaches of Dry and Arcade Creeks. The plan would reduce the average annual equivalent flood damages in the Sacramento area from about $191 million to about $57 million.

The first cost of the plan is estimated at about $698 million (October 1991 price levels). This includes a portion of the costs incurred to date by the U.S. Bureau of Reclamation on the Auburn Dam project. The total annual costs are estimated at approximately $62 million. The average annual equivalent benefits (at an interest rate of 8-3/4 percent) are estimated at $168 million, yielding a benefit-cost ratio of 2.7 to 1.0. Table II is a breakdown of the first and annual costs and benefits of the selected plan. Table III shows how these costs would be apportioned between the Federal and non-Federal interests.

Local Support

There is strong local support for a plan that would provide a high level of flood protection (200-year or greater) to the area while minimizing potential adverse environmental impacts. The State, SAFCA and other local agencies have cooperated in the development of this plan. The selected plan fully meets the non-Federal sponsors' flood control objectives. The State Reclamation Board and SAFCA will be the non-Federal sponsors for the construction of the selected plan.

TABLE I

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 Ponderosa Way Main Ave.	Hwy 49 Ponderosa Way 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 AND LENGTHEN SACRAMENTO WEIR	NO	NO	NO	YES	YES	NO	YES
LEVEE, CHANNEL AND RELATED IMPROVEMENTS IN NATOMAS	NO	YES	YES	YES	YES	YES	YES
DETENTION BASIN	NO	YES	YES	YES	YES	YES	YES

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 Ponderosa Way Main Ave.	Hwy 49 Ponderosa Way 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 AND LENGTHEN SACRAMENTO WEIR	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
LEVEE, CHANNEL AND RELATED IMPROVEMENTS ALONG AMERICAN RIVER	NO	NO	NO	YES	YES	NO	YES
BUILD DAM AT AUBURN: STORAGE CAPACITY (ACRE-FEET) FLOOD POOL ELEV. (FT) MAX. POOL AREA (ACRES) STREAM LENGTH INUNDATED (MILES)	NO	YES 545,000 868.5 4,000 35.8	YES 894,000 945 5,450 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	144.2	81.4	42.7	48.4	38.3
ADVANTAGES	• No initial impact on environmental resources.	• High level of flood protection. • High net economic benefits. • No impact to existing CVP benefits. • Likely non-Federal sponsor.	• High level of flood protection. • Highest net economic benefits. • No impact to existing CVP benefits.	• Moderately high level of flood protection.	• Meets minimum requirements for flood insurance program. • No impact to existing CVP benefits.	• Meets minimum requirements for flood insurance program.	• Meets minimum requirements for flood insurance program.
DISADVANTAGES[5]	• High remaining	• Loss of habitat	• Loss of habitat	• Significant	• Higher public	• Higher public	• Higher public

2

STREAM LENGTH INUNDATED (MILES)		35.8	39.3				
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	144.2	81.4	42.7	48.4	38.3
ADVANTAGES	• No initial impact on environmental resources.	• High level of flood protection. • High net economic benefits. • No impact to existing CVP benefits. • Likely non-Federal sponsor.	• High level of flood protection. • Highest net economic benefits. • No impact to existing CVP benefits.	• Moderately high level of flood protection.	• Meets minimum requirements for flood insurance program. • 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. • FEMA restrictions continue to apply.	• Loss of habitat in Natomas. • Intermittent loss of habitat in detention area.	• Loss of habitat in Natomas. • Intermittent loss of habitat in detention area.	• Significant remaining flood threat. • No known non-Federal sponsor. • Severe impact on existing CVP system benefits. • Severe environmental impacts to lower American River. • Significant impact on Folsom Reservoir recreation. • Loss of habitat in Natomas. • Increase of flows and velocities within levee system.	• Higher public health and safety threat than No-Action alternative. • No known non-Federal sponsor. • Significant environmental impacts to lower American River and Natomas. • Impact on Folsom Reservoir recreation. • Loss of habitat in Natomas. • Increase of flows and velocities within levee system.	• Higher public health and safety threat than No-Action alternative. • No known non-Federal sponsor. • Significant environmental impacts to lower American River. • Impact on Folsom Reservoir recreation. • Reduction in existing CVP system benefits. • Loss of habitat in Natomas.	• Higher public health and safety threat than No-Action alternative. • No known non-Federal sponsor. • Reduction in existing CVP system benefits. • Impact on Folsom Reservoir recreation. • Environmental and recreation impacts to lower American River. • Loss of habitat in Natomas. • Increase of flows and velocities within levee system.

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.

(3)

TABLE II
SELECTED PLAN COST ESTIMATE
($1,000) 1/

Item	Upper American River 2/	Natomas	Total
First Cost			
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 & Relocations	103,400	4,000	107,400
Dam	320,700	--	320,700
Levee Modification	--	5,200	5,200
Floodways and 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 5/	77,700	--	77,700
Total	649,000	49,200	698,200
Investment Cost			
Total First Cost	649,000	49,200	698,200
Creditable Expenditures Deduction 5/	-77,700	-	-77,700
IDC 6/	64,500	5,600	70,100
Total	635,800	54,800	690,600
Annual Cost 7/			
Interest and Amortization	55,700	4,700	60,400
Operation and Maintenance	1,000	300	1,300
Total	56,700	5,000	61,700
Annual Benefits			167,900
Flood Control 8/			(166,400)
Recreation			(1,500)
Net Benefits			106,200
B/C Ratio			2.7 to 1.0

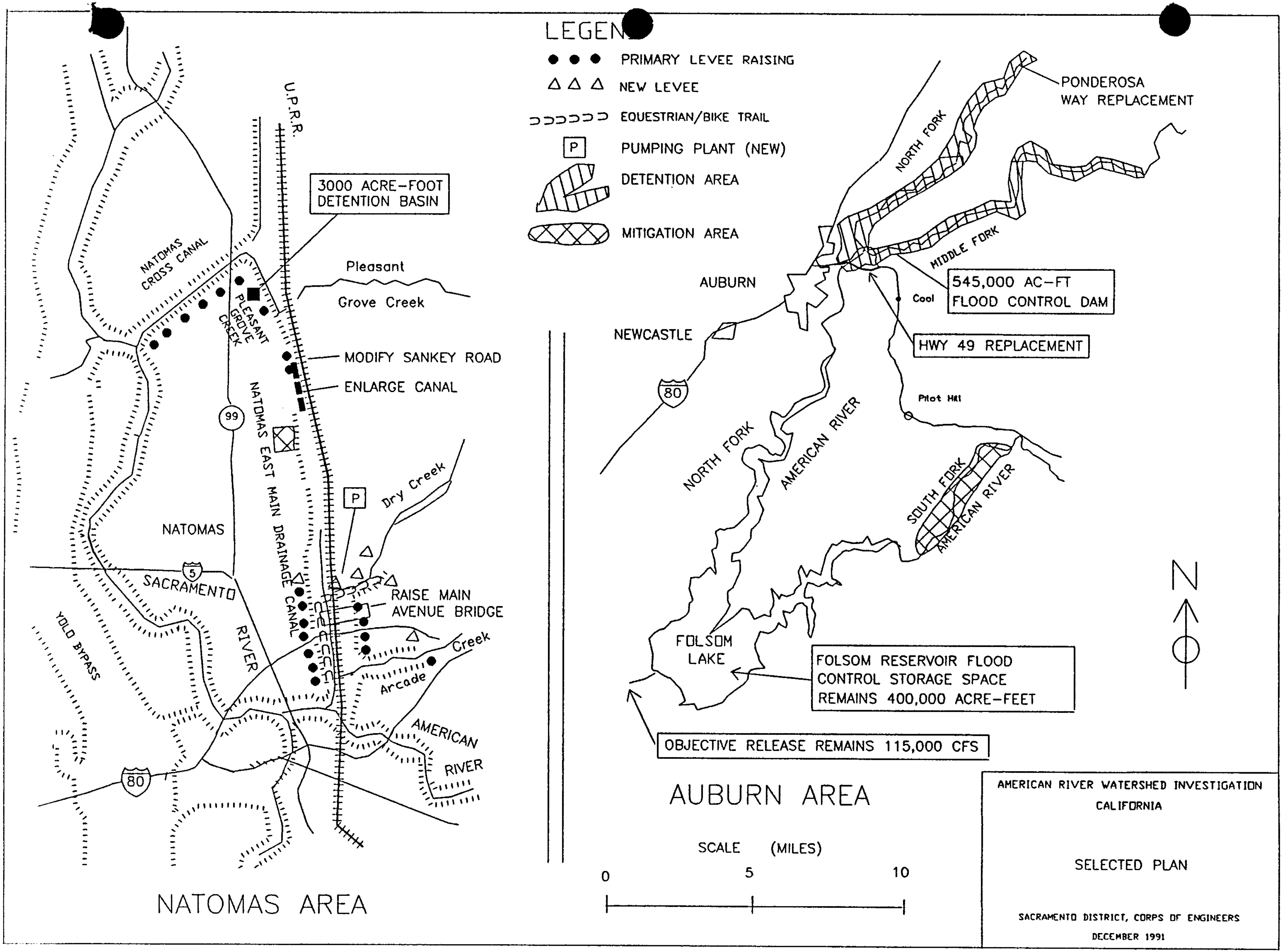
1/ October 1991 price levels.
2/ 545,000 acre-feet of flood storage near Auburn Dam site.
3/ Does not include lands.
4/ E,D,S, and A = Engineering, Design, Supervision, and Administration.
5/ Included for cost apportionment but not economic analysis.
6/ IDC = Interest during construction.
7/ On investment cost with 100-year project life and 8-3/4 percent interest rate.
8/ Including flood damage reduction, location, flood proofing costs and savings, bridge replacement savings, and Flood Insurance Program savings.

TABLE III

COST APPORTIONMENT OF SELECTED PLAN ($1,000)

Item	Flood Control			Recreation			Total		
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	Federal	Non-Federal	Total
First Cost									
Lands and Management	900	73,600	74,500	400	6,400	6,800	1,300	80,000	81,300
Relocations	100	107,300	107,400	-	-	-	100	107,300	107,400
Construction	331,200	-	331,200	1,400	-	1,400	332,600	-	332,600
Cultural Resources	4,700	-	4,700	-	-	-	4,700	-	4,700
Environmental Mitigation Facilities	9,300	-	9,300	-	-	-	9,300	-	9,300
Credible Expenditures to Date 1/	77,700	-	77,700	-	-	-	77,700	-	77,700
E, D, S, and A 2/	63,900	20,700	84,600	600	-	600	64,500	20,700	85,200
Subtotal	487,800	201,600	689,400	2,400	6,400	8,800	490,200	208,000	698,200
Cash Contribution	(34,500)	34,500		2,000	(2,000)		(32,500)	32,500	
Total	453,300	236,100	689,400	4,400	4,400	8,800	457,700	240,500	698,200
Percent of First Cost	65.8	34.2		50.0	50.0		65.6	34.4	

1/ Creditable expenditures to date include some of the costs plus interest incurred by USBR at the Auburn Dam site.
2/ The E, D, S, and A = Engineering, Design, Supervision and Administration.



AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SELECTED PLAN

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE I

American River Watershed Investigation, California

Part I

Main Report

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA
MAIN REPORT

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Acronyms and Abbreviations
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ASA(CW)	Assistant Secretary of the Army for Civil Works
ASRA	Auburn State Recreation Area
CDMG	California Division of Mines and Geology
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Corps	Corps of Engineers
CVP	Central Valley Project
DWR	Department of Water Resources (State)
EID	El Dorado Irrigation District
EIR	environmental impact report
EIS	environmental impact statement
EMBMUD	East Bay Municipal Utility District
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FWS	U.S. Fish and Wildlife Service
GDPUD	Georgetown Divide Public Utility District
LCA	Local Cooperation Agreement
MCE	maximum credible earthquake
M&I	municipal and industrial
NCC	Natomas Cross Canal
NED	national economic development
NEMDC	Natomas East Main Drainage Canal
OES	Office of Emergency Services (State)
O&M	operation and maintenance
PCWA	Placer County Water Agency
PMF	probable maximum flood
RDF	reservoir design flood
RIS	reservoir-induced seismicity
SAFCA	Sacramento Area Flood Control Agency
SMUD	Sacramento Municipal Utility District
SPF	standard project flood
State	State of California
SWRCB	State Water Resources Control Board
USBR	U.S. Bureau of Reclamation
WLRC	Washington Level Review Center

Units of Measurement

g	acceleration of gravity
ac-ft	acre-feet
cfs	cubic feet per second
cu yd	cubic yard
dB	decibels
ft	feet
GWh	gigawatthours
hp	horsepower
kW	kilowatts
kWh	kilowatthours
MW	megawatts
ug/L	microgram/liter
mi	miles
mg/L	milligrams/liter
pH	potential of hydrogen

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA
MAIN REPORT

CHAPTER I

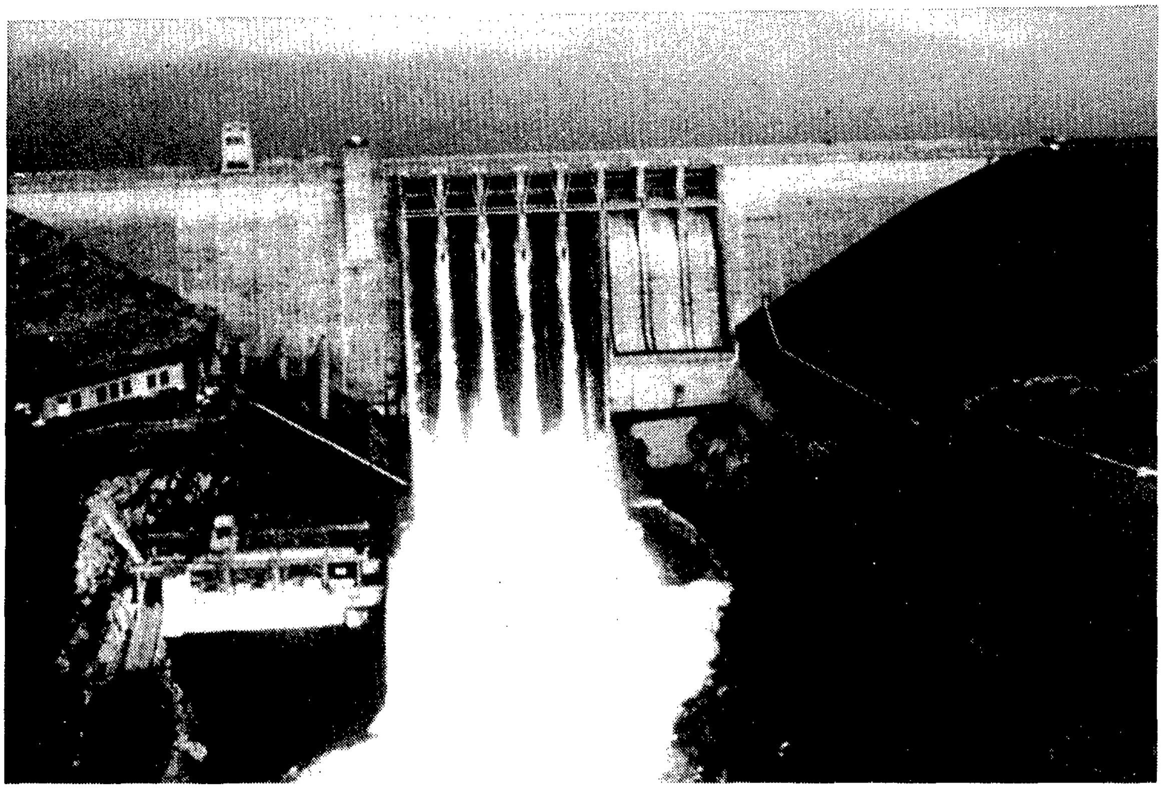
INTRODUCTION

This report presents the results of a feasibility-level evaluation by the Corps of Engineers (Corps) of measures to provide critically needed flood protection for urban areas along, and adjacent to, the lower American River in the vicinity of Sacramento, California. The American River drains a portion of the western slope of the northern Sierra Nevada. The watershed--or drainage basin--covers about 2,100 square miles northeast of Sacramento and includes portions of Placer, El Dorado, and Sacramento Counties. (See Plate 1.)

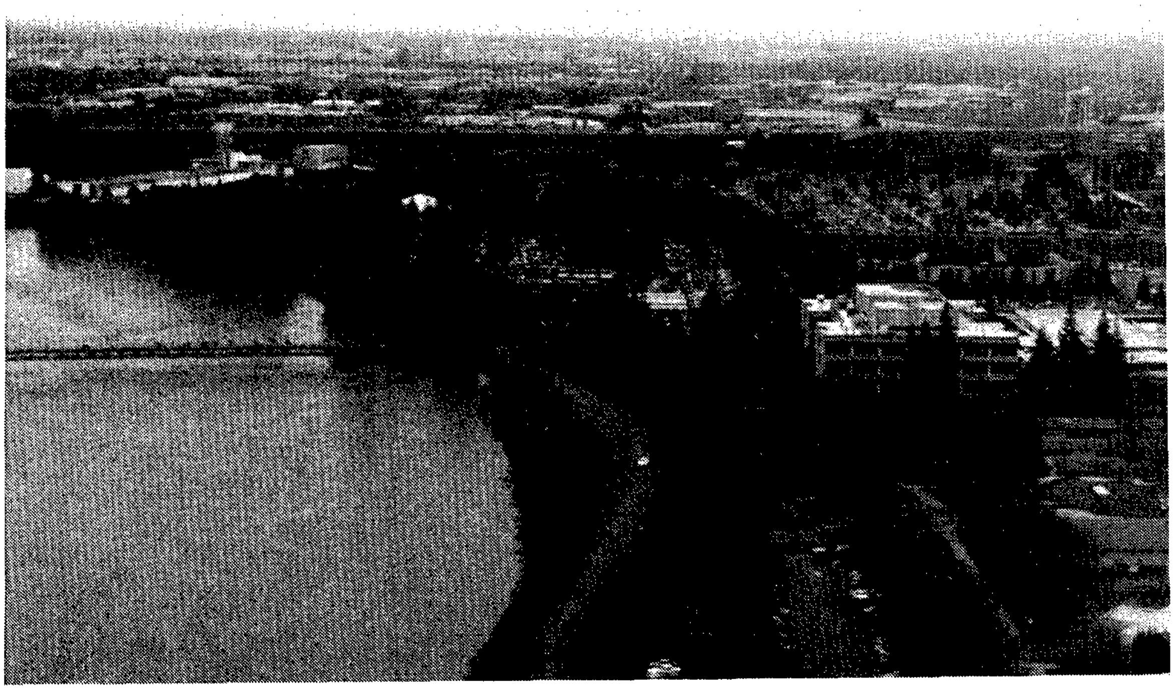
BACKGROUND

In February 1986, major storms in northern California caused record floodflows in the American River basin. Outflows from Folsom Reservoir (on the lower American River), together with high flows in the Sacramento River (into which the American flows), caused encroachment into the design freeboard of levees protecting the Sacramento area. In addition, the inside slope of a portion of the Garden Highway levee (along the Sacramento River upstream from the American) eroded as a result of seepage through the levee; only emergency repair work prevented complete failure. Had these storms lasted much longer, major sections of levee likely would have failed, causing probable loss of life and billions of dollars in damages. Photographs on the following pages show conditions during February 1986 at various locations in the Sacramento area. A description of flood problems is presented in Chapter III.

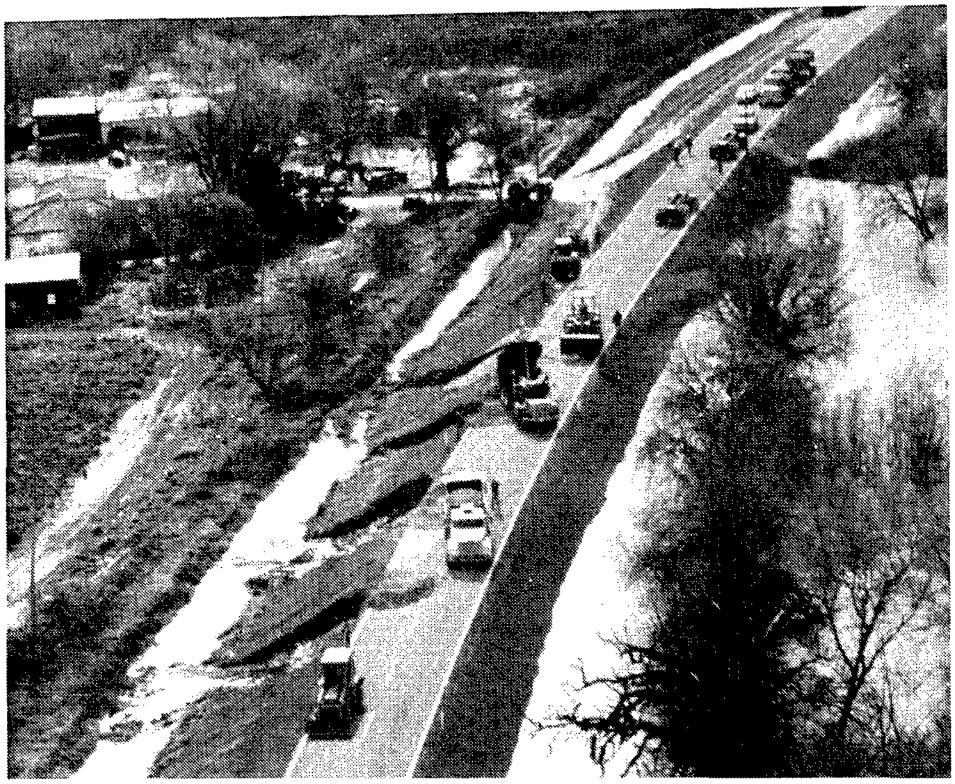
Hydrologic investigations conducted by the Corps following the February storms showed that areas along the lower American River, especially in the vicinity of the City of Sacramento, had significantly less flood protection than previously believed. Consequently, in the fall of 1986 the Congress directed the Corps to ". . . engage in a one-year reconnaissance study of alternative means of flood control in the American River, California,



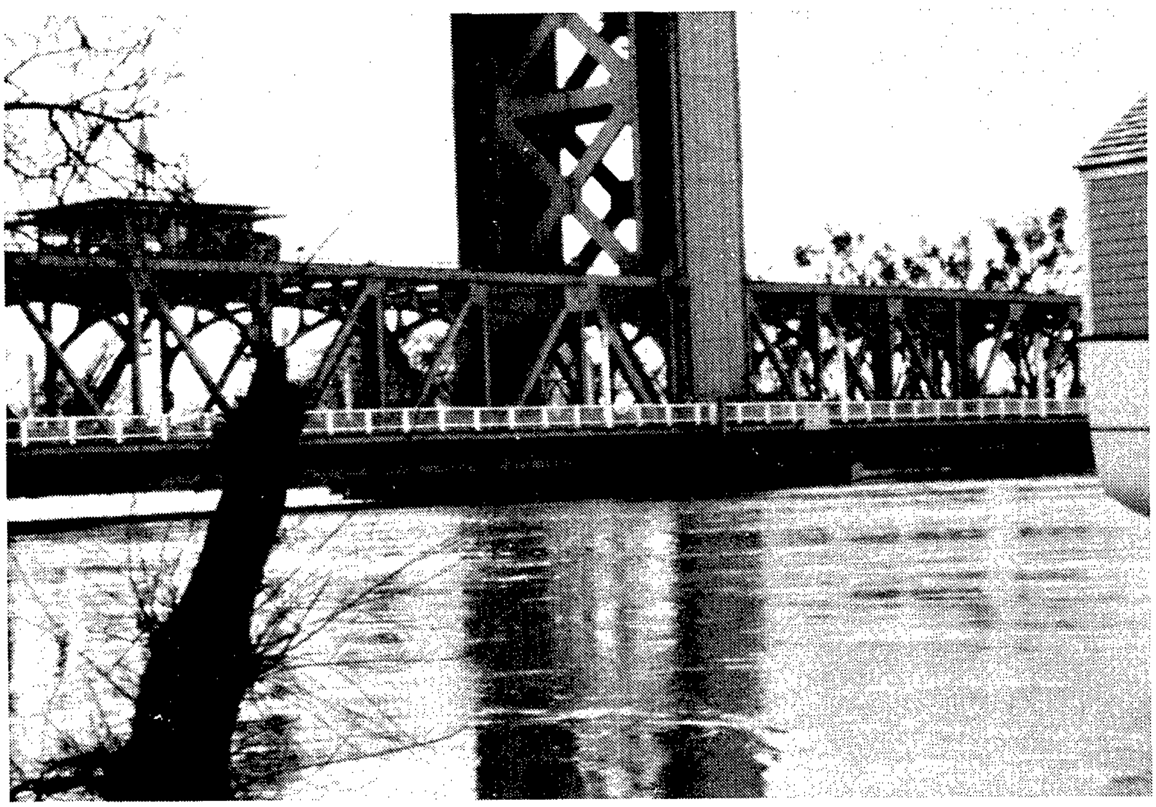
RECORD OUTFLOWS FROM FOLSOM DAM
DURING THE FEBRUARY 1986 FLOOD.



AMERICAN RIVER AT THE GUY WEST BRIDGE
NEAR CALIFORNIA STATE UNIVERSITY, SACRAMENTO.
FEBRUARY 1986



LEVEE SLUMPING ALONG GARDEN HIGHWAY
DURING FEBRUARY 1986 FLOOD.



SACRAMENTO RIVER AT TOWER BRIDGE
DURING FEBRUARY 1986 FLOOD.

watershed predicated on the assumption that an Auburn Dam as previously authorized will not be constructed."

The Corps completed its report on the reconnaissance study in January 1988. The study concluded that (1) serious flood problems confront the Sacramento area, (2) economically feasible solutions are available to resolve these problems, and (3) a feasibility-level investigation was warranted. Accordingly, the report recommended that feasibility studies be made for the main stem American River and Natomas. Natomas is located just north of downtown Sacramento at the confluence of the lower American and Sacramento Rivers.

Feasibility-level studies are cost shared 50-50 with non-Federal sponsors. The State of California (State) (the Reclamation Board and Department of Water Resources (DWR)) agreed to be the non-Federal sponsor for this study, and a cost-sharing agreement between the State and the Corps was signed on June 17, 1988. (See Pertinent Correspondence Appendix.) A draft feasibility report and Environmental Impact Statement/Environmental Impact Report (EIS/EIR) was coordinated for public and agency review between April and June 1991. Fourteen public workshops and three public meetings were held, primarily in May 1991. Numerous comments were received on the draft report, and these comments were considered in the revision of this report.

PURPOSE AND SCOPE OF STUDY

The purpose of this feasibility study and report is to describe the preauthorization planning studies to provide additional flood protection for the Sacramento area. The scope of studies were to:

- Define the flood risks to the Sacramento area.
- Identify potential flood control measures and describe the most feasible ones in detail.
- Define and present a flood control plan for the area.
- Describe the relationship between the flood control plan and other water resource needs and opportunities in the study area.
- Define the requirements of implementing the plan.
- Develop recommendations by the Corps for implementation.

AUTHORITY

The basic authority for the Corps to study flood control needs in the American River basin is in the Flood Control Act of 1962 (Public Law 87-874, dated October 23, 1962), as follows:

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

The Corps' authorization for its one-year reconnaissance study was included in the 1987 Appropriations Act. Authorization for additional study was included in committee language accompanying the Fiscal Year 1988 Continuing Appropriations Act (Public Law 100-202, dated December 22, 1987):

> . . . The conferees are aware that recent information presented by the Corps and the Bureau in a series of three fact-finding hearings in Sacramento reveals that the region may be under a greater threat from serious flooding than was previously believed. It is also clear that any improvements which may be made to increase the level of flood control on the American River may not by itself alleviate the flood danger to the northern part of Sacramento County east and west of the Natomas East Main Drainage Canal, which includes the Natomas area and the Dry Creek watershed. The conferees therefore urge the Corps of Engineers to examine potential flood control improvements to the Natomas and the Dry Creek watershed concurrent to the Corps' evaluation of improving flood protection on the American River. The conferees further recognize that there may be additional flood protection afforded by a primarily peak-flow flood control facility (the so-called "dry dam") on the North Fork of the American River above Folsom. The conferees therefore direct the Corps of Engineers to include further assessments of the relationship between such a peak-flow flood control facility and the operation of Folsom Dam as they may pertain to incidental water, power and recreational benefits. Within this assessment, the Corps should

include its analysis of the current and projected water supply demands in the American River basin.

PRIOR STUDIES AND REPORTS

Numerous studies and reports provided useful information for this feasibility study. Several of the more significant ones are discussed here.

Corps of Engineers, Sacramento District

Special Study on the Lower American River (March 1987). - Prepared for the U.S. Bureau of Reclamation (USBR) and DWR, this study provided updated information on flood problems and possible solutions along the American River.

Sacramento River Flood Control System Evaluation, Initial Appraisal Report - Sacramento Urban Area (May 1988). - This report comprises Phase I of the five-phase Sacramento River Flood Control System Evaluation. Based on this report, detailed designs were initiated in April 1989 for structural rehabilitation of approximately 32 of 110 miles of levee evaluated in the Sacramento area. Construction is now under way.

Sacramento Metropolitan Area Reconnaissance Report (February 1989). - This report covered flood problems and possible solutions for areas not covered by the American River Watershed Investigation, primarily in the West Sacramento area. The study identified serious flooding problems in the study area, economically feasible solutions, and Federal interest in undertaking feasibility-level studies. In 1989, the Corps signed a cost-sharing agreement for a feasibility study with the Reclamation Board as the non-Federal sponsor. The draft feasibility report was provided to the public for review in November 1991.

Reoperation of Folsom Dam and Reservoir. - This study assessed costs, benefits, and other impacts resulting from the temporary modification of the flood control operation of Folsom Dam and Reservoir to provide greater flood protection for parts of the Sacramento area. The report considered that reoperation of Folsom would be required for about 10 years, beginning in October 1992. It was anticipated that within this timeframe, existing flood control facilities would be improved and the construction of a new flood control facility would be completed. The Corps, in cooperation with the USBR, is in the process of completing a decision document and EIS for this temporary reoperation. A recommended plan and EIS are scheduled for completion in mid-1992.

U.S. Bureau of Reclamation

Auburn Dam Report--Auburn Dam Alternative Study (July 1987). - Prepared for members of a State/Federal Auburn Dam Task Force, the report analyzed costs associated with five alternative reservoir sizes at the Auburn Dam site. The report was prepared to provide the Secretary of the Interior and local leaders with sufficient information to determine the merits of completing the dam.

U.S. Soil Conservation Service

Sutter-Placer Watershed Area Study, Sutter and Placer Counties, California (1982). - This study presented alternative plans and recommendations for solving flooding, declining ground water, erosion, and other problems in the Sutter-Placer watershed area.

Federal Emergency Management Agency

The Corps conducted a flood insurance study of Sacramento for the Federal Emergency Management Agency (FEMA) and furnished flood plain maps for the City and County of Sacramento to FEMA in 1989.

California Department of Water Resources

A Preliminary Study of Flood Control Alternatives on the Lower American River (1982). - This study was an evaluation of flood control alternatives for the lower American River under the assumption that the authorized multipurpose Auburn Dam would not be built. The study recommended that emphasis of further studies be placed on evaluating in more detail the modification of Folsom Dam.

The Floods of February 1986 (1986). - This report provided statistical information on statewide precipitation, flows, and damages associated with the floods of February 1986.

Auburn Dam Reconnaissance Appraisal of Construction under State Sponsorship (December 1987). - In this report, DWR concluded that the State should not pursue construction of a scaled-down multipurpose Auburn Dam. The report also recognized the need for flood control and water supply and recommended support for a Corps feasibility study incorporating these needs.

CHAPTER II

STUDY AREA

This chapter briefly describes the study area for the American River Watershed Investigation. It provides information on physical, socioeconomic, and environmental conditions existing today as well as projections of future conditions likely to occur in the absence of construction of a major flood control project to protect the Sacramento area. Also described are the existing flood control and related water resource projects affecting the study area, including the USBR's Auburn Dam project. Detailed information on the study area is provided in the EIS/EIR portion of this document, and in the technical appendixes.

SETTING

Study Area Location

This study addresses flooding and flood problems in the American River basin. This basin drains about 2,100 square miles along the western slope of the Sierra Nevada range in northern California and forms a flood plain covering roughly 110,000 acres at the confluence of the Sacramento and American Rivers. The flood plain includes most of the developed portions of the City of Sacramento and virtually all of the 55,000-acre Natomas basin, an agricultural reclamation area adjacent to the two rivers which is rapidly being urbanized. In developing flood protection alternatives for the people and property currently occupying the flood plain, the American River Watershed Investigation has focused on (1) the system of levees, weirs, and bypasses along the Sacramento River and its tributaries in the vicinity of Natomas, (2) Folsom Dam and Reservoir and the levees along the lower American River below the dam, and (3) the reach of the American River above Folsom Dam near the City of Auburn where flood detention capacity could be added to the existing system through the construction of a flood control dam at or near the site of the uncompleted multipurpose Auburn Dam project.

Topography, Geology, and Soils

Folsom Dam and Reservoir are located at the base of the foothills in the lower portion of the American River basin. The basin above the dam is rugged with rocky slopes, V-shaped canyons, and few flat valley or plateau areas. Elevations range from 10,400 feet at the headwaters to about 200 feet at the dam. The average basin slope is approximately 80 feet per mile.

The upper third of the basin above the dam has been intensely glaciated and is characterized as alpine, with bare peaks and ridges, considerable areas of granite pavement, and only scattered areas of timber. The middle third is dissected by canyons that have reduced the interstream areas to narrow ribbons of relatively flat land. The lower third consists of low rolling foothills. The basin is drained by three branches of the American River (North, Middle, and South Forks), which flow in a fan-shaped pattern into the Folsom Reservoir area.

The geological features of the drainage area above Folsom Dam are characteristic of the Sierra Nevada foothill region. The formations consist of a wide variety of metamorphic rocks with intrusions of granitic rocks. Massive granitic outcrops are visible in the upper third of the basin. In the middle third, soil cover is shallow, but canyon walls and ridges are covered by a heavy coniferous forest. The lower third consists of low rolling foothills with a moderate depth of soil.

Folsom Dam is situated at the break in slope between the Great Valley and the Sierra foothills. The area is characterized by weathered granites, mine tailings, and stream clastics. Soil cover in the area ranges from moderate to heavy.

The study area below Folsom Dam is geologically part of the Great Valley geomorphic province of California. The valley was filled with erosion debris that originated in the surrounding mountains. Most of the soils are recent alluvial flood plain soils consisting of unconsolidated deposits of clay, silt, and sand that occurred as flood plain deposits.

Climate

The climate of the study area is closely associated with area topography, and there is a marked difference in temperature and precipitation within short distances. In the valley, climate is characterized by cool, wet winters and hot, dry summers. Temperatures in the valley are high in the summer and moderate in the winter. Temperatures in the mountains decrease generally with elevation; the summers are moderate at higher elevations while the winters are severe.

The major portion of the seasonal rainfall generally occurs from December through February. The seasons are so distinctly different that the period from May to October may be termed the dry season and November to April the wet season. Precipitation varies throughout the drainage area, ranges from 16 to 20 inches on the valley floor to about 70 inches in the higher mountains, and averages about 53 inches over the basin above Folsom Dam. Precipitation usually falls as rain up to the 5,000-foot elevation and as snow at higher elevations, but some storms produce rain up to the highest elevations of the basin. At rare intervals, snow falls on the valley floor. Winter snowfall above 5,000 feet normally accumulates until April, when increasing temperatures mark the beginning of the snowmelt season. Snow falling at lower elevations usually melts within a relatively short time.

Peak wind velocities in the area are generally associated with winter-type storm fronts, whereas the strongest sustained winds occur in the summer with maximum sunshine. The prevailing wind direction in the lower basin is from the south and southeast during April through September and from the north during October through March.

Runoff

Average annual runoff from the American River basin is 2.8 million acre-feet. Streamflow varies throughout the year and is highest in winter and spring and lowest in late summer and fall. The flow regime in the lower American River is governed by Decision 893 (D-893) of the State Water Rights Board, predecessor to the California Water Resources Control Board, and subsequent decisions.

EXISTING CONDITIONS

Identification of existing conditions related to population, land use, fish and wildlife resources, and other environmental factors is critical when quantifying flood problems and determining the without-project conditions in the study area.

Population and Land Use

Historically, the Sacramento region has had fairly low growth compared to California's coastal metropolitan areas. More recently, however, the region has emerged as one of the high-growth areas of the State, due primarily to the comparative advantages of good highway access, competitive commercial lease rates, a large supply of moderately priced housing, an available labor force, and proximity to a wide range of cultural activities and outdoor recreational areas.

For discussions of land use and population, the study area has been divided into these subareas:

- Natomas - The Natomas area is bounded by the Natomas Cross Canal (NCC) on the north, Natomas East Main Drainage Canal (NEMDC) on the east, American River on the south, and Sacramento River on the west.

- Lower American River - This area consists of the American Parkway and the following portions of metropolitan Sacramento which lie along the lower American River: Dry Creek, north Sacramento, Richards Boulevard, south Sacramento, and Rancho Cordova.

- Upper American River - This area, located in Placer and El Dorado Counties, consists of the 42,000 acres of land around the Auburn Dam site which are managed for recreational purposes under the auspices of the Auburn State Recreation Area (ASRA), and the communities surrounding the ASRA areas where development is occurring.

Population. - Population estimates for 1990 for the subareas within the study area are shown in Table II-1.

TABLE II-1

ESTIMATED 1990 POPULATION OF STUDY AREA

Area	Population
Natomas	36,960
Lower American River	371,940
Dry Creek	(2,500)
North Sacramento	(54,950)
Richards Boulevard	(580)
South Sacramento	(295,000)
Rancho Cordova	(18,910)
Upper American River	41,000
Total	449,900 1/

1/ Population estimates in the 100- and 400-year flood plains (excluding Upper American River) are 366,000 and 386,500, respectively.

Land Use. - The predominant land use in the Natomas basin is agriculture. However, the City of Sacramento General Plan anticipates substantial residential, commercial, and industrial development in the undeveloped areas of the southern portion of Natomas along the Interstate 80 corridor. Full development of this corridor is expected by the year 2010.

Land use in the lower American River area is virtually all urban except for the 5,000 acres of public or open space located in the American River Parkway. The parkway extends from the confluence with the Sacramento River to Nimbus Dam and is owned and managed by the Sacramento County Department of Parks and Recreation. Table II-2 summarizes existing land use in the Natomas and lower American River areas.

TABLE II-2

EXISTING (1990) LAND USE
IN THE NATOMAS AND LOWER AMERICAN RIVER AREAS 1/
(acres)

Area	Residential	Commercial	Industrial	Public	Agricultural and Vacant	Total
Natomas	2,262	723	304	3,851	47,742	54,882
Dry Creek	2,220	60	20	500	3,000	5,800
North Sacramento	4,760	445	50	45	600	5,900
Richards Boulevard	60	540	105	295	0	1,000
South Sacramento	28,530	2,570	400	6,595	5,905	44,000
Rancho Cordova	1,483	104	20	60	2,533	4,200
Total	39,315	4,442	899	11,346	59,780	115,782

1/ Area is generally the 400-year flood plain except Natomas which exceeds the flood plain by about 6,400 acres.

Detailed information on land use in the upper American River area is limited. Higher intensity urban and commercial uses are concentrated mainly in the Auburn area. The predominant land uses within the remainder of the area are low-density residential, rural residential, forests, recreation, open space and agricultural, and grazing lands. There is some light-commercial land use within the townsites. (See EIS/EIR Chapter 4.)

Vegetation and Fish and Wildlife Resources

The western part of the study area in and around Sacramento contains a diverse array of vegetation and fish and wildlife habitats within the agricultural and open space areas. The extensive riparian corridors along the American and Sacramento Rivers are the most biologically important areas in terms of providing sufficient amounts of relatively rare, high-value habitat in the study area.

Native vegetation in the study area represents a diverse mosaic of habitats. The vegetation is categorized into broadly inclusive wildlife habitat covers, including open water aquatic, emergent wetlands (see EIS/EIR Chapter 7), riparian scrub, oak woodlands, hardwood, and grasslands. Vegetation in the flood plains is primarily agricultural crops with limited riparian and wetland areas.

Over 40 species of fish inhabit the American River. The anadromous species (e.g., salmon, steelhead, and shad) are especially valued by anglers. The study area is also inhabited by several Federally-listed endangered species: valley elderberry longhorn beetle, bald eagle, and winter run chinook salmon. In addition, two State-threatened species, Swainson's hawk and California giant garter snake, are known to inhabit the Natomas area.

The study area contains habitat used by a wide variety of game and non-game wildlife species. The upper American River is populated by a variety of species, including deer, ringtail cat, mountain lion, grey fox, and many species of small mammals, reptiles, and songbirds. The lower American River supports diverse wildlife populations associated with the riparian areas such as Swainson's hawk, great blue heron, mallard, killdeer, and red-tailed hawk. Various mammals and game species such as deer, turkey, pheasant, and quail also reside there.

In Natomas, riparian areas and adjacent agricultural areas provide habitat for many different species. They include a variety of mammals such as muskrat, beaver, deer, and river otters. Bird species include herons, wood duck, black-shouldered kite, and tri-colored blackbird. Additionally, the American River basin, including Natomas, is an important component of the Pacific Flyway. Thousands of migratory waterfowl rely on the habitat in the basin each year for nesting, foraging, and breeding. (See EIS/EIR Chapter 7.)

Water Quality

Water quality in the American and Sacramento Rivers is generally good as a water source for municipal, industrial, and agricultural supply. However, standards for heavy metals, temperature, dissolved oxygen, and pH are occasionally exceeded. The likely sources of nutrient and heavy metals loadings are stormwater runoff, agricultural runoff, and other urban and agricultural land use practices. Natomas is drained year-round by a system of canals (with some pumping stations) that collect, convey, and eventually discharge water into the Sacramento River. Drainage consists of mainly irrigation tailwater during April through October, and pollutants may include organic and inorganic chemicals and sediments. During the rainy winter months, drainage is mainly urban stormwater runoff.

The operation of the complex system of reservoirs, debris dams, and diversion structures in the upper part of the basin normally increases summer and fall streamflows in the main stem of the American River. However, the study area has experienced a drought for the past several years. Water levels in rivers and upstream reservoirs are low and may drop lower as demands exceed supply. Low water levels adversely impact water quality by raising water temperatures, concentrating pollutants, lowering dissolved oxygen, and decreasing the natural flushing of the system. Water quality could continue to deteriorate in the future if precipitation amounts remain below normal. (See EIS/EIR Chapter 6.)

Air Quality

With respect to air quality, the Sacramento region, including Natomas and the lower American River, has been designated by the U.S. Environmental Protection Agency (EPA) as a "non-attainment" area. The principal constituent of concern in the area is ozone. This ozone problem is a direct consequence of hydrocarbon and nitrogen oxide pollutants. Also of concern are concentrations of carbon monoxide. The primary sources of air pollution in the Sacramento area consist of on-road vehicles (cars, trucks, etc.), aircraft, trains, construction equipment, boats, and off-road vehicles. These sources, termed "mobile," produce about 63 percent of the area's hydrocarbons, 72 percent of the nitrogen oxides, and 97 percent of the carbon monoxide.

Under the Clean Air Act, all of Placer County (except the Lake Tahoe Air Basin) will be designated a non-attainment area. Due to the direction of prevailing air currents, the Auburn area--the major urban center in the county and in the upper American River basin--is subject to air contaminants originating in Sacramento and from agricultural burning in the valley. (See EIS/EIR Chapter 12.)

Cultural Resources

One historic and 12 prehistoric archeological sites have been recorded in Natomas and adjacent areas (including south Sutter County and Dry and Arcade Creeks). Along the lower American River, 20 prehistoric sites and at least 20 Nisenan Maidu villages have been described; no historic archeological sites have been recorded. Two historic truss bridges that cross the river are listed in the National Register. Approximately

1,500 historic and 125 prehistoric sites have been identified in the upper American River basin. (See EIS/EIR Chapter 9.)

Socioeconomic Conditions

The economy of the Sacramento area has continued to grow and diversify during the past decade. The economy is based primarily on governmental agencies, services, retail trade, and agriculture. Government is currently the largest employer in Sacramento.

The economy of southern Natomas is based on business and residential construction. In north Natomas, the economy is based on agriculture (rice is the major crop) with some light industry. Sutter County's economy is based mainly on agriculture, retail trade, service industries, and government employment.

Historically, Placer County has relied heavily on the railroad industry, lumber and wood products industry, and agriculture for jobs. More recently, jobs in retail trade, service industries, government, and construction have gained significance. In El Dorado County, tourism provides the economic base. Retail trade and service industries are expected to have strong growth through 1992. In the past, the limited commercial and industrial development within the county subareas have limited employment opportunities. Unemployment is below the State average in both Placer and El Dorado Counties. (See EIS/EIR Chapter 15.)

Transportation

The major transportation facilities in the study area include Interstate 80, Interstate 5, U.S. Highway 50, State Route 99, Business 80, and Highway 49. These regional facilities connect residential locations with employment, commercial, and recreational activity centered in the area and located around the central city (Sacramento) area. Traffic congestion occurs during peak commute periods--typically 7-9 a.m. and 4-6 p.m. during weekdays. The lower American River area is generally "built out" and has extensive transportation facilities. Traffic congestion occurs during peak commute times, especially along the Howe and Watt Avenue corridors near Highway 50 and Interstate 80. Both Howe and Watt Avenues cross the lower American River.

The Auburn area is generally developed, with heavy traffic volumes passing along Interstate 80 and northward along Highway 49 to Grass Valley and Nevada City. Current regional transportation planning efforts include evaluations of new facilities to remove through traffic from the local transportation facilities, and improvements to existing facilities, including expanded transit systems, additional roadway capacity, and high-occupancy vehicle lanes. (See EIS/EIR Chapter 11.)

Recreation

Recreation is an important factor in the study area. The study area lies in a recreation corridor between Lake Tahoe and San Francisco and is easily accessed from major transportation routes Interstate 80 to the north and Highway 50 to the south. The upper American River area provides an outstanding resource for a wide variety of outdoor recreation opportunities including fishing, whitewater boating, hiking, horseback riding, camping, picnicking, and appreciation of a large number of historic sites. The lower American River is a major site for recreational activity. The Folsom Lake State Recreation Area and American River Parkway along the lower river provide opportunities for boating, biking, fishing, and general recreation to the residents of the area. (See EIS/EIR Chapter 14.)

EXISTING FLOOD CONTROL PROJECTS

The study area is affected--directly or indirectly--by numerous flood control and related water resource projects. The American River is a major east-side tributary to the Sacramento River, which drains the Sacramento Valley, the northern portion of the Great Central Valley of California. In the Sacramento area, the Sacramento River flood control system includes reservoirs, narrow leveed river channels, numerous relief weirs, and leveed tributaries. The system is paralleled by large, broad, leveed bypass channels. This system conveys all the floodwaters of the Sacramento River and its principal tributaries to the tidewater in Suisun Bay.

Major flood control features in the American River basin include Folsom Dam and Reservoir on the American River and a complex system of downstream levee and channel improvements. Downstream from Folsom Dam, the river flows into the historical flood plain, where it is contained on both banks by private and project levees.

Central Valley Project

Folsom Dam and Reservoir. - Folsom Dam is a multipurpose facility constructed by the Corps and operated by the USBR as part of the Central Valley Project (CVP). The dam regulates runoff from about 1,860 square miles of drainage area. Folsom Lake has a normal, full pool storage capacity of 1,010,000 acre-feet with a seasonally designated flood control storage space of 400,000 acre-feet. Reservoir releases are primarily controlled by two tiers of flood control sluices located in the main dam and by radial gates on the spillway. Each tier of sluices has four outlets. Five radial-type spillway gates and three radial-type emergency spillway gates control releases over the spillway. The Corps' Water Control Manual for Folsom Dam and Lake (December 1987) describes the physical and operational features of the project. (The Reservoir Regulation Appendix contains pertinent excerpts from that manual and related documents.)

Since 1981, the Corps has been reviewing the capabilities of Folsom Dam to meet current criteria for dam safety. Two problems have been identified:

- The ability of the spillway to safely pass the Probable Maximum Flood (PMF). Studies to date indicate that the existing spillway can pass only about 66 percent of the PMF.

- The potential for liquefaction and breaching of the Mormon Island Auxiliary Dam and foundation during a severe local earthquake.

The Folsom PMF and the Mormon Island problems exist regardless of actions taken to resolve flood problems along the American River. Corrective action by the Corps and the USBR on the Mormon Island problems is now under way and is expected to be completed in mid-1994.

Nimbus Dam. - Nimbus Dam and its reservoir, Lake Natoma, are located about 6 miles downstream from Folsom Dam. (See Plate 2.) Nimbus Dam, a power afterbay to Folsom, is a diversion dam constructed and operated by the USBR as part of the CVP. The reservoir has a capacity of 8,760 acre-feet. Because of its small capacity, Nimbus has essentially no regulatory effect on floodflows in the American River.

Sacramento River Flood Control Project

Features of the Sacramento River Flood Control Project associated with the American River basin consist of levees along the lower American River, NEMDC, Arcade and Dry Creeks, Pleasant Grove Creek Canal, NCC, Sacramento River, and Yolo Bypass. Levee improvements, including some new or reconstructed levees, were completed by the Corps by 1958. The levees are maintained by non-Federal interests.

American River. - The American River portion of the project consists of 10.8 miles of levee improvements along the south bank of the river and about 5.8 miles of improvements along the north bank. The south-bank levee extends from the mouth of the American River upstream to Mayhew Drain at Mayhew Road. The north-bank levee extends from the mouth of the American River upstream about 2.3 miles (in this reach, the north levee along the NEMDC contains the lower American), then about 3.5 miles upstream to the area near Cal Expo. These levees are considered capable of safely containing sustained flows of 115,000 cubic feet per second (cfs). Plate 3 is a profile of the levees.

Natomas East Main Drainage Canal. - The west levee of the NEMDC extends from the American River upstream about 13.3 miles to high ground near Sankey Road; the east levee extends from the river upstream about 4 miles to Dry Creek. The design capacity of the canal is (1) 16,000 cfs from the American River to Arcade Creek, (2) 16,300 cfs from Arcade Creek to Dry Creek, and (3) 1,500 cfs upstream from Dry Creek. The design freeboard for these levees is at least 2.5 feet. Plate 4 includes a profile of the levees along and near the canal.

Arcade and Dry Creeks. - Levees extend along both sides of Arcade Creek from the NEMDC to high ground about 2 miles upstream. (See Plate 4.) The levees were designed for a flow of 3,300 cfs with 3 feet of freeboard. A levee extends along the south side of Dry Creek from the NEMDC to high ground about 1.3 miles upstream. This levee was designed to contain a flow of 15,000 cfs with 3 feet of freeboard.

Pleasant Grove Creek Canal. - The Pleasant Grove Creek Canal is contained on the west bank by a 4-mile-long levee that extends from Sankey Road to the NCC. (See Plate 4.) The design capacity of the channel is (1) 800 cfs from Sankey Road to Curry Creek, (2) 2,300 cfs from Curry Creek to Pleasant Grove Creek, and (3) 6,000 cfs from Pleasant Grove Creek to the NCC. The levee was designed for 3 feet of freeboard at these flows.

Natomas Cross Canal. - The south levee of the NCC extends about 4.4 miles between the Sacramento River and the Pleasant Grove Creek Canal. (See Plate 4.) The levee was designed to have 3 feet of freeboard at a flow of 22,000 cfs.

Sacramento River. - The levees along the Sacramento River were designed to carry (1) 107,000 cfs in the reach from Fremont Weir to the American River and (2) 110,000 cfs downstream from the American, with at least 3 feet of freeboard. Plate 5 shows a profile of the Sacramento River levees.

Yolo Bypass. - Yolo Bypass comprises a complex series of levee and channel improvements extending from the terminus of Sutter Bypass to near Rio Vista on the Sacramento River. Yolo Bypass receives flow from west-side tributaries, the Sacramento River, and sometimes from the American River. When the combined flow of the Sacramento and Feather Rivers and Sutter Bypass exceeds about 70,000 cfs, most of the excess spills over the Fremont Weir into Yolo Bypass. Also, when flows in the Sacramento River as measured at the "I" Street bridge gage reach a stage of 27.5 feet and rising--about 94,000 cfs--gates at the

Sacramento Weir are opened sequentially, allowing excess water to flow into the Yolo Bypass, until either all 48 gates are open or the river stage at the weir stabilizes at 27.5 feet (National Geodetic Vertical Datum). During extremely high flow on the American River (approximately 100,000 cfs), the water surface will be highest at the confluence of the two rivers and cause reverse flow in the Sacramento River approximately 3 miles north to the Sacramento Weir. Thus, the Sacramento Weir acts as a "safety valve" to pass American River floodflows in excess of the available capacity in the Sacramento River, away from Sacramento via the Yolo Bypass. The design capacity of the Yolo Bypass is (1) 343,000 cfs from the Fremont Weir to the mouth of Knights Landing Ridge Cut, (2) 362,000 cfs from Knights Landing Ridge Cut to Cache Creek, (3) 377,000 cfs from Cache Creek to Sacramento Weir, (4) 480,000 cfs from Sacramento Weir to Putah Creek, and (5) 500,000 cfs from Putah Creek to the junction of the Yolo Bypass with the Sacramento River at Rio Vista. Plate 5 is a profile of levees along the Yolo Bypass.

Fremont Weir, an integral part of the bypass system, is critical to the proper functioning of the system. The weir (9,170 feet long) is located near the junction of the Sacramento River and Sutter Bypass upstream from Verona and the NCC. (See Plate 1.) During extremely high flows, water from the Sacramento River flows over the weir into Yolo Bypass. Because of the relative capacity of the Sacramento River and Yolo Bypass, the majority of floodflows from Sutter Bypass cross the Sacramento River and enter the Yolo Bypass. The State is responsible for maintaining the flood-carrying capacity of the system. Sediment had been depositing for decades on both sides of Fremont Weir--upstream to the Sacramento River and downstream for several thousand feet into the Yolo Bypass. By the early 1980's, sediment had built up higher than the sill elevation, and induced approximately 1 foot higher flood stages at the weir during the 1983 and 1986 events. In recent years the State has completed sediment removal activities to help reduce these stages to an average depth below the sill elevation.

The Corps is currently evaluating the feasibility of creating and restoring several thousand acres of wetlands in, or contiguous to, the Yolo Bypass. The study is authorized under provisions of Section 1135 of the Water Resources Development Act of 1986. Potential non-Federal sponsors include the State Department of Fish and Game and the City of Davis. A draft report is scheduled for completion in early 1992.

American River Flood Control Project

The American River Flood Control Project was constructed by the Corps in 1958 and is operated and maintained by DWR. The project consists of a levee along the north bank of the river, extending from the terminus of the Sacramento River Flood Control

Project levee near Cal Expo upstream about 8 miles to Carmichael Bluffs. The levee was designed for a sustained flow of 115,000 cfs with a minimum freeboard of 5 feet.

Others

Non-Federal Levees. - Local developers have constructed levees on the south bank of the American River upstream from the project levees from the Mayhew Drain to Sunrise Boulevard. The levee from Mayhew Drain extends upstream about 1 mile and can probably accommodate about 130,000 cfs before encroachment into its freeboard. Three other levees extend from (1) the southern boundary of Goethe Park west approximately 1 mile, (2) downstream from Sunrise Boulevard west about 0.5 mile, and (3) from Goethe Park upstream to Cordova Meadows. Following the February 1986 flood, the City of Sacramento extended the north-bank project levee of Arcade Creek upstream about 1,100 feet to Marysville Boulevard. Local levees also crisscross the Pleasant Grove area.

Upstream Reservoirs. - Numerous reservoirs are located upstream from Folsom Dam. Most of them are owned and operated by local utility companies or districts, and the largest are listed in Table II-3. The total storage capacity in these reservoirs is about 820,000 acre-feet. All of them are used for water supply and/or hydroelectric power generation; none have designated flood control space. Because these reservoirs are at relatively high elevations and much of the precipitation occurs as snow, they have a minimal effect on floodflow reduction. Plate 1 shows the locations of the largest of these reservoirs. There are also minor irrigation diversions into and out of the American River basin.

City of Sacramento Floodgates. - The City of Sacramento has an emergency plan that includes both permanent and portable floodgates. The gates are located at railroads, streets, and bike trails/pedestrian paths, where they create low points, or "subways," in the levees. The general locations of these floodgates are shown on Plate 2. Under the emergency plan, all of the gates are to be erected or closed under specified conditions. In addition, sandbagging activities are to be carried out. Following the 1986 flood, facilities were constructed to enable installation of floodgates on Arcade and Dry Creeks and the NEMDC.

Multipurpose Auburn Dam Project. - The Auburn Dam project was authorized as part of Auburn-Folsom South Unit of the CVP in 1965 under Public Law 89-161. This project would include flood control, water supply, hydropower generation, and recreation. The principal features of the project include Auburn Dam, Reservoir, and Powerplant on the North Fork American River above Folsom Reservoir.

Construction of Auburn Dam was started in 1967. The diversion tunnel was completed in 1972, the cofferdam in 1975, and work was well under way on the foundation for the main dam. But on August 1, 1975, an earthquake registering 5.7 on the Richter scale occurred near Oroville, California, which is about 80 miles from the Auburn site. Construction of the dam and powerplant was suspended pending a detailed seismic evaluation. The resulting studies showed that the Auburn Dam site is in a region of relatively low historical seismicity and that the probability of an earthquake of magnitude 6 (or greater) occurring close to the damsite during the useful life of the dam is very small. However, because of the possibility that an earthquake of engineering significance might occur in the vicinity of the site during the life of the dam, the dam was redesigned to meet higher seismic standards.

TABLE II-3

MAJOR RESERVOIRS IN THE UPPER AMERICAN RIVER BASIN

Reservoir	Stream/ American River Tributary 1/	Owner 2/	Elev. Top of Dam (ft)	Capacity (acre-feet)
Lake Clementine	N.F.	COE	716	10,600
L.L. Anderson (French Meadows)	M.F.	PCWA	5,271	136,400 3/
Hell Hole	Rubicon Riv/M.F.	PCWA	4,650	207,600
Lake Edson (Stumpy Meadows)	Pilot Cr./M.F.	GDPUD	4,272	20,000
Loon Lake	Gerle Cr./M.F.	SMUD	6,418	76,500
Union Valley	Silver Cr./S.F.	SMUD	4,883	271,000 3/
Ice House	S.F. Silver Cr./S.F.	SMUD	5,454	45,960 3/
Slab Creek	S.F.	SMUD	1,870	16,600
Caples Lake	Caples Cr./S.F.	PG&E	7,960	21,581
Silver Lake	Silver Fork/S.F.	PG&E	7,211	3,800
Ralston Afterbay	Rubicon R./M.F	PCWA	1,189	850
Chili Bar	S.F.	PG&E	1,029	3,700
Gerle Div Dam	Gerle Cr./S.F.	SMUD	5,240	1,380
Junction Div. Dam	Silver Cr./S.F.	SMUD	4,468	3,250
Camino Div. Dam	Silver Cr./S.F.	SMUD	2,918	845
Rubicon Springs	M.F.	SMUD	6,251	1,450
Oxbow	M.F.	PCWA	--	2,800
TOTAL				824,316

1/ N.F. - North Fork American River
M.F. - Middle Fork American River
S.F. - South Fork American River
2/ COE - Corps of Engineers
PCWA - Placer County Water Agency
GDPUD - Georgetown Divide Public Utility District
SMUD - Sacramento Municipal Utility District
PG&E - Pacific Gas and Electric Company
3/ Effective storage is reduced during winter months for dam safety.

A dam at the Auburn site was determined to be seismically safe, but construction has not been restarted, mainly because of (1) a change in Federal policy concerning non-Federal cost sharing of water development projects and (2) aggressive opposition by environmental interests. Under current policy, the non-Federal sponsor must pay 100 percent of the hydropower and municipal and industrial (M&I) water supply costs of the project and most of the irrigation supply costs. The USBR initiated a cost-shared study in mid-1991 to review the authorized project.

If completed, the authorized Auburn Dam would be about 653 feet high and impound a reservoir of 2.3 million acre-feet. Auburn powerplant would have a capacity of about 300 megawatts (MW). The project would yield about 270,000 acre-feet for water supply and 600 gigawatthours (GWh) annually. When operated with Folsom Reservoir, it would provide greater than a 200-year level of flood protection to the Sacramento area. It would include recreation lands and facilities to accommodate 1.6 million visitor-days per year and enhance recreation opportunities at Folsom Lake through joint operation with Folsom Dam. It would mitigate certain impacts on fish and wildlife resources by maintaining stream temperatures downstream from Nimbus Dam and by managing project lands. The ultimate reservoir area land requirement would be about 42,100 acres.

Since construction of Auburn Dam began, about $237 million (1990 price levels) in Federal funds have been spent to (1) acquire lands and rights-of-way, (2) prepare designs and estimates, (3) conduct geotechnical explorations, (4) construct the cofferdam and diversion tunnel, (5) excavate and treat the foundations for the main dam and powerplant, and (6) complete access roads and the Foresthill bridge. In addition, about $109 million in interest has accrued on these costs, bringing the total Federal investment for Auburn to date to about $346 million. Annual O&M costs average $1.5 million.

Emergency Preparedness Plans

Federal. - The Corps' response to a flood emergency involves three phases of readiness. During the "Informational Phase" (a situation of potential flooding), the Corps maintains a 24-hour liaison with the State Flood Operations Center. The "Alert Phase" is initiated when a flood situation threatens or is likely to threaten life or property. The Corps' Emergency Operations Center is activated, and personnel, in cooperation with emergency teams from the State, begin patrol and observation activities. In the "Mobilization Phase," major flooding appears to be imminent or is occurring, and the Corps is requested to furnish or is providing emergency assistance. Assistance includes repairing levee breaks, placing riprap along levees, placing material on levees to prevent overtopping, constructing additional protection levees, and providing sandbags.

State of California. - The State-Federal Flood Operations Center, in cooperation with the National Weather Service's California-Nevada River Forecast Center, monitors weather and river information and other data around the clock during the rainy season and provides early flood warnings to local, State, and Federal agencies. When rivers begin to rise, the flood center issues forecasts of conditions and makes warning calls to individuals and agencies so they can begin mobilizing levee patrols, moving equipment and livestock, and evacuating flood plain residents.

At the same time, the State Office of Emergency Services (OES) and county OES staffs are monitoring flood information and preparing to help people. The OES network includes fire departments, law enforcement agencies, and highway and road departments.

Local. -

County of Sacramento. - Sacramento County has a multi-hazard emergency plan that includes procedures to be followed during flooding and/or dam failure. Preparations for a slow-rise flood threat are organized into three stages based on river elevations at specific locations in the county. The county OES declares response stages after considering weather forecasts, dam releases, and levee conditions. Each county agency has a list of actions to be taken during each stage of the flood threat. A dam failure initiates immediate action to save lives.

County of Yolo. - Yolo County has a similar multi-hazard emergency plan. Each county agency has designated responsibilities during an emergency, and an emergency center provides information and coordinates activities.

City of Sacramento. - The City's emergency plan also includes procedures to be followed during a flood. The public-works director coordinates activities from the City's Emergency Operations Center. All City departments have specific responsibilities during pre-emergency, emergency, and post-emergency (recovery) periods. Actions during a flood may include notifying and mobilizing personnel and resources; patrolling levees; closing floodgates; coordinating activities with other local, State, and Federal agencies; and assisting flood control districts to maintain the integrity of local levees.

FUTURE CONDITIONS WITHOUT PROJECT

In order to establish a baseline against which to measure the beneficial and adverse effects of implementing a flood control project in the study area, this section describes the future conditions likely to occur in the study area if such a project is not constructed. These "future without-project" conditions were based on two fundamental assumptions: (1) the Federal Government would take no action to control floodflows in the American River beyond current levels, and (2) the multipurpose Auburn Dam project as currently authorized would not be constructed.

Land Use

Without Federal action to control floodflows in the American River, most of the City of Sacramento and virtually all of the Natomas basin would remain in the 100-year flood plain. FEMA would promulgate new Flood Insurance Rate Maps delineating this flood plain area and showing the base flood elevations (the level likely to be reached by uncontrolled flows in the event of a 100-year flood) determined in the aftermath of the 1986 storm. FEMA's new maps would become effective after November 1992 when the special legislation restricting use of the post-1986 base flood elevations expires (see discussion in EIS/EIR Chapter 4). Under existing local and Federal flood plain management regulations, flood insurance would be required for existing structures within the 100-year flood plain. Any new residential structures would have to be elevated at least one foot above the applicable base flood elevation. Nonresidential structures would have to be elevated above, or flood proofed to, the base flood elevation.

In Natomas, high base flood elevations throughout the developable portions of the basin would make compliance with these regulations infeasible. As a result, growth which would otherwise have been absorbed in Natomas would shift to nonflood prone areas in the region. In the heavily developed lower American River area, infill would continue in accordance with existing local plans in areas where base flood elevations are relatively moderate (1 to 3 feet) and compliance with flood management restrictions would be feasible. Growth would be severely constrained, however, in a portion of south Sacramento, specifically the Meadowview area of the City below Meadowview Road, and a small portion of the Pocket area, where base flood elevations exceed 5 feet.

In the upper American River area, the land in the canyon area would remain in public ownership. Growth in the surrounding communities would depend on the availability of water supplies, wastewater facilities, transportation facilities and other infrastructure. Reliable estimates of growth under this scenario are not available (see EIS/EIR Chapter 15).

Population

Under without-project conditions, no additional residential development would occur in Natomas or in the Meadowview area of the City after 1992. Increases in population which would otherwise have occurred in these areas would shift to nonflood plain areas in other parts of the Sacramento region. Based on infill in the developable portions of the flood plain, population in the lower American River area as a whole would increase to about 410,000 by the year 2010. Population in the upper American River area would increase in accordance with State Department of Finance projections to about 94,000 by the year 2045.

Socioeconomic Conditions

Growth in the upper American River area, in the developable portions of the flood plain, and in areas of metropolitan Sacramento outside the flood plain would provide increased economic opportunities and generate a substantial need for new housing, additional water supply, increased sewage capacity, new school facilities and other public infrastructure and services. As noted, inadequate water supply and sewage capacity are expected to be significant constraints on the rate of growth in the upper American River area. Providing new school facilities is likely to be an acute problem in all areas.

Flooding in connection with a 70-year or greater storm would significantly disrupt economic activity and the conduct of governmental business in Sacramento on a short-term basis. Property values in the developed portions of the flood plain would be depressed, particularly if flood damage exceeded 50 percent of the pre-flood value of the property. In that case, FEMA regulations would require reconstructed buildings to be elevated above the base flood elevation. Since this would be infeasible in the Natomas and some southern areas of the City, property values in these areas might never recover to their pre-flood levels. Finally, flooding would produce a significant short-term solid waste disposal problem due to debris generation. It is estimated that a flood covering all 110,000 acres of the flood plain would generate almost 90,000 tons of debris to be cleaned up and disposed of.

Water Quality

No significant change in water quality in the upper American River would likely occur. In the lower American River, water quality would depend on upstream water diversions and the effects of urbanization on discharges into downstream receiving waters. With respect to upstream water diversions, the USBR is expected to maintain the modified D-893 criteria (flow requirements) currently in use. It is assumed that increased water demand would result in flows closer to D-893 minimums than current operations. However, State Water Resources Control Board hearings on Delta water quality and American River water rights could affect CVP operations and restrict future diversions from the American River. Floodflows of a 70-year or greater magnitude could inundate the flood plain and trigger uncontrolled releases of hazardous and toxic waste materials into local waters.

Air Quality

Continued growth in the developable portions of the American River flood plain and in areas of the Sacramento region outside the flood plain would produce new emission sources and make attainment of State and Federal ozone and carbon monoxide standards more difficult. Compliance with the air quality attainment plan recently adopted by the Sacramento Metropolitan Air Quality Management District would create sufficient offsets in developed areas of the region to accommodate new emission sources while still achieving the overall reductions in emissions necessary to meet State and Federal standards. However, Sacramento has failed to comply with three previous air quality attainment plans. Thus, while improvements in regional air quality could be anticipated, it is likely that Sacramento would continue in a nonattainment status for ozone and carbon monoxide.

Transportation

As regional urbanization pressures continue in the upper American River, along with migration to the foothill environment, transportation facilities would be constructed to support the growth. Highway 49 and other roads into areas south of Auburn would likely be upgraded. It is expected that transportation facilities in the lower American River would be modified or constructed to meet increasing population needs.

Vegetation and Fish and Wildlife

Under without-project conditions, vegetation in the upper American River would be similar to existing conditions. Assuming Auburn Dam is not constructed, some revegetation would likely occur in areas scarred by the construction of the dam foundation. Vegetation on other public lands would likely remain unchanged. However, over time the diversity of the existing vegetation on private lands in the foothills would likely change as lands are converted to more dense residential-related uses.

A decline in aquatic resources is expected in the lower American River. The level of decline will depend on a combination of factors, including rainfall in the watershed, upstream water diversions, poorer water quality due to increased urban discharges, recreation use, increased demand in the CVP, Delta water quality releases, and evolving instream flow requirements. Little loss of agricultural and natural lands in

Natomas would be expected due to flood-related constraints on urban expansion.

Without Federal action to control floodflows in the American River, areas within the flood plain would remain exposed to a substantial long-term risk of flooding. Wildlife populations occupying these areas could be adversely affected by flooding. Depending on the timing and extent of inundation, species lacking mobility could drown. Existing fish populations could be reduced if local waterways became contaminated due to flood-related releases of toxic and hazardous materials. The casualties could include some special status wildlife species such as the California giant garter snake and the valley elderberry longhorn beetle which are subject to drowning.

Cultural Resources

Certain impacts to cultural resources would be expected in the project area even without a project. Prehistoric and historic sites could be destroyed by urban expansion in the developable portions of the flood plain, and agricultural practices could damage sites in Natomas. Prehistoric sites could be affected by a number of natural processes, such as erosion, root and rodent intrusion, flooding, and grazing. Vandalism through deliberate looting and collecting has been identified as a national problem and would continue. Historic structures located in the flood plain could be damaged in the event of a 70-year or greater flood.

Hazardous and Toxic Waste

No hazardous and toxic waste sites have been identified in the upper American River area. However, over 1,000 sites have been located within the flood plain portion of the study area. About 334 of the sites in the flood plain could result in significant contamination if they were inundated. These sites are host to leaking tanks, pits containing hazardous substances, and similar storage or disposal facilities. Of these potentially dangerous sites, 175 present an especially serious threat. This category includes sites slated for action (cleanup and/or further monitoring) under one or more of the governmental efforts to address hazardous and toxic waste issues in the Sacramento area. Aside from these listed sites, the flood plain contains other hazardous materials which could cause significant problems in the event of a flood. These 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, flooding in the Sacramento area could trigger a massive uncontrolled release of contaminants into the waterways surrounding the flood plain.

Noise

The noise levels of the study area could be expected to remain at or near their present levels. This is due to the fact that development in Natomas and the lower American River would be severely restricted due to FEMA regulations.

Recreation

Recreation use of Folsom Lake, the American River and the American River Parkway is expected to increase in the future. The County of Sacramento estimates that use of the parkway will increase from 5.5 million people in 1988 to about 7.5 million in 2000. Recreational use of Folsom Lake will increase from the current 2.1 million visitors to 3.4 million by the year 2000.

CHAPTER III

SACRAMENTO AREA FLOOD PROBLEMS

The flood control planning objective for this watershed is to protect the urbanized area from large floods caused by rare storms. To quantify the potential for flooding, it is necessary to determine what size floods can be expected in the future and how often floods of various sizes are likely to occur. Long-term weather patterns are irregular and unpredictable. This uncertainty affects the methods used to determine the magnitude of future floods.

Limited historical runoff data are available for the American River basin. For this investigation, 82 years of runoff data were available for evaluating flow frequencies and magnitudes. Although this length of record is much better than the length of record for many rivers in California, it is still considered a relatively short period of time. In comparison, over 2,000 years of record are available for the Yellow River in China. It is important to understand that even though this study is based on past events that we assume will be equaled in the future, significantly greater floodflows may also occur.

Studies of storms and floods of record indicate that critical flood-producing conditions in the American River basin will exist only during the winter season when there is a wet snowpack and a prolonged series of general storms occurring over the entire basin. Usually, storm precipitation amounts are distributed in the same general pattern as normal annual precipitation amounts. Major departures from this pattern do occur, however. Generally, a storm series will last from 2 to 5 days; however, some series have been longer (the 1986 storm lasted 10 days). During such periods, ground-water levels rise, infiltration capacities decline, and the natural and artificial storage within the basin is progressively filled.

Floodflows in the American River basin are rather frequent and of two general types--winter rainfloods (a rain-on-snow situation) and spring snowmelt floods. Historically, only floodflows resulting from intense winter rainfall over the foothills and mountains have caused serious flooding. Outside the winter season, storms are less severe, cover smaller portions of the basin at a time, and are so widely separated in time that existing basin flood control facilities are easily capable of controlling the runoff.

MAIN STEM AMERICAN RIVER HYDROLOGY

The climate and geography of the Sacramento Valley combine to form an area where flooding is not unusual. Indian folklore and newspaper accounts mention at least nine major floods prior to 1890. The losses throughout the valley due to these early floods were large. Until floodwaters subsided, transportation, business, and farming came to a standstill. Estimated losses in 41 reclamation districts during the flood of January 1909 were more than $4.5 million (1909 dollars); losses during the March 1907 flood were somewhat larger. Concerns over these losses led to construction of the current flood control system.

At least eight large floods have occurred in the lower American and Sacramento River basins since Folsom Dam became operational. As shown in Figure III-1, these occurred in 1955, 1963, 1964, 1969, 1970, 1980, 1982, and 1986. For comparison purposes, the 6-day volume is presented in Figure III-1, because the Reservoir Design Flood (RDF) at Folsom is a 6-day flood. Table III-1 shows the estimated peak flows of these floods on the Sacramento River at "I" Street and on the American River at the Fair Oaks gage.

TABLE III-1

ESTIMATED PEAK FLOWS OF HISTORIC FLOOD EVENTS

Date of Flood	Sacramento River at "I" Street (cfs) 1/	American River at Fair Oaks Gage (cfs)
November 1950 2/	104,000	180,000
December 1955	95,000	72,000
February 1963	98,000	101,000
December 1964	100,000	115,000
January 1969	96,000	73,000
January 1970	94,000	57,000
January 1980	94,600	76,000
December 1982	98,000	91,000
February 1986	109,000	134,000

1/ The design flow of the Sacramento River at "I" Street is 110,000 cfs.

2/ Prior to Folsom Dam and the completion of levees on the north side of the American River.

Annual Maximum 6-Day Volume
American River at Fair Oaks Gage
Unregulated Condition

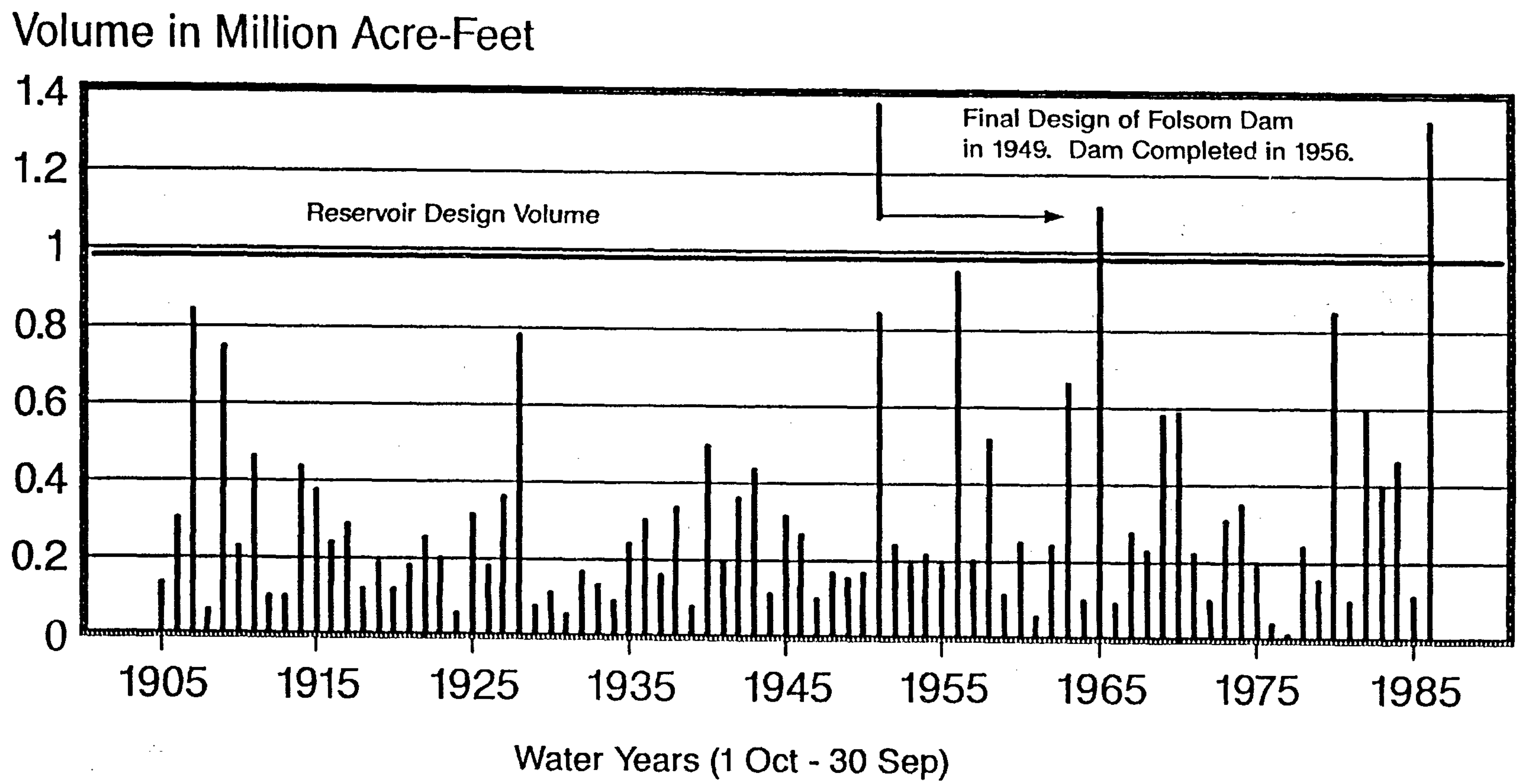


FIGURE III-1

In February 1986, large floodflows in the American River basin caused record inflow volumes to Folsom Reservoir. Significant levee damage occurred along the lower American River. Because of fairly dry conditions in the basin earlier in the water year, about 200,000 acre-feet of storage space was available in several reservoirs upstream from Folsom. Releases up to 130,000 cfs were made from Folsom Dam for about 48 hours, which exceeded the objective outflow of 115,000 cfs. Table III-2 shows the estimated peak flows and frequencies for several locations along the American River for the 1986 flood event.

TABLE III-2

RECURRENCE INTERVALS FOR PEAK FLOWS AND STAGES OF THE FEBRUARY 1986 FLOOD

Location	Peak Runoff (cfs)	Stage (ft)	Approximate Recurrence Interval (years)
Dry Creek	9,500	--	90
Arcade Creek	5,000	--	50
Natomas Cross Canal	1/	--	50
American River			
Nimbus Dam to confluence with NEMDC	132,000	--	70
Downstream from confluence with NEMDC	140,000	--	70
Sacramento River			
Ord Ferry	190,000	118.0	10
Verona	93,000	39.1	50 3/
I Street	109,000	30.6	70 3/
Freeport	117,000	25.1	--
Sacramento Weir Spill	127,700	30.6 2/	--
Yolo Bypass			
Fremont Weir Spill	341,000	38.5	50 3/
Lisbon	500,000(est)	24.9	70 3/

1/ Inflows to the NCC and Pleasant Grove Canal were about 14,000 cfs.
2/ Observed water-surface elevation on Sacramento River 550 feet upstream from weir.
3/ Estimated recurrence interval based on February 1986 stage.

Previous Hydrology Studies

Folsom Dam was built by the Corps to protect urban Sacramento from "the flood which would result from the occurrence, directly over the drainage basin, or the largest rainstorm of record within the region, at a time when ground and snow cover conditions are moderately conducive to high runoff." The largest rainstorm of record at that time was the storm of 1937. Thus, the dam was designed to safely pass the flood that would have resulted had the 1937 storm occurred directly over the drainage basin (RDF). The necessary calculations were made to handle a winter rainstorm with a peak flow of 340,000 cfs and a 6-day volume of 978,000 acre-feet. In establishing the frequency of such a storm, the Corps extrapolated from what was then less than a 50-year record, accounted for the unrecorded but apparently very large storm of 1862, and concluded that the RDF was not likely to occur any more often than once every 250 years.

Notwithstanding this conclusion, the storm of 1955, occurring just prior to the formal commencement of Folsom Dam operations, proved to be larger than the 1937 event. In fact, it was concluded that had the 1955 storm occurred directly over the basin, and had Folsom been fully operational at the time, the dam could not have safely handled the storm.

As a result, in 1961 the Corps reanalyzed the rainflood-frequency curve for the American River using updated procedures which use a 5-day flood hydrograph instead of the 6-day hydrograph. The new curve was based on two assumptions:

- The 1955 storm, when centered directly over the basin, would produce a flood event representative of "the most severe combination of meteorological and hydrological conditions that are considered reasonably characteristic of the geographic area in which the drainage is located" (standard project flood (SPF)).

- This event, based on experience in other basins and in light of the existing record for the American River basin, could be presumed to occur approximately once every 200-300 years.

The SPF was determined to have a peak flow of 460,000 cfs and a 5-day runoff of 1,296,000 acre-feet. Both of these figures greatly exceeded the original RDF. Thus, when the new frequency curve for the American River was produced using the Corps' assumptions regarding the SPF, the curve showed the RDF to have a frequency of once every 120 years. This conclusion and the general assumptions underlying the new curve were strengthened when both the peak flow and 5-day volume achieved by the storm of 1964 exceeded those of the 1937 storm.

Current Hydrology Study

The record storm of 1986 once again demonstrated the difficulties inherent in the efforts to anticipate large storm events by extrapolation from a sparse record. After correcting for the effects of the collapse of the Auburn cofferdam, which occurred during the fourth day of the storm, it was determined that the storm had an unregulated 1-day inflow of 171,000 cfs. Note on Figure III-1 that the 1986 volume was 16.5 percent greater than the RDF. Except for the effects of available storage in the water and power reservoirs located in the upper reaches of the basin, the storm would have had an unregulated 5-day runoff of 1,250,000 acre-feet, a volume comparable to the SPF. In order to reduce the possibility of uncontrolled releases during the storm, releases from Folsom Dam exceeded 115,000 cfs for 2 days, reaching 130,000 cfs for about 24 hours. This flow created erosion damage at several points along the lower American River levees and caused stormwater to reach within a foot of overtopping the west bank of the NEMDC.

In the aftermath of the 1986 storm, an ongoing effort to reevaluate flood frequencies in the American River basin was completed. The first step in this analysis was to update the unregulated rain flood volume-frequency relationships at the Fair Oaks gage downstream from Folsom Dam. These relationships reflected the flow data collected for the period 1905 to 1954 and adjusted flow data from 1955 to 1986. The adjusted flow removes the effects of Folsom Reservoir and the water and power reservoirs located in the upper reaches of the north, middle, and south fork drainage areas. There are at least 17 of these upstream facilities. However, only French Meadows, Hell Hole, Loon Lake, Union Valley, and Ice House Reservoirs significantly affect floodflows in the basin. Adjusting for the effects of these reservoirs is necessary to provide a consistent record for statistical analysis.

The updated rain flood data showed that the unregulated 1-day flow of the 1986 storm was not far out of line with previous large storms, particularly the events of 1955 and 1964. However, the unregulated 3-, 5-, 7- and 10-day volumes generated by the 1986 storm far exceeded any previously recorded event, and required a significant reassessment of the 1961 frequency curve. This reassessment was guided by two considerations:

- Given the brevity of the rain flood record for the basin, a substantial measure of uncertainty persists as to the frequency of large storms along the American River. In fact, 5 of the 10 largest storms in the basin have occurred since 1962, and the last and largest of these, the 1986 event, produced volumes not anticipated by the 1961 curve.

- Since the assumptions used in creating an updated rain flood-frequency curve might well serve as the basis for adding new flood control capacity to the existing system, it would make sense to adopt sufficiently conservative assumptions to ensure adequate sizing of the needed flood control measures.

If the frequency of various size floods is underestimated, the various flood control measures implemented may later be found to be inadequate. Flood control facilities are designed to protect the health, safety, and security of people from floods and flood damages. If flow frequencies and magnitudes are underestimated, then the flood risk to the community is increased.

Consequently, methodologies must be used that most accurately depict flooding conditions that may occur in the future. The Corps uses expected probability adjustments in flow-frequency analysis for the development of flood control projects. The principles of this approach are described in Water Resources Council's Bulletin 17B, "Guidelines for Determining Flood Flow Frequency," September 1981, prepared to give Federal agencies guidance in planning water resources projects. Additional information on this subject is included in the Pertinent Correspondence, Hydrology, and Comments and Responses Appendixes.

An updated unregulated flood-frequency curve was produced using an expected probability adjustment. It shows the 1986 runoff as a 70-year event and indicated the 100-year flood to be one with an unregulated peak flow of 353,000 cfs and an unregulated 5-day runoff of 1,500,000 acre-feet. The 200-year event is shown as a flood with an unregulated peak flow of 442,000 cfs and an unregulated 5-day runoff of 1,900,000 acre-feet.

Based on the updated unregulated flood-frequency curve, the Corps developed a regulated peak flow-frequency curve at the Fair Oaks stream-gaging station (see Plate 6). This curve essentially measures the flood control capacity of Folsom Dam by indicating the flood frequency at which releases from the dam exceed 115,000 cfs in the lower American River channel. The curve demonstrates that the current system can contain floods up to about a 63-year level of frequency.

Prior to 1986, the previous regulated 100-year flow was 115,000 cfs; after reanalysis the 100-year flow increased to 230,000 cfs with expected probability and 180,000 cfs without expected probability. This revised 100-year flow required updating of FEMA flood plain maps for the Sacramento area.

FEMA's policy does not consider expected probability. Not using expected probability is acceptable for FEMA because the analysis is used solely for flood insurance purposes. FEMA indicates that it is relatively simple to adjust flood insurance regulations if flood probabilities are changed by analysis of additional data.

The above discussion relative to the historical underestimation of the frequency of the various size floods along the American River points to one of the underlying reasons the local sponsors of this study opted for a level of protection against not less than a 200-year flood. It could lead to potential future tragic consequences if a low level of protection such as the 100-year (FEMA) level is constructed, as a number of commenters to the draft report had proposed, and additional future hydrologic events and analysis determine that the level of protection is less than previously calculated.

Capacity of Existing System

The ability of the existing system to safely handle floodflows in the American River basin depends primarily on the capability of Folsom Reservoir to control flows on the lower American River to the design channel capacity of 115,000 cfs. Other factors include antecedent soil moisture in the upper basin, the nature of the precipitation (rain or snow) at higher elevations, and, to some extent, the capacity which may be available in the upstream power generation reservoirs. Based on the flow-frequency estimates made following the 1986 flood and the Corps estimates of existing capacity, the current system can maintain safe channel flows downstream from Folsom for about a 63-year event. As a result, the risk of flooding in highly urbanized portions of the Sacramento metropolitan area is greater than the 1961 analysis indicated.

Upstream Storage

Existing upstream storage was considered for flood routings of 100-year events or less. Available space was computed by analyzing the five major upstream reservoirs--French Meadows, Hell Hole, Loon Lake, Union Valley, and Ice House. These reservoirs account for about 90 percent of the storage upstream from Folsom. Upstream storage was analyzed using data from 21 historical floods to determine how much storage actually existed before each storm. The analysis considered the effect of each reservoir during historical and future events. Several of these reservoirs have a considerable storage capacity, although they do not control a large drainage area. The peak flow-frequency curve for existing conditions for the American River at Fair Oaks (Plate 6) reflects the effects of the storage in the upstream reservoir.

This available space was computed from the storage in these reservoirs below each reservoir's spillway crest prior to the maximum 15-day inflow for Folsom Reservoir for each year of record. Upstream storage was calculated by the following process:

- The greatest flood period was determined for each year since completion of the five major upstream reservoirs.

- The storage in each reservoir at the beginning of the flood period was obtained.

- The storage that could have been used for the 100-year event was tabulated for each reservoir. The sum of this storage represented the maximum storage potentially available upstream from Folsom Reservoir.

- The total storage amounts for each year were evaluated statistically to determine the probability that specific storage amounts would be available.

From this analysis, storage of 47,000 acre-feet was determined to be available through the 100-year event. For rarer events, upstream storage was assumed unavailable because events greater than 100 years generally occur on a saturated basin and all existing upstream reservoir space is occupied.

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.) They control 14 percent of the drainage area which historically generates 15 percent annually of the runoff into Folsom Lake. 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 (including instream flows), (2) significant loss of hydropower generation potential, (3) inaccessibility during storm periods, and (4) the increased costs associated with flood control operations.

Several comments received on the draft feasibility report referenced the fairly large vacant space available in the major upstream reservoirs in most winter periods. The commenters questioned only crediting up to 47,000 acre-feet for flood control during major flood events to upstream storage. Subsequent reanalysis by the Corps confirmed that this was the maximum creditable space for major storm events with a return period less than about 100 years. There are too many variables and uncertainties associated with the effects on flows in the American River basin to assume that these facilities will produce any more than a modest reduction in the volume of water which must be processed through Folsom Reservoir.

Operational Considerations

The ability of Folsom Dam to maintain design flows in the channel is based on the amount of reservoir storage space available for flood control and the efficiency with which the dam can be operated to achieve design releases during a storm. Under existing operating criteria, 400,000 acre-feet of the total storage of 1,010,000 acre-feet at Folsom is allocated to flood control during the flood season. Releases from the dam can be made through eight gated outlets at the lower levels of the dam, three power penstocks, and eight spillway gates. Only five of these spillway gates are used in regular operation. The other three auxiliary spillway gates are used only in dam safety emergencies. Releases are limited by the capacity of these discharge structures and by existing operation criteria which limit the rate at which releases may be increased.

When the reservoir has 400,000 acre-feet of flood space available, the reservoir contains 610,000 acre-feet of water, and the maximum discharge capacity is about 36,000 cfs. As floodwaters enter the reservoir and inflow exceeds the maximum outlet capacity, the reservoir starts to fill. As the water level rises, the maximum outlet capacity increases until 115,000 cfs can be discharged with the reservoir storage at 790,000 acre-feet. The discharge may then be maintained at 115,000 cfs by regulating the five spillway gates. However, existing operational criteria state that discharges should not be increased any faster than 15,000 cfs every 2 hours, so as to minimize erosion of the levees in the lower American River channel and allow patrolling of the levee.

Past performance records reflect the difficulties inherent in operating a facility like Folsom Reservoir. Because of the climate and topography of the basin, major storms build and dissipate relatively quickly, depositing large volumes of water in a matter of days. These stormwaters reach Folsom Dam very quickly, providing dam operators with little reaction time. To complicate matters, limited outlet works capacity at low reservoir elevations can delay increasing outflows, thereby increasing needed storage and compromising efficient use of this storage. Even though dam operators attempt to follow the prescribed flood control operation, they may legitimately delay increasing releases. The delays may be prompted by the need to patrol the levees downstream, evacuate people from the parkway, and limit damage to the facilities in the parkway until it is certain that reservoir inflows dictate an increase in releases. Reservoir operation considers the inexact science of forecasting incoming storms, precipitation amounts, and basin runoff. Release decisions are determined by the flood control diagram.

However, in actual operations, these decisions must consider that although it is desirable to empty the flood control space as fast as possible, it is not desirable to cause undue downstream flooding by exceeding threshold values until factors such as increased inflow amounts and weather conditions can be accurately determined and require greater releases.

Operation of Folsom Reservoir. - The Corps attempts to anticipate as many operational conditions as possible when preparing the reservoir flood control operation guidelines. These guidelines are flexible to allow for changing conditions during actual flood operations. The guidelines require a maximum of 400,000 acre-feet of flood control storage during the winter flood season. A prudent reservoir operation requires that releases do not exceed current or recent event peak inflow at any time. This is to ensure that the operation does not create a condition worse than what would occur without the project. Interagency coordination of release schedules for large flood releases, the time to warn of these pending releases, and other concerns may contribute to release delays. Even short delays can translate into significant encroachment due to the basin's potential for generating a large volume of inflow in a relatively short time, and Folsom Dam's inability to pass these high inflows early.

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 and without the use of surcharge storage. Large reservoirs are more sensitive to volume than to peak flow. (The large storage in the reservoir will attenuate the peak flow.) The longer that inflow exceeds downstream channel capacities, the more critical available storage becomes. Major floods are often composed of a series of storm fronts extending over many days. If there is no break between storm fronts to allow evacuation of the flood control storage space, the total runoff volume becomes the critical element in the operation. This occurred in 1986.

The RDF operation is hypothetical. However, during actual flood situations, as in February 1986, forecasted inflows and other information are considered when operating Folsom Dam. A hydrometeorological network of gages installed at 12 locations in the basin above Folsom Lake transmit data on rain, snow, and temperature to a computer model located at the National Weather Service River Forecast Center in Sacramento. An accurate prediction of inflow requires advance 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 not accurate enough to be used to operate a reservoir for more than a few hours in advance of the prediction. Many of these considerations are addressed in the report

"Preventing a Crisis: The Operation of Folsom Dam During the 1986 Flood," which describes Folsom Dam operation during the period of February 14-19, 1986.

In developing flood control alternatives for this study, the Corps applied operation and design contingencies. These contingencies account for uncertainties in realtime operation that have been experienced during 31 years of actual operation, 1956-86. At the beginning of each hypothetical flood used to evaluate the alternatives in this report, the operating contingencies for beginning storage space and for outflow were developed. When flood control releases greater than 20,000 cfs were made, Folsom Reservoir storage encroached 80,000 acre-feet, on the average, into the flood control space. This encroachment occurs because of the complexity of making realtime decisions in the operation of the reservoir, as described earlier. Below Folsom Dam, damage begins at 20,000 cfs.

Lower American River Channel Capacity and Flood Stage. - Channel capacity is an important consideration in determining flow-frequency relationships for the American River. The Corps estimate of the capacity of the lower American is based on the design of the most recent structural modifications to the levee system. These involve levee construction and modification along the river from Cal Expo upstream to the Carmichael Bluffs. This reach of levee was designed to handle sustained flows of about 115,000 cfs with 5 feet of freeboard.

Levees along the lower American River have been constructed and modified over many years. Originally, near downtown Sacramento, the levees were designed to accommodate a peak flow of 180,000 cfs. Today, with the existence of Folsom Reservoir, floodflows can be attenuated for a much longer duration, but the levees cannot safely pass a sustained flow of 180,000 cfs. After the February 1986 flood, extensive geotechnical evaluations of the levees were conducted. It was determined that there are reaches which will exhibit structural deficiencies with sustained flows as low as 130,000 cfs. Accordingly, the levees along the lower river are believed to be able to safely accommodate a sustained flow of only 115,000 cfs.

Using current survey information, a hydraulic backwater model of the lower river was developed. High-water marks for the 1986 flood along with known outflows from Folsom Dam were used to calibrate the model. The results indicate that the current channel capacity does not exceed the historical capacity. Some "downcutting" or deepening may have occurred within the channel as a result of high flows, but not enough to significantly increase the channel capacity for floodflow events. It is doubtful that the channel could handle flows in excess of 115,000 cfs for any sustained period. During the 1986 flood, serious erosion occurred at several points in the American River levee system as a result of flows between 115,000 and 130,000 cfs.

Stages in the lower American River downstream from the "H" Street bridge are dependent on the flood stage in the Sacramento River. Historically, floods on the Sacramento and American Rivers have peaked within 1 day of each other at the confluence of the two rivers. The impact of upstream weirs, reservoirs, and uncontrolled runoff influences when the peaks occur on the Sacramento. However, for major floods caused by a series of large storm fronts moving through the area, the high volumes of resulting runoff tax the flood control system and reservoirs. Flood hydrographs from these large storm series are of long duration with broad peaks because of the coordination between uncontrolled area runoff and releases from reservoirs to evacuate the flood control spaces. This creates a greater probability of the peaks occurring coincidentally, which happened in 1955, 1964, 1983, and 1986. Therefore, because of the uncertainty of how floods will occur in the Sacramento and American River basins, and for safety considerations, the Sacramento and American River flood peaks were made to occur coincidentally.

NATOMAS HYDROLOGY

River channels, bypasses, and streams in Natomas make up a very complex hydrologic system. Flows in Arcade and Dry Creeks and NCC, as well as the Sacramento and American Rivers, can affect the potential for flooding in Natomas. Hydrologic data for all areas but the Sacramento and American basins are limited to high-water marks and miscellaneous staff gage elevation readings of various floods. Minimal runoff data exist for these tributary basins. Consequently, analysis of Natomas was done mainly through flow- and stage-frequency analyses and modeling, as described below. The modeling was based primarily on data from the February 14-22, 1986, and February 29 through March 9, 1983, floods.

Natomas is greatly influenced by backwater effects from both the American and Sacramento River systems. High flood stages in both rivers cause high flood stages in the NEMDC. In turn, these high water elevations cause even higher water elevations in Dry and Arcade Creeks. The hydrologic conditions of the American River basin and the Sacramento River system jointly affect flooding problems in Natomas.

The Sacramento River system upstream from Sacramento is very complex. Many flood control and other water resource-related projects have been constructed on the system. Together, these projects greatly influence the quantity and timing of floodwaters that eventually reach the Sacramento area. The drainage area north of Sacramento consists of several subbasins, including

Butte and Sutter basins, the Colusa Trough, and the Feather River basin. The flood control facilities in these basins, and how they are operated, must be taken into account in determining the conveyance of floodwaters to the Sacramento area and, ultimately, the impact on flooding in Natomas. Reservoirs in the upper Sacramento basin include Shasta, Black Butte, Oroville, and New Bullards Bar. In addition, levee systems have been constructed on most of the river system above Sacramento. In evaluating historic hydrologic data, it is necessary to account for each of these facilities, and how they affect the transport of floodwaters to the Sacramento area. For this investigation, several computer models were developed to determine the hydrologic characteristics of these basins and their interactions. These models have been calibrated to historic data to ensure that the computations are reasonably accurate.

Only minimal runoff data exist for historic floods in the Arcade Creek, Dry Creek, NCC, and Elverta drainage basins. Limited data from the 1986 and 1983 floods, including high-water marks and miscellaneous staff gage readings, were used to develop computer models of the interaction of the Natomas basin tributaries with the backwater effects of the Sacramento and American Rivers.

Flood of Record

Significant levee damage also occurred along the Sacramento River during the 1986 flood. Reconstruction was started in 1990 for those levee reach areas along the Sacramento River that showed slope instability. High stages in the Sacramento River at the mouth of NCC occurred with significant runoff into the canal from tributary streams from the east (peak runoff from these tributary streams was estimated at 14,000 cfs--about a 50-year flood), resulting in inundation of about 6,000 acres in the Dry Creek and Pleasant Grove area. Remaining freeboard on the NEMDC near Main Avenue and the NCC near the Highway 99 bridge ranged from 0.5 foot to 2 feet. In addition, floodwaters reached the understructure of the Highway 99 bridge that crosses the NCC. Floodwater flowed over Main Avenue along the NEMDC. Also, levees in the Pleasant Grove area were overtopped, permitting floodwaters to move south and into the NEMDC, which added to the flooding in the lower Dry Creek area and Rio Linda. A portion of these floodwaters also moved across a low point in the levee system at Sankey Road, flooding a small area of Natomas and threatening closure of Highway 99. Emergency sandbagging was used to block the opening at Sankey Road and prevent overtopping of the highway. Several thousand acres were flooded east of the NEMDC between Sankey Road and Dry Creek. Flooding was caused by backwater from the American River, runoff from the Dry Creek basin (peak runoff was estimated at 9,500 cfs--about a 90-year flood), and floodwaters entering the NEMDC from other tributaries.

The observed minimum freeboard along the Sacramento River downstream from the NCC was about 2.5 feet on the Natomas side. In addition, freeboard measurements of about 2 feet were made in the vicinity of Sacramento's Old Town, which is located just downstream from the "I" Street bridge. Another critical area was West Sacramento, where localized sandbagging was necessary to prevent overflow from the levee embankment upstream from Business 80 on the east levee of Yolo Bypass. Measurements in this area showed freeboard of from 1 foot to 2 feet.

Had these high flows continued much longer or increased, major levee failure and flooding likely would have occurred along the Sacramento and American Rivers and NEMDC. (Table III-3 shows peak flows and estimated recurrence intervals at various locations in Natomas during the 1986 flood.)

Stage-Frequency Relationships

Stage-frequency relationships and water-surface profiles were developed to determine the current levels of flood protection throughout the area and to determine the benefits of any project alternatives to resolve the problems. Stage-frequency curves were developed for (1) Sacramento River at the west end of Fremont Weir, (2) Sacramento River at Verona, (3) Sacramento River at "I" Street, (4) American River at "H" Street, (5) Yolo Bypass at Woodland, and (6) Yolo Bypass at Lisbon. Hydrologic and hydraulic numerical models were used to compute water-surface profiles for floods of various frequencies along the Sacramento River, NCC, NEMDC, and Dry and Arcade Creeks. A detailed description of stage-frequency relationships is included in the Hydrology Appendix.

FLOODING AND CONSEQUENCES

The frequency and extent of major flooding in the study area were estimated on the basis of hydrologic information and data about levee and channel conditions. Several important assumptions were made concerning (1) coincidence of major flood events, (2) actions by local interests, and (3) levee failure.

It was assumed that the frequency of floods between 50 and 100 years would be the same throughout the basin. For example, for a 100-year floodflow release from Folsom Dam, there would be a 100-year event in the NEMDC and the Sacramento River. This assumption is fairly consistent with occurrences during the February 1986 flood, which was generally a 70-year event throughout the basin. For events greater than 100 years, it was assumed that the concurrent event on tributary streams would be 100 years.

Actions by local interests during a major flood could include evacuation warning, installation of floodgates (see Plate 2), and flood area management during and after the event. These actions would provide some flood protection to the downtown area. For economic purposes, it was assumed that the floodgates would be in place prior to any threat of major levee break.

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 were significantly below design freeboard. During the February 1986 flood, levee damage from erosion occurred at several American River locations having adequate freeboard. At other locations, floodflows encroached into the freeboard, but significant damages did not occur. For this study, elevations of potential levee failure were based on encroachment into the levee freeboard and a projection of the impacts of this encroachment on the physical system. Failure is expected to occur 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 analysis of levee failure is based on several main factors. One is the assumption that the levee improvements described in the Sacramento River Flood Control System Evaluation, Phase I (Sacramento Urban Area) would be complete (i.e., Sacramento area levees are stable at their design flow). A second factor is the observed condition of the levees in relation to geotechnical evaluation and the function of the system during the February 1986 high flows. These conditions are described in the Geotechnical Investigations Appendix. The last was hydrologic observations and forecasts described in the Hydrology Appendix.

Table III-3 is a summary of remaining freeboard, stages (or flows) at which levee failure could occur, and frequencies used for the levee failure evaluations.

Included in the Economics Appendix is a more detailed description of the estimated location and sequencing of levee failure used for this investigation.

Flood Plains

Flood plain maps were developed to identify areas subject to flooding in and around Sacramento. Plate 7 shows the flood plains for the 100- and 400-year events (500-year event for the Dry Creek area). The flood plains were delineated into six reaches, and each reach was then broken into subreaches of either

TABLE III-3

POTENTIAL LEVEE FAILURE 1/

Levee Reach	Remaining Freeboard 2/ at Failure (Feet)	Stage or Flows 3/	Return Period (years)
Reclamation District 1000			
Sacramento River (Left Bank)			
NCC to NEMDC	3	5/	--
NCC (North and South Levees)	2 4/	40.0 ft.	200
NEMDC (West Levee)	1.5 4/	35.4 ft.	71
American River Levee System			
North (Right) Bank, Sacramento River to River Mile 5.2	3	180,000+ cfs	85+
North (Right) Bank, upstream from River Mile 5.2	4	140,000 cfs	71
South (Left) Bank, Sacramento River to River Mile 5.2	5	140,000 cfs	71
South (Left) Bank, River Mile 5.2 River Mile 7.8	5	145,000 cfs	73
South (Left) Bank, upstream from River Mile 7.8	4	200,000 cfs 6/	94
Dry and Arcade Creeks, and East Levee of the NEMDC	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 NCC to the Sacramento Bypass	8/	--	--

1/ For flood damage estimates only. Actual levee failures may occur at higher or lower flows and stages.

2/ Assumptions: (a) levee rehabilitation as part of the Sacramento River Flood Control and Sacramento River Bank Protection Projects in Sacramento area has 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 cause 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.

ponding or overflow areas. The 400-year flood plain covers about 110,000 acres.

Flooding from levee failure would be similar in Natomas, downtown Sacramento, and, to some extent, north Sacramento areas regardless of the frequency of the flood event because (1) the ground elevation adjacent to the levees in these locations is lower than the water surface in the river, and (2) the volume of water in the American River (and Sacramento River in the case of Natomas and downtown Sacramento) would fill the flood plains to similar depths. However, along the Dry Creek, south Sacramento, and Rancho Cordova reaches, progressively more area would be flooded as increased flows are diverted through the levee break.

Flooding in the Natomas area can be influenced by flows and stages in the Sacramento River and failure of levees east of the Sacramento River and along the Feather River. Any levee failure on the NCC would permit Sacramento River flows to enter the Natomas area via the canal. In addition, runoff entering the NCC from the east would also be conveyed through the breach. The volume of water passing through the breach would depend on several factors, including the size of the breach, flood stage and duration of floodflows in the Sacramento River, and direct runoff into the Pleasant Grove area. If flood stages in the Sacramento River remained high for several days after a breach, then the entire Natomas area would likely be inundated to significant depths. The levees encircling Natomas are from 15 to 20 feet higher than the interior land surface.

Public Health and Safety

A major adverse impact from levee failure and resulting flooding would be the loss of human life. The extent of the impact would depend on many parameters, several of the most significant being flood plain, population, flood warning time, depth of flooding, and the magnitude of the flood event. Based on experience in other areas, between 3 to 25 percent (depending on location) of the population in the flood plain would either not be able to evacuate or would choose not to evacuate following an evacuation order. Although the warning time for levee breaks can be very short (less than 1 hour during a sudden failure) for this report, the warning time was estimated at between 2 and 4 hours for the Dry Creek, Richards Boulevard, and north Sacramento areas. The warning time for the Rancho Cordova, south Sacramento, and Natomas areas was estimated to be between 7 and 9 hours. Using the expected remaining flood plain population (defined as the population at risk), potential flood warning times, and likely depths of flooding, it is estimated that about 25 fatalities would occur in the Sacramento area during a 100-year flood. The estimated number of fatalities would be greatly increased if the warning time were reduced and/or evacuation routes blocked.

Flood Damages Evaluation

Although major levee failure and flooding have not occurred in Sacramento in recent years, significant flood damages have occurred.

Table III-4 shows estimated damages on the American River for several floods. The damage estimates are for the time of the flood (i.e., not updated to current values).

TABLE III-4

HISTORICAL FLOOD DAMAGES
AMERICAN RIVER

Date of Flood	Acres Flooded	Damages 1/
November - December 1950 2/	9,100	$ 3,505,000
December 1955	100	808,000
January - February 1963	1,400	558,000
December 1964 - January 1965	3,780	1,500,000
February 1986	3/	2,600,000 4/

1/ Dollars are for years shown and have not been adjusted to today's dollars.
2/ Prior to Folsom Dam.
3/ Not available. Significant areas in lower Dry Creek.
4/ Main stem American River only; estimate does not include damages in areas along tributaries to American River.

Flood damages of great magnitude are anticipated should floodflow in the American and Sacramento Rivers be high enough to cause levee failure and major flooding. Following is an estimate of the expected damages.

Flood Damage Categories. - Flood damages were computed by determining relationships between damage and flood depths, flows, and frequencies. Damages were determined for these categories:

- Industrial - Facilities that use raw materials and manufacture or fabricate commodities were classified as industrial. Losses and destruction of industrial properties from inundation consist of (1) fixtures and equipment, (2) inventory, and (3) structures.

- Commercial - Commercial damages were computed by using both structure value and content value, which includes equipment and furniture, supplies, merchandise, and other items used in the conduct of business.

- Residential - Residential damages consist of (1) physical damages to dwellings (single-family, multiple-family, and mobile homes) and (2) damages to residential contents, including household items and personal property. Based on discussions with local insurance agents, the value of contents is equal to 50 percent of the replacement cost of the structure. Benefits were not estimated for the projected increase in household content (affluence).

- Public - Public damages are 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 to crops were not considered in the analysis primarily because it is expected this category would be fairly low. Flooding would likely not occur in the growing season.

- 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.

- Auto - Auto damages were divided into two categories for (1) autos at private homes and (2) autos located at dealership lots.

Flood Plain Inventory. - Flood plain structures were inventoried in 1989. Essentially, the inventory involved (1) estimating the number and size of physical units within the flood plain and (2) assessing existing and future replacement costs of the units. Field surveys, aerial photos, and data analysis were used to determine the number, size, and foundation heights of structures for each flood hazard zone (100- and 400-year events) for each land use category.

The 400-year flood plain contains approximately 168,000 structures with a replacement cost of about $37 billion. The 100-year flood plain has about 113,000 structures with a replacement cost of about $23.3 billion. Existing and future structures for each reach of the flood plain and land use category are discussed in detail in the Economics Appendix.

Of the total vacant and agricultural lands (about 60,000 acres shown in Table II-2) approximately 15,826 acres of vacant and agricultural land are subject to development under without-project conditions. Estimates of future land use are based on projected population growth, the general plans of the City and County of Sacramento, and the availability of land to accommodate the projected growth. Future growth within the flood plain area is estimated to take place by 2010.

Land uses within the flood plain are residential (single-family, multiple-family, and mobile homes), commercial, industrial, public, and agriculture. The replacement costs for existing properties were determined from various sources, such as personal interviews, data from SACOG, realtors, and the Marshall and Swift appraisal handbook. The replacement costs for structure contents were estimated as a percentage of structure value for residential, commercial, and public structures. The replacement costs for industrial structures and contents were determined from personal interviews.

Depth-Damage Relationships. - Depth-damage relationships describe the probable damages that would occur under different depths of flooding as a percentage of the total value of damageable property. The Federal Insurance Administration's 1988 depth-damage relationships were used for residential and public structures. The depth-damage relationship outlined in "Small Business Research for Flood Insurance Rate Setting," developed in December 1969 by the Tennessee Valley Authority for the Department of Housing and Urban Development, was used in estimating damages to commercial structures. Industrial structures were grouped into four categories: (1) food and food related, (2) construction, (3) auto/machinery, and (4) miscellaneous. Managers of industrial structures identified specific uses and values of inventories and equipment and estimated the extent of damages for various depths of flooding inside buildings. These depth-damage relationships were adjusted for structure foundation heights. Other factors considered in the flood-damage analysis were velocity and duration of floodwaters.

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

Average Annual Damages. - 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-5 shows the estimated average annual flood damages for 1989, the base year 2000, 2010, and 2100. Average annual equivalent damages for 2000-2100 were estimated on the basis of an 8-3/4 percent interest rate and October 1991 prices, using standard discounting procedures.

TABLE III-5

AVERAGE ANNUAL WITHOUT PROJECT DAMAGES FOR TOTAL FLOOD PLAIN 1/

($1,000)

	1989	2000	2010	2100	Average 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	10,570	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
Mobil 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

CHAPTER IV

PLAN FORMULATION PROCESS AND FLOOD CONTROL MEASURES

Plan formulation is the process of developing and evaluating alternative plans to meet the needs and desires of society as expressed in specific planning objectives and selecting that plan that best satisfies the objectives. This planning process is in accordance with the Federal Water Resources Council's Principles and Guidelines. The plan formulation process is explained in detail in the Plan Formulation Appendix. The procedure followed in this study for formulating and selecting a plan for recommended implementation was:

- Establish specific planning objectives.
- Define constraints and criteria for formulating an implementable plan.
- Identify management measures to address the planning objectives.
- Develop alternatives from the measures to meet address the planning objectives and criteria.
- Identify the alternative that maximizes national economic development (NED) benefits.
- Compare and evaluate the alternative and select a plan for recommended implementation.

PLANNING OBJECTIVES

On the basis of the identified flood problems described in Chapter III and other water resource needs and opportunities described in Chapter VIII, the following planning objectives were developed and used in the formulation of a selected plan.

- Provide greater levels of flood protection for the Sacramento urban area from overflows from the lower American River and in the Natomas and lower Dry Creek areas. In this regard the non-Federal sponsor's planning objective is to seek a higher level of flood protection (200 years or greater) from the 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 elsewhere 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.

PLANNING CONSTRAINTS AND CRITERIA

Plan formulation constraints for this investigation include congressional direction; current applicable laws, regulations, and policies (complete list is found in EIS/EIR Chapter 23); and existing water resource projects affecting the study area. In addition, specific criteria applicable to development of alternatives and plan selection for all Federal water projects (Water Resources Council's Principles and Guidelines) must be met. Several of the most significant ones are:

- Completeness - Completeness is the extent to which a given alternative plan provides and accounts for all necessary investments or other actions to ensure the realization of the planned effects.

- Effectiveness - Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified objectives.

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

- Acceptability - Acceptability is the workability and viability of the alternative plan with respect to acceptance by State and local entities and the public and compatibility with existing laws, regulations, and public policies.

POTENTIAL FLOOD CONTROL MANAGEMENT MEASURES

A variety of measures to help increase the level of flood protection in the American River basin were identified by the Corps, local sponsor, and other interested organizations and individuals. A full description of the measures and whether or not they were retained or deleted from development into alternative plans are contained in the Plan Formulation Appendix (Appendix B). The measures are:

Main Stem American River

- Increase Flood Control Storage Space in Folsom Reservoir
- Increase Downstream Channel Capacity With Levee and Channel Modifications
- Increase Downstream Channel Capacity With Setback Levees
- Make Structural Modifications to Folsom Dam
- Raise Folsom Dam
- Use Storage Space in Upstream Reservoirs for Flood Control
- Construct Flood Control Storage Facilities Upstream From Folsom Reservoir
- Improve Flood Forecasting and Folsom Reservoir Operations
- Construct Small Detention Dams in the Upper Basin
- Construct Offstream Storage Facilities
- Construct Out-of-Basin Diversion Facilities
- Divert Floodflows into Sacramento River Deep Water Ship Channel
- Nonstructural Including Flood Proofing, Flood Plain Evacuation, Development Restrictions, and Flood Warning

Natomas

- Construct Levee and Channel Improvements in and Around Natomas
- Construct Compartment Levee in Natomas
- Construct Gated Structures and Pumping Stations
- Construct Detention Dams Upstream From Natomas
- Modify Fremont Weir and Yolo Bypass
- Construct Sacramento River Constriction
- Construct New Natomas Cross Canal
- Reduce Objective Releases From Folsom Dam to Lower Stages
- Use Nonstructural Measures Including Flood Proofing, Flood Plain Evacuation, Development Restrictions, and Flood Warning
- Construct a Detention Basin in North Natomas

Four of the measures for the main stem American River and three for Natomas were retained for further study and consideration in the development of alternative plans. All the measures are briefly described below, including the reasons for either retaining or dropping them from further consideration.

Main Stem American River - Measures Retained for Further Study

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.

Because of the overall configuration of the Folsom Dam spillway and outlet works, the maximum effective flood control storage in Folsom Reservoir would be about 650,000 acre-feet. Assuming (1) existing objective release of 115,000 cfs; (2) an increase in flood control storage from 400,000 to 650,000 acre-feet; (3) significant encroachment into the reservoir surcharge storage space at Folsom; and (4) approximately 50,000 acre-feet of storage space in existing reservoirs for flood control upstream from Folsom, flood protection along the lower American River would be increased to a level slightly above FEMA requirements along the main stem American River. However, increasing the seasonal flood control space would result in losses of existing project accomplishments (water supply, hydropower, and recreation) and adversely affect the environmental resources of the area.

Increase Downstream Channel Capacity With Levee And Channel Modifications. - This measure would permit an increase in the objective release from Folsom Dam to allow better management of the flood control space and control larger flood events. It would require raising the height of existing levees along the American River, stabilizing the levees, and providing additional bank protection. It would also require lengthening the Sacramento Weir and raising the levees along Yolo Bypass to accommodate the greater release from Folsom Dam. This measure would provide up to a 100-year (Corps) level of protection. The measure was retained for further study because initial analysis indicated that it likely would be economically feasible. The measure would result in significant adverse impacts to fish and wildlife and recreation resources along the lower American River.

Make Structural Modifications to Folsom Dam. - Modifying the spillway at Folsom Dam could increase the flood control operating efficiency of the dam. The best way would be to lower the crest of the spillway and replace the tainter gates so greater flows could be released earlier in the flood event. Lowering the spillway 10 to 15 feet could help increase downstream flood protection. However, this measure would only produce significant results when considered in conjunction with increases in the objective releases and/or with greater levels of space dedicated to flood control.

Construct Flood Control Detention Facilities Upstream from Folsom Reservoir. - New reservoir detention space for flood control could be obtained by constructing either a single-purpose flood control dam or a multiple-purpose dam upstream from Folsom Reservoir. This investigation addressed a single-purpose flood control facility. This measure was the only measure that could provide high (greater than about 200-year) levels of flood protection while controlling releases from Folsom Dam at the downstream channel's safe design capacity of 115,000 cfs. Also, because of the existing heavy dependence on levees and great potential for catastrophic damage in the Sacramento area, this measure would result in a greater ability to better manage the floodflows through reservoir storage rather than relying on levee and channel improvements.

The most logical site for a new flood control dam in the American River basin is along the north fork near the existing Auburn Dam site. This determination was based on a review of potential reservoir sites in the upper basin and the wealth of information gathered for the USBR's Auburn Dam project (see Appendix J).

A flood control dam at Auburn would create an inundation zone, periodically flooding on a temporary basis up to about 6,000 acres (400-year flood level). The level of inundation would range from a fairly small pool (several thousand acre-feet) once every 5 years or so and lasting only a day or two to filling of the reservoir for a design event (400-year flood) lasting up to about 3 weeks at the dam base. The canyon upstream from the dam would be similar in appearance to its appearance today.

Main Stem American River - Measures Dropped from Further Study

Increase Downstream Channel Capacity with Setback Levees. - Increased releases from Folsom Dam could be accommodated by widening the levee system along the American River. This would require (1) removing and reconstructing the levee on one bank or the other for the entire length of the system; (2) acquiring nearly 3,500 acres of residential, commercial, and industrial lands; (3) depending on whether the north or south levee is removed, relocating from 5,000 to 6,000 residential structures, 4 schools, several apartment complexes, and even 140 commercial and industrial properties; and (4) relocating existing roads and other infrastructure. It would also require additional bank protection along the American River, modifying the Sacramento Weir, and raising levees along the Sacramento River and Yolo Bypass. This measure was dropped from further study mainly because of the likely high cost and low potential for community acceptance.

Raise Folsom Dam. - The flood control storage space in Folsom Reservoir could be increased by raising Folsom Dam. This would involve raising the concrete gravity section of the main dam (1,400 feet long), the wing dams (each 8,830 feet long), and eight dikes around the reservoir (together approximately 11,700 feet long). However, this measure was not considered further because of the inherent difficulties associated with enlarging the existing structure (reconstructing main and auxiliary dams, modifications to spillway and outlet works, etc.), the prohibitive construction and relocation costs, and social and environmental impacts.

<u>Use Storage Space in Upstream Reservoirs for Flood Control</u>. - This measure assumed acquiring up to 200,000 acre-feet of flood control space among five of the larger existing reservoirs upstream from Folsom. The reservoirs are Loon Lake, Ice House, and Union Valley, which are owned and operated by the Sacramento Municipal Utility District (SMUD), and French Meadows and Hell Hole which are owned and operated by the Placer County Water Agency (PCWA).

These reservoirs were built exclusively for water supply and power generation. Based on cost estimates for other projects, modification of each of the outlet works for flood control operation could be between $10 million to $20 million. Discussions with SMUD and PCWA concluded that acquisition of the storage space would cost between about $350 million to $700 million. Based on estimates of about $15 million to modify each outlet works and $550 million to acquire the space (cost similar to the loss in power generation over 30 years), this measure could cost about $625 million. In addition, in order to achieve a 100-year level of protection, Folsom Reservoir would have to be reoperated to 500,000 acre-feet of flood control storage. Reoperation of Folsom would result in additional water supply and hydropower losses. Assuming (1) a 100-year level of downstream flood protection and (2) an allowance for operation and maintenance, and mitigation, the annual costs significantly exceed the flood control benefits.

<u>Improve Flood Forecasting and Folsom Reservoir Operations</u>. - With this measure, the flood control operation of Folsom Dam and Reservoir would rely more heavily on forecasting weather patterns and emphasizing flood control. Before and following the February 1986 flood, various claims were made that Folsom Dam and Reservoir were not properly operated for flood control. It has been claimed that more efficient operations would allow accommodation of larger flood events.

The USBR and Corps analyzed the potential for improved flood forecasting using available weather prediction technologies. The results showed that these technologies do not provide information specific enough for effective multipurpose reservoir operation. Despite technological advances such as computer maps, satellite photographs, radar and observed data, forecasts are not accurate enough to be used to operate a reservoir for more than a few hours in advance of the prediction. This measure would require the rapid and frequent evacuation of Folsom's water conservation space when large storms start to develop over the Pacific Ocean. Since there is no way of currently predicting the specific watershed effects of the storms, and reservoir drawdown capabilities are limited, the resulting unwarranted frequent evacuation of reservoir storage in Folsom would result in major adverse impacts on other project purposes.

Construct Small Detention Dams in the Upper Basin. - Construction of numerous small-capacity dams on upper basin streams could provide a minor level of flood protection. However, based on existing conditions in the basin and results of studies of similar concepts in other basins, this measure was viewed as not practical. It is unlikely that several small dams could provide the same or similar high level of protection provided by one large facility. Further, the cost associated with constructing several smaller facilities and the cumulative environmental impact from them would significantly exceed the cost and impact from one facility.

Construct Offstream Storage Facilities. - This measure would involve constructing a flood detention basin near Folsom Dam to augment storage in Folsom Reservoir. However, this measure was dropped from further study because (1) it would not significantly increase downstream flood protection, (2) the cost would be high (DWR's estimated cost for a similar facility in 1982 was about $100 million), and (3) significant residential and commercial development is occurring and expected in the basin area.

Construct Out-of-Basin Diversion Facilities. - Another measure considered involved diverting American River flows to a detention basin in the Deer Creek (Cosumnes River) basin about 10 miles south of Folsom. A detailed cost estimate was not made for this measure; however, a preliminary hydraulic analysis and results of recent flood control studies in the Cosumnes River basin indicated that this option would be significantly more costly than other measures being considered. In addition, the diversions could cause significant impacts in the Deer Creek and Cosumnes River basins and east Delta area.

Divert Floodflows into Sacramento River Deep Water Ship Channel. - This measure would involve using a pump and siphon to divert a portion of Sacramento River floodwaters into the deep water ship channel via the navigation lock and barge canal. Sufficient gradient would be created for the water to flow to the Sacramento River near Collinsville. However, the additional flow capacity in the channel would be relatively insignificant compared with American River flows 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. Because of high costs, adverse impacts to the ship channel, and marginal flood reduction, this measure was dropped from further consideration.

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

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

- 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 structure or using it for some other purpose.

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

- Flood Warning - Flood warning consists of flood forecasting; warning the population; evacuation before, during, and after a flood; and postflood reoccupation and recovery. Those procedures are currently in force by a coordinated plan involving Federal, State, and community governments. (See Plan Formulation Appendix.)

Nonstructural measures were considered in accordance with Corps' regulations, which require that a nonstructural plan be included in a full array of alternatives. However, because of the large flood plain; large numbers of residential, commercial, industrial, and institutional structures in the flood plain; and high flood depths, raising structures or removing them from the flood plain would not be economically feasible. Similarly, flood proofing measures such as constructing small walls or levees around structures would not be economically, socially, and environmentally feasible. Increased efforts in flood plain evacuation and local flood warning systems are being aggressively pursued under both with- or without-project conditions in the Sacramento area by local and State agencies. Consequently, these measures were not formulated into a specific alternative.

Natomas - Measures Retained for Further Study

Construct Levee Improvements in and Around Natomas. - Raising sections of levees along the NEMDC, NCC, and Pleasant Grove Creek Canal could prevent flooding in Natomas from high river stages. The extent of the modifications would depend mostly on the level of protection desired. A primary assumption for this measure was that floodflows would occur simultaneously in all the waterways. It was also assumed that each existing levee and channel system is structurally stable.

NEMDC Levee. - To decrease the likelihood of levee failure on either side of the NEMDC, the east and west levees would be raised up to 4 feet. During high flows, however, this higher levee would result in induced flooding in the Dry and Arcade Creek areas. To offset this impact, levee and related modifications would be required at various locations along Dry and Arcade Creeks.

Pleasant Grove Creek Canal. - The East Side and Pleasant Grove Creek Canals comprise a levee system that extends north and south from the NCC. The levee system impounds water from several small tributaries. Natomas is subject to flooding from the south end of the Pleasant Grove Creek Canal where Sankey Road can be overtopped and floodflows can enter the Natomas area or NEMDC. Protective measures in this area would include raising the levees at selected locations along the Pleasant Grove Creek Canal and modifying East Levee Road at Sankey Road. Because these modifications could result in a slight increase in upstream ponding and a slight increase in flood depths in the Pleasant Grove area, this measure would need to include some mitigation of this impact. This mitigation could consist of (1) the purchase of flowage easements on lands east of the raised levees that would be subject to the induced flooding or (2) other measures aimed at lowering the water surface.

NCC. - The NCC conveys flows from the Pleasant Grove Creek and East Side Canals to the Sacramento River. Potential overtopping into Natomas or failure of the south levee 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 reduced by (1) raising the south levee at selected locations, (2) providing a pumping plant/gated closure structure on the canal, (3) lengthening Fremont Weir, or (4) providing a flow restriction structure upstream in the Sacramento River.

Construct Gated Structure and Pumping Station. - This measure would involve constructing a gated embankment structure and pumping station at locations including the NCC at the Sacramento River, the NEMDC north of Dry Creek, and/or the NEMDC at the American River. During normal flow conditions, the gates on the embankment would be open, allowing water from the NCC or NEMDC to discharge downstream. During high flows downstream from the structure, the gates would be closed to prevent backflow. Large-capacity pumps at the structures would accommodate upstream tributary inflows. The pumps would control the stages in the NCC or NEMDC to avoid encroachment into the freeboard on the adjacent and upstream levees for specified design events.

A gated pump structure near Dry Creek was retained for further study because of its relatively low cost in comparison with other measures. However, structures at the NCC and at the mouth of the NEMDC were dropped because of the high cost.

Construct North Natomas Detention Basin. - This measure entails constructing a detention basin in northern Natomas. When viewed in combination with levee modifications along the NCC and Pleasant Grove Creek Canal, a small storage facility in the northeast corner of Natomas appeared practical and was retained from further study.

Natomas - Measures Dropped from Further Study

Construct Compartment Levee in Natomas. - This measure would consist of "compartmentalizing" Natomas by constructing a levee across Natomas between the Sacramento River and NEMDC. The two levee locations considered are (1) just north of and parallel to Elverta Road and (2) just north of and parallel to Del Paso Road (other locations would also be possible). The area north of the cross levee would remain in the flood plain. A levee at Elverta Road would provide protection to the Sacramento Metropolitan Airport, Interstate 5, Interstate 80, Sacramento City area, and a portion of Sacramento County. A levee at Del Paso Road would protect Interstate 80 and south Natomas. This measure was dropped from further consideration because the cost would be unreasonably high, and the measure would aggravate the flood problem in the northern Natomas area. This concept is described in more detail in Chapter VIII.

Construct Detention Dams Upstream from Natomas. - Small detention dams could be constructed on various tributaries to the NCC and NEMDC to reduce inflows to the canals. They would also reduce flooding on the creeks downstream from the dams. This measure was not considered further, however, because of the (1) high cost, (2) potential adverse impacts in the reservoir areas, and (3) relatively minor effect on controlling downstream stages in the canals.

Construct Sacramento River Constriction. - This measure would consist of a check structure on the Sacramento River between Fremont Weir and the mouth of the NCC just downstream from the confluence with the Feather River. The check structure would act to constrict the Sacramento River flow and lower the stage in and near the NCC. Sufficient additional flows would be diverted from the Sacramento River into the Yolo Bypass via the Fremont Weir. This measure was dropped from further consideration mainly because of possible major impacts to recreation and environmental resources.

Construct New Natomas Cross Canal. - A new canal across Natomas similar to the NCC could help divert flows from Pleasant Grove and Curry Creeks to the Sacramento River. However, this measure was dropped from further study because of its high cost and low potential for local acceptability.

Reduce Objective Releases from Folsom Dam to Lower Stages in NEMDC. - Lowering the objective release from Folsom Dam from the current 115,000 cfs to between 100,000 to 80,000 cfs would reduce the stage in the lower NEMDC for a major flood event by about 0.7 foot to 2 feet, respectively. The reduction would be less in the upper canal where the backwater effects from the river are less. The objective release could be reduced by either increasing the flood control storage space in Folsom Reservoir and/or providing additional flood control storage upstream from Folsom. However, reducing the release to lower stages in the NEMDC was dropped from further consideration because it would be significantly more costly than other measures.

Modify Fremont Weir and Yolo Bypass. - Increasing conveyance capacity of the Yolo Bypass through lengthening the Fremont Weir and widening the bypass was examined for its feasibility. These measures were not found to be effective in reducing stages in the Sacramento River, NCC, and Pleasant Grove area.

Use Nonstructural Measures. - Because of high depths of flooding in the Natomas area, only permanent flood-proofing measures such as elevation of structures above the flood stage (piles, posts, piers, or fill) and perhaps floodwalls would be effective; however, they would not be economically feasible. Consequently, flood proofing measures were not considered viable. As mentioned, enhanced flood warning and flood plain evacuation planning are being aggressively pursued by local and State agencies.

CHAPTER V

ALTERNATIVE PLANS CONSIDERED

This chapter includes a description of flood control measures and resulting alternatives. A detailed description is included in Appendix B. As outlined in Chapter IV, four flood control measures along the main stem American River and three in the Natomas area were retained for development into alternative plans. The 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. (These early alternatives are briefly discussed in Chapter VIII.)

INITIAL ALTERNATIVES IDENTIFIED

Twenty-seven alternatives were initially formulated from the seven flood control measures carried forward. These alternatives are summarized in Table V-1 and briefly described in the sections below.

As shown in Table V-1, 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 Natomas features common to all the alternatives.

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

ALTERNATIVE Feature	Level of Protection	Folsom Flood Storage (ac-ft)	Folsom Objective Release (cfs)	Lower Folsom Spillway (feet)
LEVEE IMPROVEMENT	1. 100-Yr (FEMA)	400,000	145,000	0
	150-Yr - 400-Yr			
FOLSOM REOPERATION -Modified Storage	2. 100-Yr (FEMA)	590,000	115,000	0
	150-Yr - 400-Yr			
-Modified Spillway	100-Yr (FEMA) - 400-Yr			
-Modified Storage and Spillway	3. 100-Yr (FEMA)	555,000	115,000	15
	150-Yr - 400-Yr			
LEVEE IMPROVEMENT/ FOLSOM REOPERATION -Levee Improvement /Modified Storage	4. 100-Yr (FEMA)	530,000	130,000	0
	150-Yr - 400-Yr			
-Levee Improvement /Modified Spillway	5. 100-Yr (FEMA)	400,000	143,000	15
	150-Yr - 400-Yr			
-Levee Improvement /Modified Storage and Spillway	6. 100-Yr (FEMA)	470,000	130,000	15
	7. 150-Yr	650,000	180,000	15
	200-Yr - 400-Yr			
FLOOD CONTROL DAM	8. 100-Yr (FEMA)	400,000	115,000	0
	9. 150-Yr	400,000	115,000	0
	10. 200-Yr	400,000	115,000	0
	11. 400-Yr	400,000	115,000	0
FLOOD CONTROL DAM /LEVEE IMPROVEMENT	12. 100-Yr (FEMA)	400,000	130,000	0
	13. 150-Yr	400,000	130,000	0
	14. 200-Yr	400,000	130,000	0
	15. 200-Yr	400,000	180,000	0
	16. 400-Yr	400,000	130,000	0
	17. 400-Yr	400,000	180,000	0
FLOOD CONTROL DAM /FOLSOM REOPERATION -Flood Control Dam /Modified Storage	18. 100-Yr (FEMA)	200,000	115,000	0
	19. 150-Yr	200,000	115,000	0
	20. 200-Yr	300,000	115,000	0
	21. 200-Yr	650,000	115,000	0
	22. 400-Yr	300,000	115,000	0
	23. 400-Yr	650,000	115,000	0
-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
	25. 150-Yr	470,000	130,000	0
	26. 200-Yr	550,000	130,000	0
	27. 400-Yr	550,000	130,000	0
-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.

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TABLE V-1
SUMMARY OF INITIAL ALTERNATIVES FORMULATED

Folsom Objective Release (cfs)	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]
145,000	0	21	10	8	0	176.6
				Not Achievable		
115,000	0	7	0	0	0	128.9
				Not Achievable		
				Not Achievable		
115,000	15	7	0	0	0	154.1
				Not Achievable		
130,000	0	13	10	1	0	198.5
				Not Achievable		
143,000	15	21	10	2	0	227.9
				Not Achievable		
130,000	15	13	10	1	0	225.1
180,000	15	27	10	12	0	495.9
				Not Achievable		
115,000	0	7	0	0	180,000	437.4
115,000	0	7	0	0	430,000	497.7
115,000	0	7	0	0	545,000	535.3
115,000	0	7	0	0	894,000	631.6
130,000	0	13	10	1	170,000	593.8
130,000	0	13	10	1	370,000	588.7
130,000	0	13	10	1	484,000	626.5
180,000	0	27	10	12	328,000	724.8
130,000	0	13	10	1	810,000	719.1
180,000	0	27	10	12	620,000	818.7
115,000	0	7	0	0	330,000	464.4
115,000	0	7	0	0	580,000	542.9
115,000	0	7	0	0	598,000	549.5
115,000	0	7	0	0	485,000	674.5
115,000	0	7	0	0	998,000	665.2
115,000	0	7	0	0	778,000	758.8
				Similar to Flood Control Dam		
				Similar to Dam/Modified Storage		
130,000	0	13	10	1	80,000	555.3
130,000	0	13	10	1	350,000	618.6
130,000	0	13	10	1	440,000	705.8
130,000	0	13	10	1	720,000	788.9
				Similar to Dam/Levee Improvements		
				Similar to Dam/Levee Improvements/Modified Storage		

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TABLE V-1
. ALTERNATIVES FORMULATED

Bank and Levee Protection (miles)	Levee Stabilizing (miles)	New Upstream Flood Detention (ac-ft)	First Cost ($millions) [1]	Annual Cost ($millions) [2]	Annual Benefits ($millions) [3]	Net Benefits ($millions)
10	8	0	176.6	17.3	60	42.7
	Not Achievable					
0	0	0	128.9	11.6	60	48.4
	Not Achievable					
	Not Achievable					
0	0	0	154.1	14.3	60	45.7
	Not Achievable					
10	1	0	198.5	18.9	60	41.1
	Not Achievable					
10	2	0	227.9	22.2	60	37.8
	Not Achievable					
10	1	0	225.1	21.7	60	38.3
10	12	0	495.9	46.6	128	81.4
	Not Achievable					
0	0	180,000	437.4	41.3	60	18.7
0	0	430,000	497.7	47.0	128	81.0
0	0	545,000	535.3	50.5	166	115.5
0	0	894,000	631.6	59.8	202	142.2
10	1	170,000	593.8	56.5	60	3.5
10	1	370,000	588.7	56.1	128	71.9
10	1	484,000	626.5	59.7	166	106.3
10	12	328,000	724.8	69.6	166	96.4
10	1	810,000	719.1	68.4	202	133.6
10	12	620,000	818.7	77.9	202	124.1
0	0	330,000	464.4	43.8	60	16.2
0	0	580,000	542.9	51.2	128	76.8
0	0	598,000	549.5	51.8	166	114.2
0	0	485,000	674.5	62.6	166	103.4
0	0	998,000	665.2	61.8	202	140.2
0	0	778,000	758.8	70.5	202	131.5
	Similar to Flood Control Dam					
	Similar to Dam/Modified Storage					
10	1	80,000	555.3	52.6	60	7.4
10	1	350,000	618.6	58.7	128	69.3
10	1	440,000	705.8	66.5	166	99.5
10	1	720,000	788.9	74.3	202	127.7
	Similar to Dam/Levee Improvements					
	Similar to Dam/Levee Improvements/Modified Storage					

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 using Corps methodology). Levels of protection greater than about 100-year (Corps) are not achievable with levee improvements alone.

Surcharge storage space was used for alternatives using the existing spillway at Folsom (see Plate 8). 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 used 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.

Table V-2 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 be lengthened, and the Sacramento Bypass northern levee would be set back. In addition, levee work along the Yolo Bypass south of the Sacramento Bypass would be required.

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.

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 95-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 the level of protection, surcharge space in Folsom Reservoir must be used as well as incidental storage in existing upstream reservoirs. Changes required by this alternative are limited to operation of Folsom Reservoir. No structural modifications would be required.

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

TABLE V-2

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.

not by itself provide 100-year (FEMA) protection, no alternative was developed.

Surcharge storage was not used for any of the modified spillway alternatives (see Plate 8). 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 for project design.

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.

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.

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 V-2 shows the levee and channel modifications that would be required.

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.

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 V-2 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 V-2.

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.

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

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 to permit increased releases from Folsom. Six possibilities are shown in Table V-1. 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.

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.

Dam/Modified Storage. - Table V-1 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.

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.

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. However, because the objective release of 115,000 cfs would be maintained, the benefit would be small.

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.

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 V-1 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.

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.

Dam/Levee Improvements/Modified Storage and Spillway. - Alternatives for this combination would be similar to the dam/levee improvement/modified storage alternatives.

Natomas

All the alternatives described above for the main stem American River include additional features to provide protection to Natomas. Similar levels of flood control for the main stem area and Natomas were lumped into a single alternative. This is primarily because of the physical and socioeconomic interrelationships of each area to the other. As described in Chapter VII (Selected Plan) 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. Even so, for numerous reasons including cost repayment assessments, community understanding, and relative environmental and related impacts, it would be prudent 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 VIII (with a more detailed explanation in the Plan Formulation Appendix).

The features described below are for a 100-year (FEMA) level of protection, assuming an objective release from Folsom Dam of 115,000 cfs. Features required for higher levels of protection (assuming an objective release of 115,000 cfs) would be similar, but slightly larger. However, for alternatives including a larger increase 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) features 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 18,000 lineal feet of the south levee along the NCC about 0.5 foot.

- 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.

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.

Environmental Impacts

The major features associated with the various alternatives would result in some adverse environmental impacts. The potential impacts are highlighted below according to major project feature. They are described in more detail in the Plan Formulation Appendix and in the EIS/EIR.

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 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 be made 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.

Increasing the capacity to 180,000 cfs would create the most severe impacts. Lesser increases would have proportionally fewer impacts.

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.

- 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 the changed Folsom release, the 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 near 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. Known sites within the flood control drawdown pool include 37 prehistoric and 10 historic sites plus 31 additional prehistoric and 16 historic sites that could be exposed in drier years. 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.

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 actual. Statewide, this vegetation type is common to about 3 million acres.

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.

Flood Control Benefits. - Flood control benefits are associated with (1) inundation reduction, (2) location, (3) savings in flood-proofing costs, (4) bridge replacement, and (5) 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.

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.

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 the year 2010. Average annual location benefits range from about $8 million to about $30 million for the 100-year (FEMA) and 400-year levels of protection, respectively.

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.

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 the various alternatives--Howe Avenue, Main Avenue, Norwood Avenue, Camino Avenue, Highway 49, and Ponderosa Way. Bridge replacement benefits range from about $130,000 to $1.8 million.

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. For the 200-year alternative, this benefit amounts to $6.4 million.

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.

Benefit Comparison. - Table V-3 summarizes the average annual benefits for the four levels of flood protection.

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 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 the 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 GWh per year and project-dependable capacity between 3 and 6 MW. Assuming a replacement value of 100 mills per kilowatthour (kWh), 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.

Costs and Comparisons. - Table V-1 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.

TABLE V-3

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.

- 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 $12 million. The next least expensive plan would incorporate lowering the spillway at Folsom Dam (alternative 3), with an annual cost of $14 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 about $17 million. Alternative 1 provides (for just levee improvements) 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 about $22 million.

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 not considered 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 GWh a year. The annual economic benefit would be about $1.3 million (based on values of $300 per acre-foot and 100 mills per kWh).

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 V-4 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.

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. An alternative that focuses on satisfying Federal flood control objectives also was

TABLE V-4
SUMMARY RESULTS OF SCREENING OF INITIAL ALTERNATIVES [1]

Alternative: Major Feature	Alternative: Folsom/Channel Spillway/Dam [2]	Level of Protection	Status	Reasons for Retaining, Deleting, or Not Formulating Alternative
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

1

				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
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 [illegible]	See Reasons	100-yr (FEMA)-[illegible]	Deleted	Low cost effectiveness without environmental benefits

				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
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).

formulated; this plan maximizes net economic development (NED) benefits. It is Federal policy to select and recommend the NED plan for implementation. 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 (NED)

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 normally the responsibility of the non-Federal sponsor.

Following are brief descriptions of the various plans.

<u>No Action</u>

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 future population trends, land use, and related urban growth along the main stem American River would continue generally as described in current local plans as previously summarized. 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.

Major flooding also would be expected as previously described. The average annual equivalent flood damages are expected to reach about $191 million in the study area. In addition to the damages directly caused by flooding, there would be other resources losses. These are highlighted in Chapter VI (Plan Selection).

<u>Recreation Features</u>

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 in Natomas 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 that recreation 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 Boulevard.

These recreation developments are expected to provide about 335,000 user days annually.

<u>100-Year (FEMA) Levees</u>

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 10 is a general layout of the alternative. The plan includes the measures outlined below.

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: about 0.9 mile
- Toe Drain: about 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

Downstream from American River. - The increased objective release and certain levee and selected construction in Natomas would require the following:

- 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.

Natomas. - Table V-5 shows the flood control work required in Natomas. Recreation features are outlined in an earlier section.

Impacts and Mitigation. - Likely major adverse impacts and potential mitigation features are shown in Table V-6.

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 11 is a general layout of the plan.

Downstream from American River. - There are no modifications required from the American River in this plan.

Natomas. - Table V-7 shows Natomas flood control features. Recreation is previously described.

Impacts and Mitigation. - Potential impacts and mitigation features are shown in Table V-8.

TABLE V-5

NATOMAS FEATURES FOR 100-YEAR (FEMA) LEVEE ALTERNATIVE

FEATURE	LOCATION	LENGTH	HEIGHT	RELOCATION/OTHER
NEMDC:				
East Levee	•American R.to Arcade Creek •Arcade to Dry Cr.	1 mi. 2.6 mi.	1.9 ft. 2.7 ft.	El Camino Ave. Bridge Norwood Ave. Bridge Union Pacific RR
West Levee	•El Camino Rd. to Main Ave. •Main Ave. to NEMDC Pump Station •Riego Rd. to Sankey Rd.	3.1 mi. 0.7 mi. 0.6 mi.	3.5 ft. 1 ft. 1.1 ft.	Main Ave. Bridge Levee Road 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 •New levee	- 0.9 mi.	- 9.2 ft.	RR Floodgates at Sankey Rd. Ramp Ascott Ave./200 ft. of fence
South Levee	•Raise various locations •Extend levee	0.5 mi. 0.4 mi.	1.4 ft. 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 V-6

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 V-7

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 V-8

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.

100-year (FEMA) Levee/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 the Natomas area. Plate 12 is a general layout of the plan.

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

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.

Natomas. Table V-9 shows Natomas flood control features. Recreation is previously discussed.

Impacts and Mitigation. - Likely major adverse impacts and potential mitigation features are shown in Table V-10.

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.

TABLE V-9

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 •Arcade to Dry Cr.	- 2.5 mi.	- 1.9 mi.	- -
West Levee	•El Camino Rd. to Main St. •Main St. to NEMDC pump station •Riego Rd. to Sankey Rd.	3.0 mi. - 0.6 mi.	2.7 ft. - 1.1 ft.	Main Ave. Bridge - 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 •New levee	- 0.9 mi.	- 8.5 ft.	Ramp Ascott Ave./ 200 ft. of fence RR Floodgates
South Levee	•Raise various locations •Extend levee	0.3 mi. 0.4 mi.	0.9 ft. 3.5 ft.	- -
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 V-10

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.

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 V-1 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

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.

Natomas. - Natomas flood control features are shown in Table V-11. Recreation is discussed previously.

Impacts and Mitigation. - Potential mitigation features are shown in Table V-12.

200-Year Protection

Major elements of this alternative include a flood control dam upstream from Folsom Reservoir, and levee and channel modifications in Natomas. Plate 14 is a general layout of the alternative.

Main Stem American River. -

- Construct a roller-compacted concrete dam 425 feet high on the North Fork American River at river mile 20.1.

- Create a detention reservoir to accommodate a peak storage of 545,000 acre-feet.

- Relocate Highway 49 and Ponderosa Way.

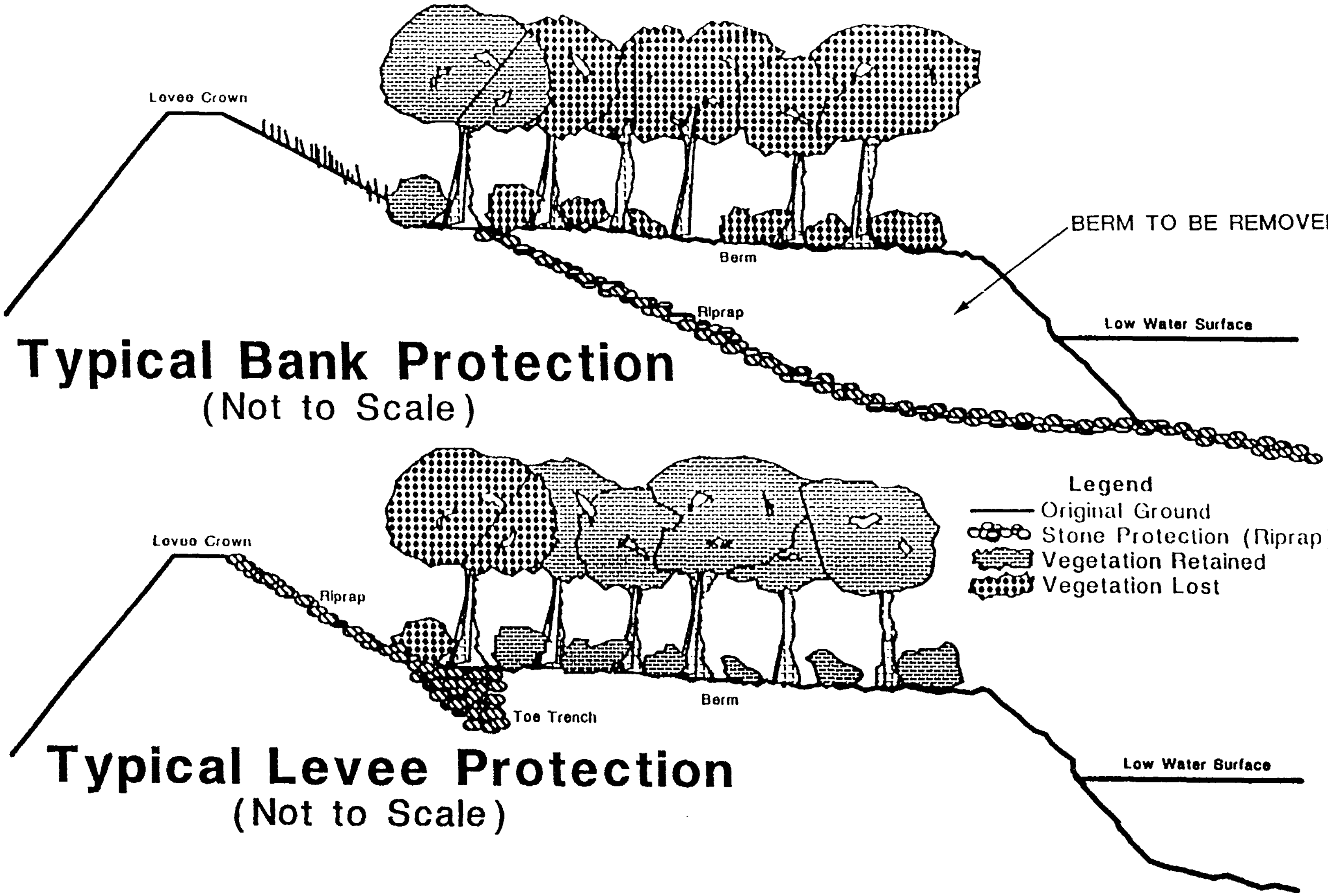

Figure V-1 Typical Examples of Bank and Levee Protection Considered in Alternatives Requiring Flow Increases in Lower American River

TABLE V-11

NATOMAS FEATURES FOR 150-YEAR ALTERNATIVE

FEATURE	LOCATION	LENGTH	HEIGHT	RELOCATION/OTHER
NEMDC:				
East Levee	•American R. to Arcade Creek •Arcade to Dry Cr.	1.1 mi. 2.6 mi.	1.9 ft. 3.4 ft.	El Camino Ave. Bridge Union Pacific RR.
West Levee	•El Camino Rd. to Main St. •Main St. to NEMDC Pump station •Riego Rd. to Sankey Rd.	3.2 mi. 0.7 mi. 0.6 mi.	4.2 ft. 1.0 ft. 1.1 ft.	Main Ave. Bridge Levee Rd. 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 •New levee	- 0.9 mi.	- 9.9 ft.	Ramp Ascott/200 ft. of fence RR Floodgates
South Levee	•Raise various locations •Extend levee	0.6 mi. 0.4 mi.	1.9 ft. 6.0 ft.	- -
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 V-12

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.

Downstream from American River. - None.

Natomas. - Flood control features for Natomas are shown in Table V-13. Recreation features are previously described.

Impacts and Mitigation. - Potential impacts and mitigation features are shown in Table V-14.

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 15 is a general layout of the 400-year alternative.

Main Stem American River. -

- Construct a roller-compacted concrete dam 498 feet high on the North Fork American River at river mile 20.1.
- Create a detention reservoir to accommodate a peak storage of 894,000 acre-feet.
- Relocate Highway 49 and Ponderosa Way.

Downstream from American River. - None.

Natomas. - Flood control features for Natomas are shown in Table V-15. Recreation features are previously described.

Impacts and Mitigation. - Potential impacts and mitigation features are shown in Table V-16.

NED

The Federal objective in water and related land resources planning is to contribute to national economic development consistent with the Nation's environment, applicable executive orders, and other Federal planning guidelines. Contributions to NED are increases in the net value of the national output of goods and services, expressed in monetary units. These contributions are the direct net benefits that accrue in the planning area and the rest of the Nation. A detailed description of the formulation of the NED plan is in the Economics Appendix.

Basically, the results of the NED analysis show that the alternative that maximizes NED (NED Plan) would provide a 400-year level of protection to Sacramento and Natomas from flooding from the American and Sacramento Rivers. Plate 16 is a plot of annual costs, flood control benefits, and net flood control benefits for

TABLE V-13

NATOMAS FEATURES FOR 200-YEAR ALTERNATIVE

FEATURE	LOCATION	LENGTH	MAXIMUM HEIGHT	RELOCATION/OTHER
NEMDC:				
East Levee	•American R. to Arcade Creek •Arcade to Dry Cr.	- 1.4 mi.	- 1.0 ft.	- -
West Levee	•El Camino Ave. to Main Ave. •Main Ave. to NEMDC Pump Station •Riego Rd. to Sankey Rd.	2.6 mi. - 0.6 mi.	2.0 ft. - 1.1 ft.	Main Ave. Bridge - 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 •Extend levee	0.2 mi. 0.5 mi.	0.7 ft. 4.8 ft.	- -
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 V-14

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 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 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.

TABLE V-15

NATOMAS FEATURES FOR 400-YEAR ALTERNATIVE

FEATURE	LOCATION	LENGTH	MAXIMUM HEIGHT	RELOCATION/OTHER
NEMDC:				
East Levee	•American R. to Arcade Creek •Arcade to Dry Cr.	- 1.4 mi.	- 1.8 ft.	- -
West Levee	•El Camino Rd. to Main Ave. •Main Ave. to NEMDC Pump Station •Riego Rd. to Sankey Rd.	2.6 mi. - 0.6 mi.	2.8 ft. - 1.1 ft.	Main Ave. Bridge - 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 •Extend levee	0.2 mi. 0.5 mi.	0.9 ft. 5.0 ft.	- -
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 V-16

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.

combinations of measures capable of providing from 100- to 500-year levels of flood protection. A 500-year level of protection plan was required to define conditions beyond a 400-year level of protection.

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. Essentially for these lower levels of protection, providing additional flood control storage space in Folsom Reservoir would be more cost effective than developing new upstream storage space. For levels of protection above 150 years, it would be more cost effective to construct new detention facilities and retain the existing storage capacity in Folsom Reservoir for water supply and hydropower. Annual flood control benefits exceed annual costs well beyond the 500-year level of protection.

SUMMARY DISPLAY

Table V-17 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 V-17

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 Ponderosa Way Main Ave.	Hwy 49 Ponderosa Way 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: SLURRY WALL TOE DRAIN NEW LEVEE LEVEE RAISING BANK RIPRAP LEVEE RIPRAP BANK/LEVEE RIPRAP	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	4.1 MILES 7.8 MILES 1.0 MILE 11.4 MILES 1.5 MILES 5.3 MILES 3.2 MILES	0.9 MILE 2.7 MILES 1.0 MILE 2.7 MILES 1.5 MILES 5.3 MILES 3.2 MILES	NOT APPLICABLE	0.7 MILE 0.6 MILE 0.9 MILE 0 MILES 1.5 MILES 5.3 MILES 3.2 MILES

1

RAISE/REPLACE BRIDGE AT:	Not Applicable	Hwy 49 Ponderosa Way Main Ave.	Hwy 49 Ponderosa Way 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: SLURRY WALL TOE DRAIN NEW LEVEE LEVEE RAISING BANK RIPRAP LEVEE RIPRAP BANK/LEVEE RIPRAP	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE	 4.1 MILES 7.8 MILES 1.0 MILE 11.4 MILES 1.5 MILES 5.3 MILES 3.2 MILES	 0.9 MILE 2.7 MILES 1.0 MILE 2.7 MILES 1.5 MILES 5.3 MILES 3.2 MILES	NOT APPLICABLE	 0.7 MILE 0.6 MILE 0.9 MILE 0 MILES 1.5 MILES 5.3 MILES 3.2 MILES
BUILD DAM AT AUBURN: STORAGE CAPACITY (ACRE-FEET) FLOOD POOL ELEV. (FT) MAX. POOL AREA (ACRES) STREAM LENGTH INUNDATED (MILES)	NO	YES 545,000 868.5 4,000 35.8	YES 894,000 945 5,450 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. • High net economic benefits. • No impact to existing CVP benefits. • Likely non-Federal sponsor.	• High level of flood protection. • Highest net economic benefits. • No impact to existing CVP benefits.	• Moderately high level of flood protection.	• Meets minimum requirements for flood insurance program. • 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. • FEMA restrictions	• Loss of habitat in Natomas. • Intermittent loss of habitat in detention area.	• Loss of habitat in Natomas. • Intermittent loss of habitat in detention area.	• Significant remaining flood threat. • No known non-Federal sponsor. • Severe impact	• Higher public health and safety threat than No-Action alternative. • No known non-Federal	• Higher public health and safety threat than No-Action alternative. • No known non-Federal	• Higher public health and safety threat than No-Action alternative. • No known non-Federal

2

MAX. POOL AREA (ACRES) STREAM LENGTH INUNDATED (MILES)		4,000 35.8	5,450 39.3				
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. • High net economic benefits. • No impact to existing CVP benefits. • Likely non-Federal sponsor.	• High level of flood protection. • Highest net economic benefits. • No impact to existing CVP benefits.	• Moderately high level of flood protection.	• Meets minimum requirements for flood insurance program. • 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. • FEMA restrictions continue to apply.	• Loss of habitat in Natomas. • Intermittent loss of habitat in detention area.	• Loss of habitat in Natomas. • Intermittent loss of habitat in detention area.	• Significant remaining flood threat. • No known non-Federal sponsor. • Severe impact on existing CVP system benefits. • Severe environmental impacts to lower American River. • Significant impact on Folsom Reservoir recreation. • Loss of habitat in Natomas. • Increase of flows and velocities within levee system.	• Higher public health and safety threat than No-Action alternative. • No known non-Federal sponsor. • Significant environmental impacts to lower American River and Natomas. • Impact on Folsom Reservoir recreation. • Loss of habitat in Natomas. • Increase of flows and velocities within levee system.	• Higher public health and safety threat than No-Action alternative. • No known non-Federal sponsor. • Significant environmental impacts to lower American River. • Impact on Folsom Reservoir recreation. • Reduction in existing CVP system benefits. • Loss of habitat in Natomas.	• Higher public health and safety threat than No-Action alternative. • No known non-Federal sponsor. • Reduction in existing CVP system benefits. • Impact on Folsom Reservoir recreation. • Environmental and recreation impacts to lower American River. • Loss of habitat in Natomas. • Increase of flows and velocities within levee system.

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.

3

CHAPTER VI

PLAN SELECTION PROCESS

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. 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.

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 and the average annual costs of that alternative. Net economic benefits for each alternative are shown in Table V-17. 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 $23 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 as the NED plan and would become a Federally supportable plan.

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.

Direct Impacts. - Increasing the channel capacity of the lower American River 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. These cover types and the areas associated with them support a greater diversity of wildlife than any other terrestrial habitat. Over the past century, dramatic statewide losses of freshwater marsh and riparian forest, in particular, make 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. In order to compensate for the loss of wildlife values associated with this habitat, up to 1,410 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.

Bank armoring, levee enlargement, and removal of riparian vegetation would significantly reduce the quality of both water-dependent and water-enhanced recreation in the lower American River. 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. In this case, such adverse impacts 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 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 from 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. Finally, the added space for flood control at Folsom could trigger adjustments in overall CVP operations which would adversely affect the winter run Chinook salmon and the Delta smelt, two Federally listed endangered species.

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 Americanf River including the fishery, riparian vegvetation, 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 USBR's authorized 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 boat ramp adjacent to the keyway, thereby providing some environmental restoration values.

Operation of the flood control only dam would have little effect 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. Investigations resulted in a determination that 1,927 acres of oak woodland, chapparal, and conifer forest cover types will be lost due to the combined effects of inundation and soil slippage along the canyons walls in the inundation zone. 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 acres 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. 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.

<u>Indirect Impacts</u>. - 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. 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.

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) social and economic dislocation due to the death and injury of flood plain occupants, inundation of transportation facilities, damage to automobiles and other means of transport, and destruction of capital equipment, (4) generation of significant quantities of land fill related to the disposal of flood-related debris, and (5) consumption of the environmental resources needed to replace damaged structures. Each of the alternatives would reduce the risk of incurring these impacts. However, since the reductions would vary, the residual flood damages associated with each of the alternatives would be different.

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) alternatives during the life of the project would be significantly greater than the impacts produced by all of the other alternatives.

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 one 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. DWR 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 States . . . 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- to 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, thereby eliminating the risk associated with the use of surcharge space. Planned use of surcharge space induces a greater risk of 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 would achieve the greatest net gains in public safety by substantially reducing the risk of flooding.

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.

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 the Sacramento Area Flood Control Agency (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 SPF. This standard was developed by the Corps in the late 1940's and early 1950'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.

In comparison 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. 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 converted 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.

PLAN SELECTION

Final plan selection was based on all of the above criteria. 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. The 200-year plan was extensively discussed in the draft EIS. The potential change in the selected plan could have been reasonably anticipated by the public. Indeed, during public review of the draft feasibility report and EIS/EIR, considerable comment was received in opposition to the higher level of protection.

CHAPTER VII

SELECTED PLAN

PLAN ACCOMPLISHMENTS

The plan selected for this report would provide, in conjunction with Folsom Reservoir and other existing flood control facilities, protection to most of the Sacramento area from a 200-year flood in the American and Sacramento Rivers. This includes Natomas and most of the lower reaches of Dry and Arcade Creeks. The selected plan would reduce average annual equivalent flood damages from about $191 million to approximately $57 million. The plan includes recreation trails on the flood control levees to be modified in Natomas. These facilities would provide about 335,000 additional recreation use days per year. The plan, in conjunction with policies and practices of local land use planning, would offset adverse impacts on environmental resources directly attributable to construction and operation of project features. No change in operation of Folsom Dam and Reservoir is included in the selected plan. Plate 14 is a plan view of the selected plan.

PLAN COMPONENTS

Main Stem American River

The major plan component in the upper basin is a peak-flow flood control dam to be located at river mile 20.1 of the North Fork American River near Auburn, California. The dam would provide a detention reservoir with a gross pool capacity of 545,000 acre-feet. At this storage--designed to provide 200-year flood protection along the main stem American River--the detention reservoir would have a flood pool elevation of 868.5 feet and cover about 4,000 acres. Except during flood periods lasting several days, the area behind the dam (river canyon) would be dry and look much as it does today.

Plate 17 shows the maximum elevation of floodwater which is expected to result from a variety of storm durations and frequencies. The duration of this depth is short because the floodwater continuously drains through the sluice gates.

From streambed, the dam would be about 425 feet high. It would be a concrete gravity structure (placed with roller compaction techniques) about 400 feet wide at the base and decreasing to about 25 feet at the top. Plate 18 shows the gross pool detention boundary behind the dam. Plate 19 shows a plan of the dam. Plate 20 is a cross-sectional view of the outlet works, and Plate 21 shows the dam in section and profile. The dam would be 2,600 feet long at the crest. The total volume of the dam would be about 5.2 million cubic yards. Most of this material would come from aggregate to be mined from an existing commercial quarry located about 4 miles from the damsite near Cool. (See Plate 28.)

Figure VII-1 is an artist's conception of the dam. Table VII-1 summarizes the major pertinent data and features of the selected plan, including the dam and associated facilities. More detailed information is included in the Designs and Cost Estimates Appendix.

Flood releases would pass through 12 sluices (measuring 5 feet by 9.5 feet) through the dam. The combined capacity of these sluices at flood control pool would be 87,000 cfs. The existing diversion tunnel constructed for Auburn Dam would be blocked with a bulkhead. Each sluice would be fitted with an emergency closure gate. In addition, bulkheads are available to block the sluices for inspection and maintenance. During normal conditions, these gates would remain open. They would be closed only to retard flows from the dam in the extremely unlikely event of an emergency affecting the dam and/or the downstream system. Such safety related conditions could include (1) at the dam--damage to one or more sluiceways affecting the structure; (2) at Folsom Dam--a seismic event damaging Folsom Dam and affecting its capacity to store or discharge water, and (3) along the levees--a flood event that would cause imminent levee failure. Additional safety scenarios can be found in Chapter VIII.

The project would require 6,032 acres of land in the detention dam area. Additional lands are included along the South Fork American River for environmental mitigation purposes (described later in this chapter). These lands include about 100 acres in fee title and 5,932 acres in flowage easements for occasional flooding. In addition, about 100 acres within the flowage easement limits would be needed for temporary construction easements and about 50 acres for road easements. Approximately 75 percent of the lands within the project are Federally-owned and would be retained in Federal ownership. The estimate of 6,032 acres of land is a reduction in the estimated required land of 18,000 acres identified in the draft report. This reduction occurred as a result of changes in criteria for establishing take-line areas for dry dams. The 6,032 acres is a smaller portion of the original 18,000 acres. Consequently, this change is not considered new and significant information.

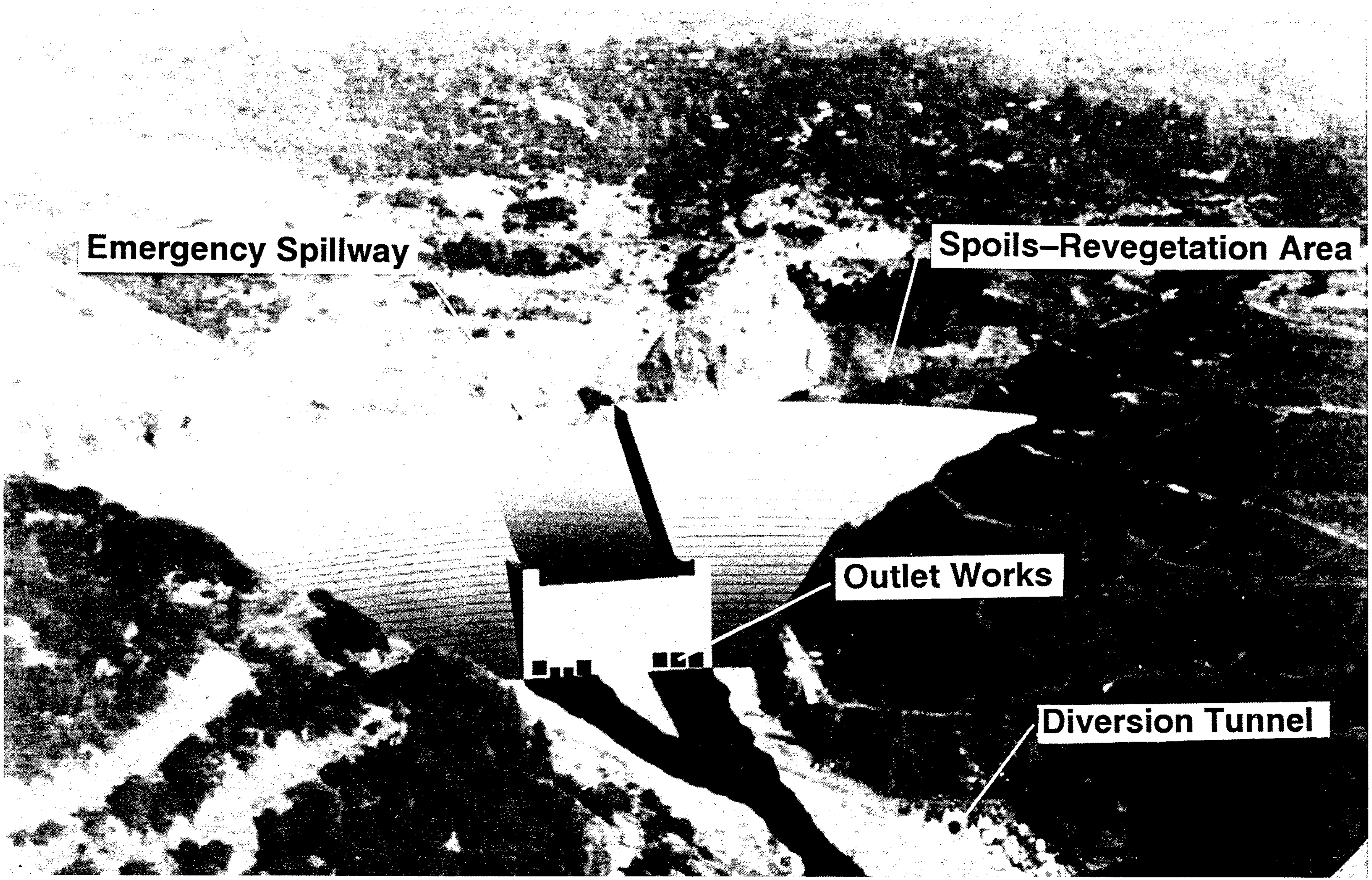

FIGURE VII–1 200–YEAR FLOOD CONTROL DAM

TABLE VII-1

PERTINENT DATA - SELECTED PLAN

Item	Data		
GENERAL			
State and Counties	California - Placer, El Dorado, Sacramento, and Sutter		
Rivers	American and Sacramento		
Purpose	Flood Control and Recreation		
Drainage Area American River Basin (square miles)	2,100		
Drainage Area at Damsite (square miles)	970		
Flood Plain Area (400-year acres)	109,400		
1990 Flood Plain (400-yr) Population	387,000		
Property Value ($ Billion-100/400-yr, 1990)	23/37		
Existing Event Damage ($ Billion-100/400-yr, 1990)	9/16		
Flood Protection Level (yr)	200		
MAIN STEM AMERICAN RIVER			
<u>Detention Basin</u>			
Mean Annual Runoff to Damsite (acre-feet) (Gaged flows, North Fork American River below Auburn Dam site, 1973-1985)	1,640,000		
100-year Peak Inflow/Outflow (cfs)	237,000/80,000		
200-year Peak Inflow/Outflow (cfs)	298,000/87,000		
Storage Data			
Event	<u>200</u>	<u>100</u>	<u>10</u>
Peak Storage (1,000 acre-feet)	545	390	39
Elevation (ft-msl)	868.5	826	634
Surface Area (acres)	4,000	3,240	660

Dam

Type	Roller Compacted Concrete
Top-of-Dam Elevation (ft-msl)	923.7
Streambed Elevation (ft-msl)	498.7
Bottom of Foundation (ft-msl)	450
Maximum Height Above Streambed (ft)	425
Crest Length (ft)	2,600
Crest Width (ft)	25
Base Width (ft)	400
Freeboard Above Spillway Design Flood Pool (ft)	3
Total Volume of Concrete (cu yds)	5.2 million

Spillway

Location	Center of Dam
Type	Ungated Ogee with Flip Bucket into Plunge Pool
Crest Elevation (ft-msl)	868.5
Crest Length (ft)	600
Flip Bucket Lip Elevation (ft-mls)	604.9
Spillway Design Discharge (cfs)	860,000

Flood Control Outlet Works

Type	Sluices
Location	Six each side of spillway
Number	Twelve
Shape	Rectangular
Width x Height (ft)	5 x 9.5
Emergency Gates	One per sluice
Peak Capacity (each - cfs)	7,250

Lands

Total Required (acres)	6,098
Detention Dam Area	(6,032)
Highway 49 and Ponderosa Way	(66)

Major Relocations

Highway 49	
Length (mi)	1.8
Lanes	Two
Bridges	
Number	Four
Type	Post Tension Concrete
Height (Elev ft-msl)	1,000
Total Length (ft)	8,900
Ponderosa Way	
Length (mi)	0.8 mi
Lanes	Two
Bridge	
Type	Concrete
Height (Elev (ft-msl))	1,250
Length (ft)	1,200

<u>Existing Folsom Dam and Reservoir</u>	
Purposes	Flood Control, Water Supply, Hydropower
Mean Annual Unregulated Runoff to Reservoir (acre-feet)	2,788,000
100-yr Peak Inflow/Outflow (cfs)	195,000/115,000
200-yr Peak Inflow/Outflow (cfs)	228,000/115,000
Flood Control Storage Space (acre-feet)	400,000
<u>Environmental Mitigation</u>	
General Wildlife, Vegetation, Fish	- Acquisition and vegetation planting on 2,685 acres along the South Fork American River - Adaptive management plan in detention area
Valley Elderberry Longhorn Beetle	- Acquisition and elderberry shrubs planting on 2,700 acres along the South Fork American River

NATOMAS

	NEMDC	Dry Cr	Arcade Cr	Pleasant Grove Cr	NCC
<u>Levee Modifications</u>					
Locations - No.	2	1	1	2	3
Height (ft-avg)	1.0	0.5	1	1-2	0.5
Length (ft)	21,300	1,100	1,200	500	18,000
<u>New/Extended Levee</u>					
Height (ft)	4	8	6	-	-
Length (ft)	3,000	4,600	2,400	-	-
Top Width (ft)	-	20	20	-	-
Bottom Width (ft)	60	40/50	40	-	-
<u>Channel Modification</u>					
Length (ft)	10,600	-	-	-	-
<u>Bridge Replacement</u>					
Site	Main Ave.	-	-	-	-
<u>Land Requirements</u>					
Levee Easement (ac)	8.3	13.8	2.2	-	-
Flowage Easement (ac)	-	-	-	-	-
Channel Easement (ac)	19.5	-	-	-	-
Temp. Easement (ac)	24.2	12.0	14.3	-	-

NEMDC - Pump Structure

Location	NEMDC Just North of Dry Creek
Streambed Elev (ft)	24
Top-of-Structure Elev (ft)	44
Length (ft)	90
Maximum Pumping Capacity (cfs)	700
Sluices	2 - Low Level, Normally Open

Pleasant Grove Detention Basin

Location	Northeast Corner of Natomas Area
New Levee	
Length (ft)	11,600
Max. Height (ft)	17
Top Width (ft)	20
Avg. Bottom Width (ft)	100
Storage Capacity (ac-ft)	3,000
Area of Basin (acres)	300
Inlet Sluices	6 - 8x8 foot culverts
Land Requirements:	
Levee Easements (ac)	29.3
Flowage Easements (ac)	279.2
Channel Easements (ac)	-
Temp. Easements (ac)	65.0

Borrow Site

Levee Easements	-
Flowage Easements	-
Channel Easements	-
Temp. Easements	125.0

Environmental Mitigation

Direct
- Manage 280 acres in Natomas
- Install fish screens on pump inlets in NEMDC

Recreation Trails	Pedestrian/ Bicycle	Equestrian
Location		
NEMDC	5.5 miles	5.5 miles
Arcade Creek	2.0 miles	-
Dry Creek	2.0 miles	2.0 miles
American River Parkway (Hwy 160 undercrossing)	1.0 miles	2.0 miles

Land Requirements

- Purchase 2 acres in fee for parking.
- 24 acres in fee for trails on lands now covered by existing easements.

Features

- Picnic facilities, sanitary and water supply at existing park sites

The non-Federal sponsor would need to acquire flowage and road easements from private landowners and USBR. The sponsor would also need to acquire fee lands for fish and wildlife mitigation and permanent road easements for relocation of Highway 49 and Ponderosa Way. The Corps would obtain jurisdiction over the lands currently held by USBR which are needed for the dam and embankment. The Corps would also obtain the necessary right-of-way or negotiate agreements for those lands currently under the jurisdiction of the U.S. Bureau of Land Management and U.S. Forest Service. The Corps would take this action because right-of-way issued to a Federal agency cannot be altered or revoked without agency consent.

The selected relocation for Highway 49 and Ponderosa Way includes a two-lane bridge across the American River as close as practical to the existing highway at each location and constructed to current standards. The route chosen for Highway 49 is shown on Plate 22. The bridge would be at about elevation 1,000 feet.

Allowance for a "dead pool space" for sediment would not be required mainly because only small amounts of material would likely reach the damsite. Sediment yield studies described in Chapter VI of the Hydrology Appendix indicate that about 26,000 acre-feet of material could reach the damsite over 100 years. Most would pass through the outlet sluices. Even if a large portion does not pass the damsite, this amount of sediment relative to the flood control storage is insignificant.

<u>Natomas</u>

Plate 23 shows the overall flood control plan features for Natomas; Plates 24 through 26 show the locations for construction in more detail. The flood control features for the Natomas area portion of the selected plan include:

- Raise 13,500 lineal feet of the west NEMDC levee an average 0.5 foot from El Camino Avenue to Main Avenue (Plate 24).

- Raise 7,600 lineal feet of the east levee of the NEMDC an average of 0.5 foot from Arcade Creek to Main Avenue (Plate 24).

- Replace the Main Avenue Bridge (Plate 24).

- Construct a high-volume (700-cfs) pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek (Plate 24). (This would also provide flood protection to the western portion of Rio Linda.)

- Construct about 4,600 lineal feet of new levee an average of 6 feet high along the north side of Dry Creek from the proposed pumping station at the NEMDC to high ground near West 2nd Street and Ascot Avenue (Plate 24). (This would also help provide flood protection to the western portion of Rio Linda.)

- Extend the existing south Dry Creek levee 2,400 feet east to Rio Linda Boulevard (Plate 24).

- Construct about 2,400 lineal feet of new levee about 3 feet high on the north side of Arcade Creek downstream from Marysville Boulevard (Plate 24).

- Raise 1,200 lineal feet of levee on the south side of Arcade Creek downstream from Marysville Boulevard about 1 foot (Plate 24).

- Raise 18,000 lineal feet of the south levee of the NCC about 0.5 foot at three selected locations (Plate 25).

- Raise 500 lineal feet of the West Pleasant Grove Creek Canal levee about 1 foot at two bridge crossings and modify a containment levee across the canal at Sankey Road (Plate 26).

- Raise the East Levee Road by 4 feet from Sankey Road south for 3,000 lineal feet (Plate 26).

- Enlarge a drainage channel south from Sankey Road for about 10,600 feet (Plate 26).

- Construct a 3,000 acre-foot detention basin on about 300 acres in the northeast corner of Natomas.

The 3,000 acre-foot detention basin in the northeast corner of Natomas replaces Fremont Weir and adjacent Yolo Bypass construction activities identified in the draft report. This change was made based upon more detailed evaluations carried out during the draft report review process. The alternative of using a detention basin was discussed in the draft report. The impact of this refinement is not significant because impacts associated with it will be reduced below significance with mitigation measures associated with the detention basin.

The draft report identified two internal drainage pumps in Natomas as a project feature. Based on policy review during the public review process, these pumps are no longer included as features of the Federal project. This change is not significant because the pumps will still have to be installed prior to any development in Natomas, but their construction will be the responsibility of the non-Federal sponsor at the time when development occurs.

Recreation Plan

The primary recreation features in Natomas would include paved pedestrian/biking trails (9.5 miles) and unpaved equestrian trails (7.5 miles) along portions of the NEMDC and lower Dry Creek and Arcade Creek. The trail system will be located entirely off-street, utilizing overpasses and underpasses to avoid surface crossings or arterial streets wherever possible. Additional minor connector trail segments will be developed to link the trails to the adjacent neighborhoods. Existing and planned city and county parks will be used as staging areas (parking and restrooms). Shade trees plantings will also be implemented along the NEMDC to beautify and enhance the recreation trail. Finally, for safety reasons a 1.1-mile section of the existing Jedediah Smith bike trail would be relocated.

The City and County of Sacramento will serve as joint non-Federal sponsors of the NEMDC trail. The proportion of the costs to be borne by each agency will be negotiated between the two participating agencies.

Trail construction will be located on lands acquired for construction of the Natomas portions of the American River Watershed flood control project or on existing lands that are part of the Sacramento River Flood Control Project. (See Plate 27.) No new lands would be purchased other than those required for access to the trails or to provide for public health and safety.

In general, the non-Federal sponsors wish to have a minimal level of development. The surrounding area has a high vandalism and crime rate; thus, elaborate facilities (except for those with controlled entry) are not desired. Basic trails with trash containers, occasional picnic tables, shade trees, and drinking fountains will be the basic recreation trail elements. (See Figure 2.)

Unless specified otherwise, all bicycle trails would be constructed with asphaltic concrete over a compacted base course, 12 feet wide with 2-foot-wide decomposed granite surfaced shoulders (for runners). A yellow centerline stripe would be provided. Where levee top widths or major obstructions such as large trees would not permit a 16-foot-wide trail, the width may be reduced to as little as 8 feet, with 2-foot shoulders. City and county recreation staff experience with other heavily used local trails has found trails with 12-foot widths have significantly lower accident rates. At points where the trails pass under bridges, a minimum clearance of 12 feet will be required. (See Figure 3.)

The NEMDC bicycle/pedestrian trail consists of a 9.5-mile system of paved trails extending north from the American River Parkway trail (via the Sacramento Northern Trail) along the NEMDC to Elkhorn Boulevard (5.5 miles), where a staging area will be located. Spur trails approximately 2 miles in length will extend east along lower Arcade Creek and lower Dry Creek. The southern terminus of the trail would be located on the NEMDC east levee, where the City's Sacramento Northern Trail leaves the NEMDC levee and continues northeast across the Union Pacific Railroad tracks.

To the west of Highway 160, the existing bike trail crosses a busy section of Del Paso Boulevard creating a safety problem for trail users. To avoid the safety problems, the trail would be rerouted, starting approximately 400 feet east of the Highway 160 overpass. It would go south to the river where it would pass under the Highway 160 bridge and be routed around the trailer park to the west of Northgate Boulevard. The total length of trail is approximately 1.1 miles.

Where possible, equestrian trails will be located apart from bicycle trails, generally on opposite sides of the creek. (See Figure 4.) The alignment will usually be located at the base of the levees within the NEMDC. For the construction of the equestrian trail tread, clearance of native soil, 18 to 36 inches in width would be required.

The equestrian trail consists of a 7.5-mile system of cleared dirt trails extending from the existing equestrian trail in the American River Parkway north along the NEMDC to Elkhorn Boulevard (5.5 miles) with a spur trail (2 miles long) along Dry Creek to the existing Sacramento Northern Trail. On the south end of the trail, the existing staging areas on the American River Parkway would be used for the connecting NEMDC trail. The trail would follow the base of the existing Sacramento River Flood Control Project levee up to Arcade Creek. Between Arcade Creek and Main Avenue, the existing levee will be raised and widened on the channel side. The equestrian trail will follow the base of the new levee work.

DESIGN AND CONSTRUCTION CONSIDERATIONS

Main Stem American River

The major design considerations for the damsite were to:

- Use as much as possible of the existing construction work already accomplished by the USBR.

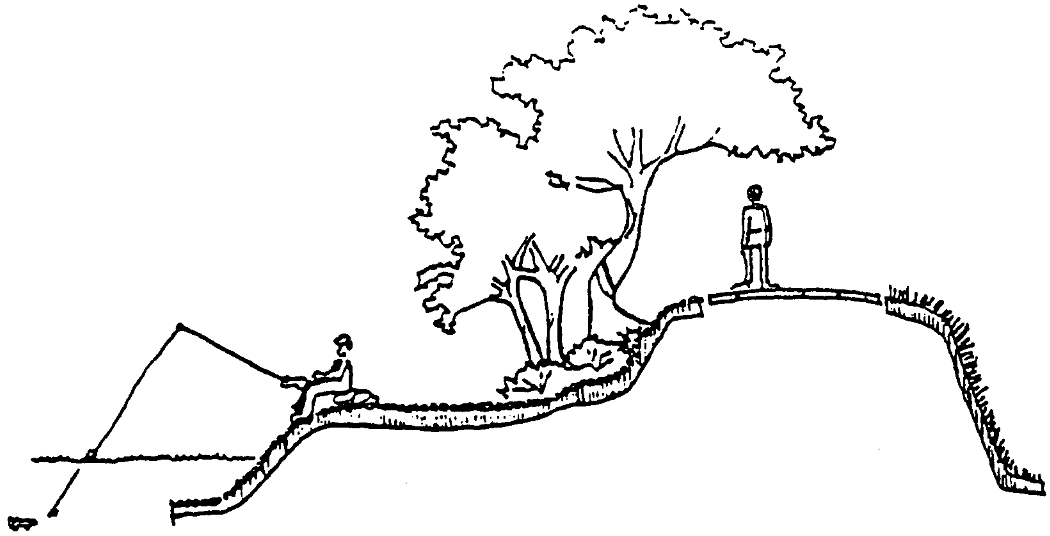

Figure VII-2 - Cross-section of pedestrian /bike trail and walk-in fishing access.

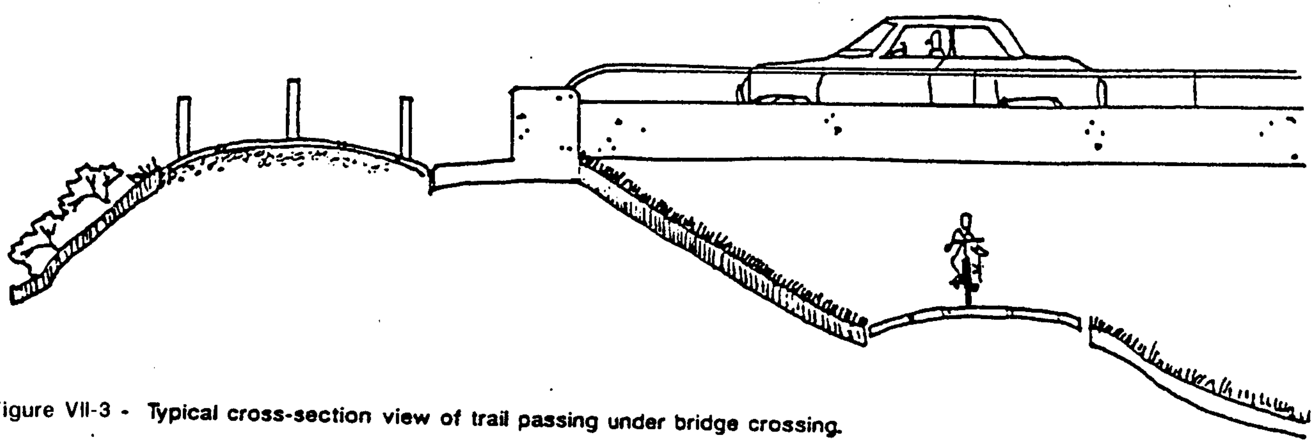

Figure VII-3 - Typical cross-section view of trail passing under bridge crossing.

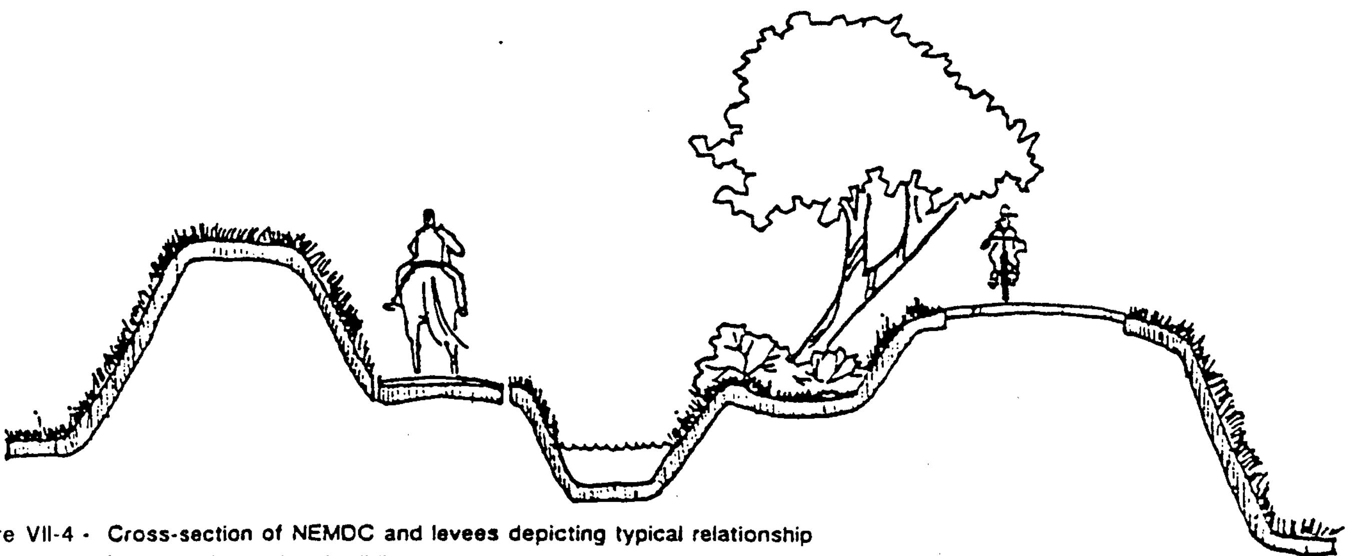

Figure VII-4 - Cross-section of NEMDC and levees depicting typical relationship between the pedestrian/bike trail and equestrian trail.

- Be certain the dam could withstand the design seismic event.

- Meet the design criteria for the required relocations.

Existing work that could be used includes the remaining section of the cofferdam, diversion tunnel, some of the foundation work for the main dam, and access roads. The tunnel would be used to divert water during construction. Also, some of the detailed exploration and engineering design information developed for the site by USBR would be used for project design.

Full consideration has been given to the seismicity of the river mile 20.1 site in the preliminary design of the flood control dam. The seismic design parameters used were a maximum credible earthquake of magnitude 6.5 with a peak ground acceleration of 0.64 g in the horizontal direction and 0.39 g in the vertical direction. In addition, the design used a fault displacement of 9 inches. With the present alignment, the dam is not located on the surface trace of the fault in the footprint of the original arch dam. A slight curvature in the dam alignment has been provided, and concrete strengths in the dam would be sufficient to withstand stresses during the design seismic event. Additional information is provided in Chapter VIII and the Geotechnical Investigation Appendix.

Approximately 5.1 million cubic yards of aggregate will be used in constructing the dam. This aggregate will be mined from the existing commercial quarry near Cool. Processed material will be transported from the quarry by a conveyor belt system to the construction site. Additional information is contained in the EIS/EIR.

Highway 49 replacement will be in-kind with a bridge and road generally along the river mile 23.0 alignment. This directly impacts 31 acres of land in the area. There would be no indirect impacts related to this relocation in northwestern El Dorado County since the commute times are not significantly reduced. The State, as a non-Federal sponsor, is responsible for this relocation. The proposed action will be reviewed by the California Transportation Commission. Given the long-term needs of the State to consider a major relocation of the highway in the Auburn area, route adoption studies will be conducted by the State. As part of this process, additional environmental analysis may be performed.

Folsom Spillway Adequacy

It should be noted that the 200-year dry dam design at Auburn increases the ability of Folsom Dam to pass extremely large, remotely-occurring floods. Folsom Dam, at present, can only pass about 65% to 75% of the Probable Maximum Flood (PMF).

The range in the percent passing results from how much freeboard remains in the reservoir. The lower bound is based on five feet of freeboard remaining, while at the higher bound there is no freeboard remaining. With a 200-year dry dam at Auburn, Folsom Dam could pass about 73% of the PMF with five feet of freeboard. If the freeboard is reduced to zero, the 200-year dry dam allows Folsom Dam to pass about 90% of the PMF. These percentages are based on the current operation of Folsom Dam.

A series of detailed design documents will be prepared for the different aspects of project construction. Construction will proceed with different contracts for the major aspects of work--relocations, foundation, and main dam. The existing diversion tunnel will be used during construction. The local sponsor is responsible for relocations, which will have to be done before completion of the main dam.

Natomas

Most Natomas levee related work will be done on top of existing levees and involves increasing their heights by 0.5 to 2 feet. Consequently, for rare events, the levees will not fail or overtop at the existing elevations but at an elevation slightly higher. This slightly higher flood level is mitigated for by providing a detention basin in Natomas. This basin has been sized to store the volume of the floodwater resulting from the increased flood elevations due to construction of the project. This impact occurs at the peak of infrequent floods, so basin inlets were sized to pass the increased volumes over the time of the peak flood. Levee stability was investigated during the Sacramento River Flood Control Project System Evaluation, and no problems were identified for the levees being modified as part of this project when evaluated for current design water surface elevations and flow. Design for, and construction of, the new levee section along Dry and Arcade Creeks will follow standard practices.

Another design consideration for Natomas is ensuring that the Sankey Road modifications work with the NEMDC pump station near Dry Creek. As a result of raising the East Levee Road at Sankey Road, high stages from Pleasant Grove will now be prevented from flowing into Natomas. The slight increase in stages (0.1 foot) which would occur to the water naturally overflowing Sankey Road and flowing south into NEMDC will be prevented by reducing the backwater effects from NEMDC in two ways. The first is to close the gates at the NEMDC pump station to prevent American River water from filling the storage space available in the upper NEMDC and creating a natural backwater. The second is to construct a 3,000-cfs capacity channel which will facilitate the removal of overflow water which occurs only during the short time of the peak stages.

The pumping plant in the NEMDC will be completed before the new north levee of Dry Creek is finished. The Natomas levees will be the first work contracted for the project and should take about 18 months to complete.

Construction of recreation trails will be on lands acquired for levee modification of the Natomas portion of the project or on existing lands that are part of the Sacramento River Flood Control Project. Unless limited by on-site conditions, all paved trails will be 12 feet wide. Where possible, equestrian trails will be located apart from bicycle trails, generally on the opposite side of the creek. In general, the non-Federal sponsors prefer a minimal level of development on trails.

Coordination with State Dam Safety Officials

During design and construction of the project, the Corps will coordinate with the State Dam Safety Agency. The Corps is solely responsible for the design of the project, but will provide an opportunity for State officials and any non-Federal technical review board to comment on feature design memoranda and plans and specifications. Additionally, the Corps will provide a copy of the plans and specifications with the State prior to initiation of construction. During construction, the Corps is solely responsible for administering the construction contract, including inspection of the contractor's work. In order to keep the State informed, State representatives will be allowed access to Corps' files to review any construction-related documents they desire to see. Copies of specific documents requested by the State will be provided by the Corps. The State may arrange with the Corps to visit the site during construction. The Corps will not be required to pay any permit fees to the State during any phase of the project. No such fees have been added to the project cost.

ENVIRONMENTAL MITIGATION

Without mitigation, the selected plan would adversely affect environmental resources in the project area. Mitigation measures are briefly described below and in the EIS/EIR.

Direct Impacts

Mitigation for direct adverse impacts will be included in the project. Costs for mitigation will be shared in accordance with established procedures.

Main Stem American River. - About 1,927 acres of oak forest/woodland, coniferous forest, chaparral, and riverine habitat could be lost over the life of the project (average annual equivalent loss at 1010 acres) in the detention dam area. Also, there could be an adverse impact to the threatened valley elderberry longhorn battle. Mitigation concurrently in the selected plan consists of acquiring 5,385 acres along the South Fork American River and both preserving the wildlife values of the area and accomplishing some elderberry shrub plantings. On the basis of available local land use information, it is estimated that much of the lands along the South Fork of the American River will be developed in the future. Mitigation would primarily consist of allowing those lands to remain in their present state. Of the 5,385 acres, 2,685 acres would be acquired and preserved. The remaining 2,700 acres would be acquired to offset possible impacts to the valley elderberry longhorn beetle. Also included is an adaptive management plan for the detention dam area as part of the operation and maintenance. (See operation and maintenance section of this chapter). A map showing the general area of the mitigation land is shown on Plate 28. It was determined that mitigation on project lands in the detention dam area was not appropriate due to high wildlife values in that area. Lands on the South Fork American River were previously identified by the U.S. Fish and Wildlife Service (FWS) alternative mitigation site in the draft EIS/EIR.

Impacts to historic prehistoric, and paleontological resources would also be mitigated. Mitigation will consist of data recovery and documentation. Mitigation actions for cultural sites will be guided by a programmatic agreement. This agreement can be found in the Cultural and Paleontological Resources Appendix.

Impacts to fisheries resources would be mitigated with a program to remove material from the river that might result due to potential slides as a result of inundation.

Following public review of the draft feasibility report, the FWS indicated that elderberry shrubs in the detention dam area may be habitat for the threatened valley elderberry longhorn beetle. To ensure the environmental mitigation for the selected plan encompasses a possible impact on the threatened beetle, a plan based on the most severe set of assumptions was developed. These assumptions include:

- Beetle species in the detention dam area are, in fact, the threatened valley elderberry longhorn beetle.
- All elderberry shrubs in the area provide effective habitat for the threatened beetle.
- All the detention area lands would be inundated during

the first few years of the project life.

- When the elderberry shrubs become inundated, no matter the duration, they no longer provide habitat for the threatened beetle over the 100-year project life.

- All of the shrubs in the lowest elevations provide highly effective beetle habitat while at the higher elevations the shrubs provide less valuable habitat due to their being more isolated.

The chances of the above assumptions occurring are remote. However, on the basis of these assumptions, estimated densities of elderberry shrubs in the detention dam area, and an average shrubs replacement ratio of 3 to 1, about 32,336 shrubs would need to be planted. The FWS identified a requirement for 2,700 and the elderberry shrubs planted to offset potential impacts to threatened beetle. Accordingly, as mentioned, of the 5,385 acre mitigation area, 2,700 acres would be acquired and managed for potential impacts to the threatened beetle. However, studies will be conducted during the preconstruction engineering and design portion of the project to determine the presence or absence of the threatened beetle in the detention dam area and to refine the mitigation requirement, including the appropriateness of planting elderberry shrubs within the area acquired for general wildlife and vegetation mitigation.

Natomas. - About 290 acres of wildlife habitat would be affected as a result of levee modifications in the Natomas area (levee raising, new levees along Dry Creek and in the detention basin area, and relocated channel modifications). Mitigation would involve acquiring 280 acres of agricultural lands and managing as a wetland/upland complex as described by FWS. This land would be located near the Sutter/Sacramento County line in Natomas. Impacts due to the bike trail would be mitigated through a tree planting program along the trail.

Indirect Impacts

Indirect impacts are the growth-inducing effects associated with project implementation. The Corps is responsible for identifying the likely indirect impacts, and the non-Federal sponsor is responsible for avoiding or mitigating them when development occurs. In the detention area, no significant growth-inducing impacts are expected. Although Highway 49 and approaches would be raised above the detention dam gross pool elevation, it would still be well within the canyon area and would not significantly decrease the travel time between Auburn and northwestern El Dorado County. In Natomas, it is reasonably and foreseeable clear that the project would result in induced residential, industrial, and related development. Less clear, however, are the specific type, location, and magnitude of this development and the impacts associated with it. The EIS/EIR identifies the impacts associated with project-induced growth anticipated under existing local agency plans, which are generally based on forecasts through the year 2010. The EIS/EIR further contemplates development and impacts which could occur in Natomas beyond this planning period.

Another feature of the mitigation plan is the development and implementation of a Habitat Conservation Plan for endangered species. Under this plan, a conservation strategy will be identified for each of the endangered species impacted under this project. Long-term management strategies will be identified, including identification of a detailed mitigation plan, annual costs, proposed monitoring, and annual reporting requirements. This Habitat Conservation Plan is to be coordinated between the State Department of Fish and Game, USBR, Corps, and SAFCA.

OPERATION AND MAINTENANCE CONSIDERATIONS

General

Once the project is complete, ownership is transferred to the local sponsor. The local sponsor is then responsible for the operation, maintenance, replacement, and rehabilitation of the project. The Corps will provide the following documents to regulate how the local sponsor operates, maintains, and rehabilitates the facilities: Water Control Manual, Operation and Maintenance Manual, and Initial Flood Inundation Plan. The Corps has the responsibility to ensure that the local sponsor inspects, operates, maintains, and rehabilitates the project facilities according to the criteria provided in these manuals to ensure that a safe project is maintained.

Operation

Main Stem American River. - Operation of the detention dam for flood control would not be required. During the flood season, the gates on the outlet sluices would be left open under all anticipated conditions. The gates would be inspected periodically, normally during the summer. Two of the 12 outlet sluices would be at streambed elevation. This would allow normal low flows without backing up water in the reservoir area. These low level sluices would be closed annually for up to 2 days each year for inspection and maintenance. There would be no permanent minimum pool upstream from the dam. The only condition under which the gates would be used would be to maintain the integrity of the downstream flood control system. The gates are for emergency operation only. Additional information on the gates is included in the Special Topics Chapter.

Folsom Dam would be operated as it is currently. Peak floodflows into Folsom Reservoir would be less, due to the additional upstream storage. During flood conditions, the storage in Folsom would fluctuate less than under existing conditions because of the effects of the new dam. The Water Control Manual for Folsom Dam would be modified to reflect the impacts of the additional upstream storage.

Natomas. - Operation of the pump station on the NEMDC would be coordinated with (1) stages in the Sacramento River and (2) releases from Folsom Dam. Normally, the low-flow sluices at the pump station would be open. When the stage in the Sacramento River at the I Street gage reaches 25 feet (mean sea level), the gates would be closed. Once closed, the gates would remain closed as long as the water level upstream from the structure is lower than the level downstream. When the levels are reversed, the gates would be opened, allowing evacuation of the pooled area upstream. If during major floods the depths upstream from the structure exceed 28 feet, the pumps would be activated to evacuate the pooled area even if the downstream stage is higher. The detention basin will require infrequent operation. Flood levels in Pleasant Grove Creek will be automatically monitored. When the levels reach a predetermined elevation, the gates will be opened to store affected flows.

Maintenance

The periodic maintenance of the project would be described in an Operation and Maintenance (O&M) Manual to be prepared by the Corps. All O&M activities are to be paid for and accomplished by the non-Federal project sponsors. The non-Federal sponsors are required to provide the Corps with a semi-annual report describing operation and maintenance accomplishments.

Main Stem American River. - Maintenance of project features on the main stem American River would consist of:

- Structure Maintenance - Periodic inspection and maintenance of the dam structure, outlet works, and spillway.

- Adaptive Management Plan - Implement an adaptive management plan as part of the operation and maintenance manual. This adaptive management plan will address resource losses in the detention dam area induced by the project in excess of those identified and mitigated through offsite mitigation. Should impacts primarily to vegetation occur as a result of flood inundation or sloughing in excess to those expected, this plan would include features to insure they would be mitigated. Under the plan, mechanisms for identifying project induced impacts will include establishing a baseline information database for preinundation conditions and a monitoring program for identifying impacts. In addition, the plan will provide a mechanism for determining appropriate mitigation measures for identified impacts and a implementation process.

- Remove sediment immediately upstream from the dam (should significant amounts accumulate at site).

- Periodic restoration of minor roads and trails currently used for river access and general area relocation.

Natomas. - Maintenance requirements in Natomas would include:

- Periodic removal from the levee improvement area of vegetation which could be disruptive to levee integrity.
- Restoration of any degenerating conditions at the pump station structure. The telemetry system would also be periodically serviced.
- Periodic removal of deposited sediment from the Sankey Road overflow canal.
- Periodic inspection and operation of sluice gates at the detention basin.

Inspection

A post-construction inspection plan will be detailed in the Operation and Maintenance Manual. At the first periodic inspection, the Corps will train the local sponsor on inspection procedures. Both the State and local sponsor will participate, and the Corps will prepare the first periodic inspection report. During subsequent inspections, the local sponsor will perform the inspection and prepare the report. The Corps may participate in this inspection and will review the report.

PLAN ECONOMICS

The costs, benefits, and accomplishments of the selected plan are summarized in the following paragraphs. Detailed information is provided in the Economics Appendix. The project economics are based on October 1991 price levels, 8-3/4 percent interest rate, 100-year repayment period, 7-year construction period beginning in 1995, and full flood control in 2001.

Costs

An M-CACES "Code of Accounts Cost Estimate" was made for the selected plan. The cost is based on a design at the feasibility study level of detail for the selected plan consistent with applicable Corps' guidelines. Because this cost estimate method is extremely time consuming and, thus, highly costly, it was not applied to all the alternatives previously described. This estimate resulted in a first cost for the 200-year alternative about 20 percent greater than the estimate used to identify the NED plan and in plan selection. It is believed, however, that the relationship of the costs of the various alternatives to the costs of the selected plan would be similar if the detailed cost estimate were applied for all cases (see Economic Appendix for more information).

Estimated first and annual costs of the selected plan are summarized in Table VII-2. The total estimated first cost is $698.2 million, and the estimated average annual cost is $61.7 million.

The estimated cost of the Tentatively Selected Plan (400-year plan) identified in the draft report was $836 million. The estimate cost of the final selected plan is about $140 million less. The draft report considered a full range of alternatives at various cost levels. The potential change in plan costs could have been reasonably anticipated by the public. Some comments voiced concerns relating to the cost of the project. A reduction in cost is consistent with such concerns.

Benefits

As shown in Table VII-3, the total average annual economic benefits are about $167.9 million. This includes flood control benefits (including flood damage reduction, location and related type benefits) of $166.4 million. The annual recreation benefits are estimated at $1.5 million.

Economic Justification

Selected Plan. - An economic summary of the selected plan is included in Table VII-3. As shown, the estimated net economic benefits are about $106.2 million, and the benefit-cost ratio is 2.7 to 1. A description of the economic analysis is contained in Chapter XIII and the Economics Appendix.

Incremental Analysis of Natomas. - As indicated, flood control features on main stem American River can help but not resolve flood problems in Natomas. Conversely, protecting only Natomas would not likely be feasible due to induced flooding in adjacent areas. Consequently, Natomas can be analyzed as a last-added increment to a flood control project in the watershed.

An analysis of Natomas as a last-added increment basis is included in the Economic Appendix. Briefly, however, the estimated average annual flood control related benefit for a project design to protect the main stem American River (detention dam near Auburn capable of providing a 200-year level of protection to main stem American River (excluding Natomas)) is approximately $138.2 million. As indicated, the total average annual flood control related benefits for the selected project 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).

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. The net average annual flood control related economic benefit for Natomas as a last-added increment is $24.1 million ($28.2 - $4.1). Since the benefits outweigh the costs, the Natomas features are economically feasible as a last-added increment.

RISK AND UNCERTAINTY

Whether the selected plan will provide the full accomplishments anticipated is dependent on the validity of pertinent assumptions, base data, and analytic techniques used in this study; the successful completion of future studies, designs, and construction; and appropriate operation and maintenance after construction. Several significant study elements and the estimated relative risk and/or uncertainty associated with them are described below.

Interior Drainage Problems

Generally, flooding from sources other than the Sacramento and American Rivers and their tributaries is considered to be "local," or "interior," flooding. The potential for interior flooding is high and, except in areas where development is induced by the project, would not be affected by implementing the selected plan. In most cases, this interior flooding would be shallow and localized. The City and County of Sacramento have identified many local areas with interior flood problems. An example is the Pocket area in south Sacramento, which is subject to flooding from Morrison Creek. To help protect the Pocket area, the City of Sacramento will rehabilitate the north levee of Morrison Creek west of Highway 99 prior to completion of the selected plan.

TABLE VII-2
SELECTED PLAN COST ESTIMATE
($1,000) 1/

Item	Upper American River 2/	Natomas	Total
First Cost			
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 & Relocations	103,400	4,000	107,400
Dam	320,700	--	320,700
Levee Modification	--	5,200	5,200
Floodways and 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 5/	77,700	--	77,700
Total	649,000	49,200	698,200
Investment Cost			
Total First Cost	649,000	49,200	698,200
Creditable Expenditures Deduction 5/	-77,700	-	-77,700
IDC 6/	64,500	5,600	70,100
Total	635,800	54,800	690,600
Annual Cost 7/			
Interest and Amortization	55,700	4,700	60,400
Operation and Maintenance	1,000	300	1,300
Total	56,700	5,000	61,700

1/ October 1991 price levels.
2/ 545,000 acre-feet of flood storage near Auburn Dam site.
3/ Does not include lands.
4/ E,D,S, and A = Engineering, Design, Supervision, and Administration.
5/ Included for cost apportionment but not economic analysis.
6/ IDC = Interest during construction.
7/ On investment cost with 100-year project life and 8-3/4 percent interest rate.

TABLE VII-3
ECONOMIC SUMMARY OF SELECTED PLAN

Item	($1,000)
First Cost Less Creditable Expenditures to Date	620,500
Annual Cost 1/	61,700
Annual Benefits 2/	
Flood Control	
Inundation Reduction	134,010
Location	24,000
Savings in Flood Proofing Costs	170
Bridge Replacement	1,770
Savings in Flood Insurance Program Costs	6,400
Recreation	1,500
Subtotal (Rounded)	167,900
Net Benefits	106,200
B/C Ratio	2.7 to 1.0

1/ Includes IDC and operation and maintenance.
2/ 100-year project life and 8-3/4 percent interest rate.

Environmental Mitigation

The uncertainty of adequately offsetting adverse impacts to environmental resources resulting from project construction is low. A detailed analysis of impacts and mitigation measures has been coordinated with various agencies. The success of mitigation efforts will be monitored by the non-Federal sponsor, and the Corps will enforce the required measures in accordance with the Operation and Maintenance Manual. In Natomas, the non-Federal sponsor plans to follow a Memorandum of Understanding, which is included in the Pertinent Correspondence Appendix and described in the EIS/EIR, when avoiding or mitigating indirect impacts.

Project Cost

The confidence level in the project cost estimates is high. The cost estimate, based on the Code of Accounts Cost Estimating procedures, was used for the selected plan. Also, detailed information about highly variable conditions was available for the project area from work previously done by USBR for the multipurpose Auburn Dam project. Contingencies in the cost estimate have been included to ensure adequate cost estimates for those items where unknowns exist.

Benefits

The confidence in achieving the estimated economic benefits is high. Included in the Economic Appendix is an analysis of levee failure under various conditions (failure at bottom of freeboard and failure at the top of levee in comparison to the selected failure mode used for the without-project conditions). The analysis showed that the economic benefits are relatively insensitive to varying levee failure assumptions, within reasonable ranges. In all cases, the benefits are similar and sizeable.

NED

As can be seen in Plate 16, net economic benefits are fairly similar for levels of flood protection ranging from about 300 to 500 years. Although the NED plan is the 400-year alternative (on the basis of analysis to date), changes in the relationship between costs and benefits could result in a different NED plan. However, given the relative high quality of base data available for this complex feasibility study, it is believed that the identified NED size of 400 years adequately represents the band of potential optimal project sizes.

Impacts of Other Projects

There are various studies and projects which could be influenced by construction of the selected plan. Several are highlighted in Chapter I. Following is an estimate of the magnitude of influence on each study or project.

Sacramento Metropolitan Area Investigation. - This feasibility study examines ways to increase flood protection primarily for portions of the City of West Sacramento. The draft feasibility report was completed in November 1991 and recommends modification to the existing levees adjacent to West Sacramento along the eastside of the Yolo Bypass and southside of the Sacramento Bypass. Constructed by itself the project would provide more than 100-year protection to the City of West Sacramento. In conjunction with the construction of the selected plan, the City of West Sacramento would receive an estimated 400-year level of protection. This project could proceed with or without the selected plan.

Westside Yolo Bypass Levee Study. - This reconnaissance study is for flood control and covers the levee systems along the westside of the Yolo Bypass from the Fremont Weir to an area below Putah Creek, including some tributary streams of Cache and Putah Creeks, and Willow Slough. Any proposed alternative plan resulting from this study would likely include levee modification and could be constructed with or without the selected plan. Recommended improvements in the selected plan could influence the scope of levee modification in lower Yolo Bypass.

Cache Creek Settling Basin Project. - This project will raise the existing settling basin, levees, and weirs to trap the large volume of sediment flowing down Cache Creek before the creek enters the Yolo Bypass. This sediment reduces the flow capacity of the bypass. Construction began in August 1991. This project would not be influenced by, or influence the features of, the selected plan.

Sacramento River Bank Protection Project. - This project is a long-term program that allows the Corps to use erosion control and related features to maintain the integrity of the Sacramento River Flood Control Project against erosion damage. The project area encompasses 1,300 miles of levees along the Sacramento River from Collinsville to Chico Landing, distributaries such as Steamboat Slough; the Feather, Bear, Yuba, and American Rivers; the Sutter and Yolo Bypasses; and smaller tributary streams. Implementation of the selected plan could reduce the extent of potential future increments of the project in the Sacramento area.

Sacramento Area Flood Control Agency Local Natomas Project. - SAFCA is working toward initiating construction of several elements of the selected plan in Natomas in advance of the Federal project. Federal construction of the selected plan features in Natomas would not begin until 1996 at the earliest (see Chapter IX). Because of the great threat of flooding and catastrophic loss of life in Natomas, SAFCA anticipates initiating construction of many of the Natomas elements in late 1992 or early 1993. The primary features of the local project in Natomas are described in the Cumulative Impact chapter of the EIS/EIR. Construction costs of the local project will be 100 percent non-Federal. However, SAFCA plans to seek a crediting of a portion of these costs toward the Federal project. In other words, assuming advanced construction of the local non-Federal (SAFCA) project, during implementation of the Federal project the construction cost would be adjusted to give a credit for the earlier construction of the Natomas features. It is believed that the local project would not proceed without Federal authorization of the selected plan. A recommendation is included in this report to allow for the crediting of the local project.

South Sacramento Urban Levees and Tributaries Project. - The south Sacramento urban levees and tributaries project would provide increased flood protection to people and property subject to flooding from the Morrison Creek stream group. This group of waterways includes Morrison, Laguna and Elder Creeks. Morrison Creek has an extensive flood plain, including portions of south Sacramento. Laguna Creek drains an area of 47 square miles above its confluence with Morrison Creek in the bufferlands around the Wastewater Treatment Plant. Elder Creek runs parallel to Morrison Creek and drains almost the same acreage. Much of the Morrison Creek flood plain area is at a lower elevation than the Sacramento River. The city envisions three projects to increase the level of flood protection afforded to property in these areas:

- Immediate Urban Levees Project - This project would include stabilization and raising of the west/north Morrison Creek levees, and would provide protection to southwest Sacramento and the Pocket area. It is anticipated that this project will be completed prior to completion of the selected plan.

- Tributaries City Projects - These projects could provide channel and levee improvements on Florin, Strawberry, Elder, Unionhouse, and lower Morrison Creeks. The selected plan would not influence implementation of any of these projects.

Central Valley Project. - Construction and future effects of the selected plan will not impact features or operation of the CVP. With exception of fairly rare storm events, Folsom Dam will be operated in a similar manner to current conditions. Water surface fluctuations in Folsom Reservoir will be similar to existing conditions.

<u>Magpie Creek Diversion Channel Improvement Project</u>. - This project would control flooding in a portion of the north Sacramento area of the City of Sacramento outside the flood plain of the American River. Magpie Creek, a tributary of the American River, originates east of McClellan Air Force Base. Construction of the selected plan will not influence implementation of this project.

<u>Dry Creek Flood Control Project</u>. - This project would control flooding in the Dry Creek flood plain upstream from work associated with the selected plan in Sacramento County. The SAFCA is investigating alternatives to provide adequate protection to people and property located in the Dry Creek flood plain. Implementing the selected plan would likely benefit the potential of the Dry Creek project. Conversely, not implementing the selected plan would probably make the Dry Creek project difficult to implement due to potential features needed in the project to offset adverse hydraulic impacts downstream primarily along the NEMDC.

<u>Folsom Reoperation Study</u>. - The Corps is evaluating the potential impacts associated with reoperating Folsom Dam and Reservoir to achieve FEMA-level flood protection to parts of Sacramento. This temporary nonstructural measure could be implemented quickly and could be used until the more permanent flood control storage of the selected plan is in place. Initiated in November 1988, a special report was completed in early 1991, and an EIS is scheduled for completion in mid-1992. Reoperating Folsom for a 10-year period would not likely influence implementation of the selected plan. (See Comments and Response Appendix.)

CHAPTER VIII

SPECIAL TOPICS

This chapter summarizes information on various water-related resource needs and special topics that either influenced plan formulation or are important in understanding flood problems and solutions. These topics are divided into four categories: (1) other water resource needs, (2) related water resource opportunities, (3) engineering considerations, and (4) Auburn Dam project creditable expenditures. Several of these special topics are discussed in more detail in various appendixes.

OTHER WATER RESOURCE NEEDS

These discussions 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 peak flow 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. Several of these resources and issues are discussed in more detail in the Plan Formulation and Economics Appendixes.

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 the 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 1
City of Roseville and San Juan Suburban Water District

- 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.

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 VIII-1.

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 VIII-2 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.

Water Shortage or Surplus. - Table VIII-2 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.

TABLE VIII-1
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 VIII-2
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.

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 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 State 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.

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.

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.

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.

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 entitled "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.

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 the California Energy Commission's 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.

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.

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 VIII-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

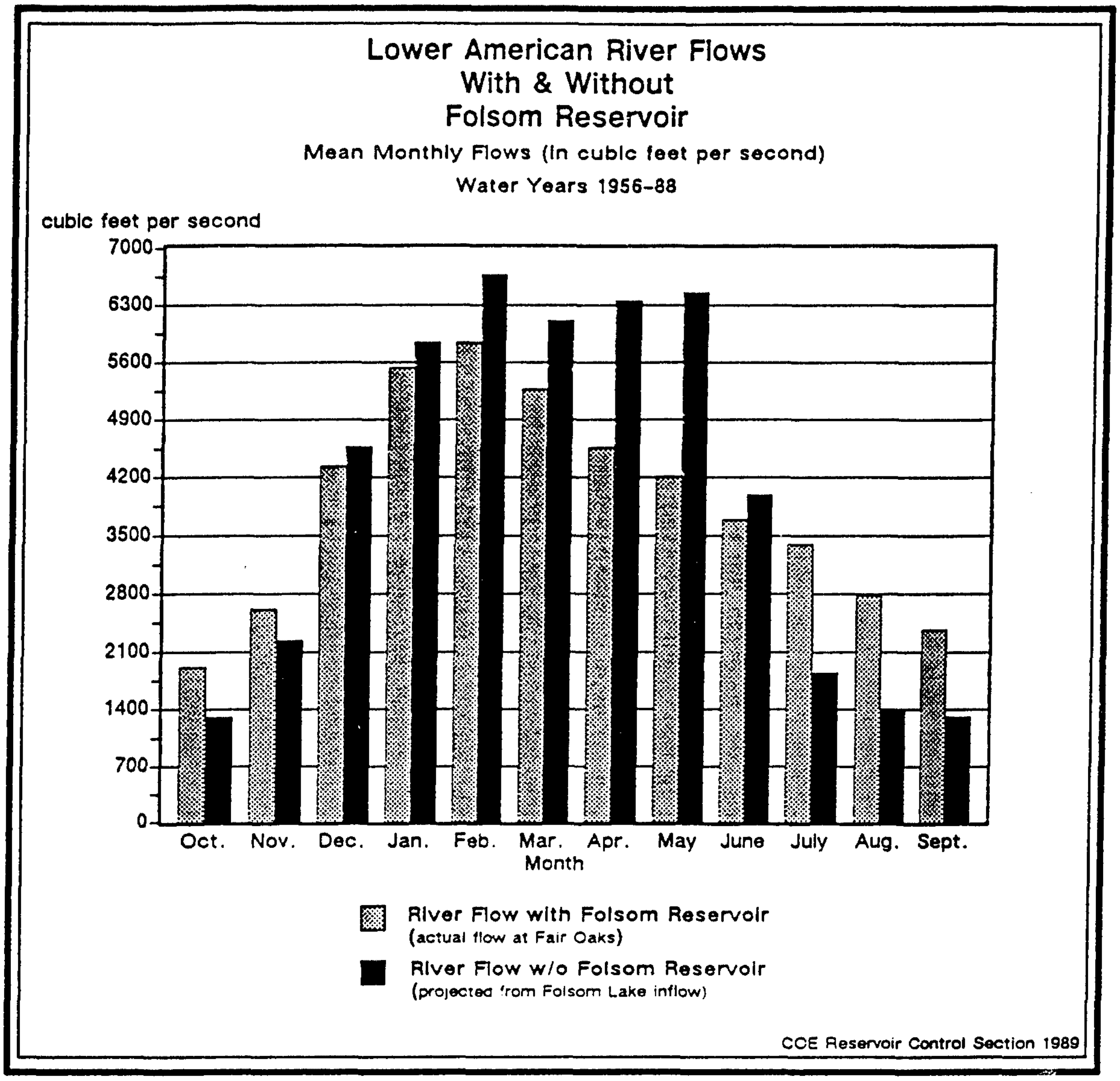

Figure VIII-1 **Mean Monthly Flows for the Lower American River Below Nimbus Dam With and Without Folsom Reservoir** and 800 cfs for the remainder of the year. D-1400 also established minimum recreation flows of 1,500 cfs between July 16 and October 14. D-1400 was conditioned on the construction of the 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 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 as 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.

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.

Local Benefits Options

A flood-control-only project would not address other water resource-related needs of the local area. Options identified to help meet these needs are (1) a minimum-pool dam and reservoir, (2) local water delivery plans, (3) an expandable dam, and (4) an enlarged flood control dam. Conceptual layouts and preliminary cost estimates were developed.

Minimum Pool Dam and Reservoir. - In the 1960's, the PCWA constructed its Middle Fork American River Project to provide additional water for Placer County. This project includes the Ophir Tunnel, which was to convey water from the then-proposed multipurpose Auburn Reservoir to Auburn Ravine, then on to western Placer County. However, without Auburn Dam, the water surface of the American River is several hundred feet below the inlet portal of Ophir Tunnel. Thus, the tunnel has been used only in very dry years when relatively small amounts of water have been pumped from the river below. This operation has limited capacity and is very costly because the pumping plant is removed in the winter and replaced in the spring and because a large amount of energy is required to pump the water to the elevation of the tunnel entrance.

One way to place the tunnel into useful service would be to create a permanent pool of about 130,000 acre-feet behind a flood control dam at the Auburn Dam site. The pool would serve only as temporary storage for existing PCWA supplies and entitlements from the CVP. This option also could have potential use as a diversion facility for water that could be pumped and piped to the Georgetown Divide/Pilot Hill areas (served by 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 because the water surface during the recreation season would be constant. A non-Federal sponsor would have to provide a substantial financial contribution for the non-flood control facilities.

Outside the pool area, the impacts associated with a minimum-pool project would be similar to the impacts associated with a flood-control-only dam. Vegetation (including riparian habitat) within the permanent pool zone would be lost, and wildlife would be displaced. Further, the permanent pool would result in permanent inundation of about 37 miles of the American River canyon and elimination of whitewater recreation below Ruck-A-Chucky rapids. Additional impacts could result from induced growth in the water supply service areas.

Preliminary estimates indicate that a minimum-pool project would cost about $120 million more than a flood-control-only project.

Local Water Delivery Plans. - Numerous plans have been developed to convey water from the American River to areas of need in western Placer County, to EID, and to the GDPUD service areas. Several different concepts are described below. Each concept would generally be independent of a flood control dam.

Western Placer County. - PCWA has contractual and other rights to American River water, but it does not have an economical method for delivering this supply. One way (besides a minimum-pool project) to provide water is to continue to expand current pumping from the American River. This would require a large pumping plant and pipeline to the Ophir Tunnel and large annual purchases of energy by PCWA. Water supplies for this option and the other water delivery options listed below would come from releases by PCWA from French Meadows and Hell Hole Reservoirs and from CVP entitlements.

Another way to provide water to western Placer County would be to construct a conveyance 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 requires additional water supplies to meet the year 2020 needs projected for its service area. EID is considering several different facilities, including Small Alder Dam and Reservoir and White Rock Penstock Diversion.

The White Rock Penstock Diversion would divert up to 100 cfs from SMUD hydroelectric facilities on the South Fork American River to EID's storage and distribution facilities near Placerville. The Small Alder Dam and Reservoir project would include a dam and 32,000-acre-foot reservoir (with provision for enlargement to 185,000 acre-feet). Water would be conveyed to the EID service area via the El Dorado Forebay, El Dorado Canal, Sly Park Reservoir, and Hazel Creek Tunnel. Small Alder Dam would be located on Alder Creek about 4 miles upstream from the confluence with the South Fork American River.

Georgetown Divide Public Utility District Service Area. - GDPUD and DWR have identified three types of potential water delivery systems: (1) river pumping, (2) river diversions, and (3) conveyance facilities from new upstream reservoirs.

Two of the river pumping options would have a pumping lift of about 1,140 feet from the Middle Fork American River to the Auburn Lake Trails Treatment Plant in the Pilot Hill/Cool area. Untreated water could be released directly into the Georgetown Divide Ditch. Another option would involve pumping from the vicinity of the Auburn Dam site. Under these options, GDPUD would have to obtain water rights for direct year-round diversion for consumptive use.

Facilities could be constructed to divert flows from the Rubicon River to GDPUD service areas. In one plan, water from SMUD's Robbs Peak Diversion on the Rubicon would be diverted into a gravity flow pipeline extending 7.7 miles to the headwaters of Pilot Creek. From this point, the water would be gravity fed to GDPUD's Stumpy Meadows Reservoir. GDPUD would have to acquire rights to use the water consumptively and develop an agreement with SMUD for reimbursement of power generation revenue forgone.

DWR and others have identified several potential dam and reservoir sites in the upper American River basin to provide a water supply to GDPUD. One of the most attractive sites is on Canyon Creek at an elevation of about 2,300 feet. A reservoir there with a capacity of about 17,500 acre-feet could provide an annual water supply of about 6,100 acre-feet. About 1.8 miles of tunnel and 2.6 miles of pipeline conveyance would also be required.

Advance Features Dam. - This concept consists of a single-purpose flood control dam with advance features that could be expanded later by non-Federal interests to meet water supply and power needs. Under this plan, it was estimated that before construction of the flood control dam, the non-Federal sponsor would acquire all lands necessary for the future multipurpose project. Also, minimum advance features would be included in the dam during initial construction to facilitate future expansion. These features would include blocked-off penstocks for possible hydropower facilities and a foundation for a future wet well.

The non-flood control features of an expanded dam would be funded in full by a non-Federal entity. Expansion would require new authorization and environmental documentation.

Enlarged Flood Control Dam. - The 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 it would affect incidental water supply, power, and recreational benefits. In other words, assuming a constant level of flood protection, increasing the size of a flood control dam at the Auburn site would allow a reduction in flood storage requirements at Folsom Reservoir. This could, in turn, result in more water being available for longer periods of time in Folsom Reservoir. This additional water could potentially provide (1) an additional water supply, (2) a higher average head at the powerplant for increased power generation, (3) higher average water-surface elevations to increase the recreational use at the Folsom State Recreation Area, and (4) higher head for flood control operation efficiency.

To estimate the potential economic feasibility of substituting--or swapping--flood space in Folsom to an upstream flood control dam, the monetary benefits and costs for several levels of flood protection were evaluated. It was found that the resulting annual economic benefit for water supply and hydropower would be about $1.3 million for reducing Folsom flood storage from 400,000 acre-feet to 300,000 acre-feet and $2.1 million for reducing it to 200,000 acre-feet. Assuming a 200-year level of flood protection, an additional 55,000 and 195,000 acre-feet would be required at a new peak-flow dam to compensate for the flood space reductions in Folsom to 300,000 and 200,000 acre-feet, respectively. The estimated annual costs for adding the increased space to the peak-flow dam are $1.3 million and $4.9 million, respectively. Consequently, it can be concluded that costs outweigh the benefits or there is only insignificant positive benefit associated with transferring space.

Multipurpose Auburn Dam Project

This option consists of completing the multipurpose Auburn Dam project. As authorized, the project would provide a reservoir with a capacity of 2.3 million acre-feet. The project includes a conventional concrete gravity dam with a straight axis alignment. The dam would be located at essentially the same site as the proposed flood control dam. The project would include relocation of Highway 49, construction of a powerplant and recreation facilities, and features for wildlife mitigation.

As mentioned, 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. Water supply diversions could be made to western Placer County via the Ophir Tunnel and to GDPUD. Releases for instream flow improvement, water supply, and some flood control would also pass through the powerplant. Because Folsom Reservoir could provide short-term and seasonal reregulation of Auburn Dam releases, considerable operational flexibility would be possible, particularly for power and lake recreation purposes. With a multipurpose dam, the average summer flows in the American River would be greater than under expected future conditions without the project. It could also provide increased instream flows in the lower American River, which could help in meeting the flow objectives outlined in a recent decision by the Superior Court of Alameda County concerning diversions from the river for East Bay Municipal Utility District.

Vegetation (including riparian habitat) and wildlife within the permanent pool zone of the reservoir would be lost. Cultural resources and whitewater and river-oriented recreation would also be adversely affected. The environmental community has expressed a continuing concern about the Auburn Dam project.

Status of Options

Each of the related water resource opportunities was dropped from further consideration as part of the American River Watershed Investigation. Following is a brief explanation of the reasons each was dropped.

- Minimum Pool Dam and Reservoir. - Preliminary cost estimates indicated that this option would cost about $120 million more than a flood-control-only project. No non-Federal sponsor was identified to fund this cost.

- Local Water Delivery Plans. - These plans either do not have local support or are being pursued separately by the local non-Federal entities.

- Expandable Dam. - Studies indicated that it would be cost effective to include the advance features in initial construction if expansion were to occur within 5 to 10 years from construction of a flood control project. 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 advance features as part of the selected plan.

- Enlarged Flood Control Dam. - As mentioned, 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 Project. - The cost to complete the 2.3 million acre-foot Auburn Dam would probably be about $1 billion more than a flood-control-only dam. 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. Because of these factors and the authorization language for this feasibility study, this option was not considered in detail.

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 river mile 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. These engineering considerations include damsite selection, seismicity and dam design, Highway 49 relocation, and incorporation of emergency gates into the structural design for system safety. These considerations are described below.

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 river mile 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 river mile 20.1 was chosen for the selected plan.

Seismicity

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 Dam site, following the August 1975 Oroville event, has established a precedent for considering the Foothills Fault system to be active. Faults of the Foothills Fault system within a 2-mile radius of Auburn Dam sites 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 Dam site 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 terranes (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 river mile 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 State Division of Mines and Geology (CDMG) and DWR, Division of Safety of Dams.

DWR, in the development of the official position of the State, 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, Allen 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 g 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 0.75 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. 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 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 g 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.

Design and Construction Review Panel

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.

Highway 49 Relocation

Operation of a flood control dam at Auburn would result in the periodic inundation of Highway 49. Primary impacts from this inundation would include (1) interruption and rerouting of traffic for up to several days every 4 to 5 years on average and (2) significant increased maintenance costs for the bridge structure and approaches. Because of these impacts, the State Department of Transportation (Caltrans) and Corps determined that Highway 49 would be relocated under any alternative that includes a dam at the Auburn site.

Five alternative alignments were initially considered for the Highway 49 relocation. Four alignments were deleted from consideration for purpose of determining project feasibility because they did not fit the replacement in-kind Federal criteria for road relocations. The highway replacement would be of comparable facilities--without any enhancements and without consideration to projections of future traffic levels. However, the State, the non-Federal sponsor responsible for this relocation, intends to conduct additional route selection studies and may choose during the detailed design phase to adopt another alignment as a betterment.

The Corps-selected alternative (see Plate 21) 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 47 acres. The new alignment is entirely within the American River canyon and exits 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 bridges are a total of 8,900 feet in length, and the roadway is 400 feet long. This relocation replaces 13,000 feet of canyon roadway. The road profile was kept above elevation 995, maximum pool elevation for the proposed project, at all locations.

A more detailed description of Highway 49 route alignments is included in the Plan Formulation Appendix.

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 two to four 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.

Aggregate Borrow Sources

Several alternative sources of aggregate for construction of the dam were examined. Each of these alternatives is discussed below.

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 VIII-3 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 on required production rates, three to four large draglines

TABLE VIII-3

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	6.0	4,357,000	968,000
Weighted Average	26.5[1]	TOTAL	9,573,000

[1]Excluding depth of channel deposits

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 oversized 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 plants located above Mammoth Bar. This allows storage of aggregate in areas distributed along the primary conveyor.

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 can process 600 tons per hour 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.

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.

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 the total quantity of material in the lake would be insufficient as a 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.

Oregon Bar Pluton and River Mile 22.4 Quarry Site. - The Oregon Bar Pluton potential quarry site is located near the proposed damsite. However, due to 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 across the river from the site.

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.

Mississippi Bar. - The bar located on the south shore of Lake Natomas is owned by the Federal Government and was used to supply aggregate for Folsom Dam construction. Deposits could be trucked to the site or transported via railroad.

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 the Geotechnical Appendix. Under the draft feasibility report and draft EIS/EIR, the criteria for selecting an aggregate source were established as the quality of aggregate, suitable quantities of aggregate available at the site, and closeness to the project area. The draft EIS/EIR acknowledged that further details of the aggregate source would be identified in the final EIS/EIR. Under the draft report, it was proposed that the bulk of aggregate material be obtained from the middle fork sand and gravel bars. As a result of further evaluations and public concern regarding impacts to the middle fork, the source of aggregate has been refined to eliminate the severe environmental consequences associated with mining the river bars. The selected aggregate borrow source is now the Old Cool Quarry. This quarry site has a long history of operation and is a familiar feature in the Auburn area. Indeed, the quarry has been used as a source of aggregate in the past. The quarry is located within the same canyon and very close to the initially proposed river bars. Impacts are to the same general community. The public comments were equally applicable to both sites and tended to focus on typical expressions of concern relative to mining operations performed in proximity to residential communities and recreational areas. The Old Cool Quarry appears to have adequate supplies of suitable material and has stockpile areas available. In additional evaluations, the river bars were determined to have the greatest potential for significant environmental impacts. In contrast, the Old Cool Quarry was identified as the alternative with the least potential for adverse environmental impacts.

Spoils

Spoils are waste materials generated during excavation for various project features. When excavations are required, removed material is used to the extent possible in the construction of the project. 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 spoils, 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 was generated. Most of this material was 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 near the damsite. Much of this material needs to be excavated and disposed of in order to construct the flood control dam. The cofferdam debris consists of rock fragmented material.

Additional spoils would be generated during earthwork associated with the construction of the currently proposed dam. This spoil includes an estimated 5.5 million cubic yards 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). 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 of spoils would also involve contouring to coincide with adjacent topography and would be revegetated.

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.

Primary flood control measures are those required to provide a specific level of protection. These include raising levees on the NCC, Pleasant Grove Creek Canal, and NEMDC and providing (building) a pump station on the 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, and 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.

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. 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 of these features are $4.5 million and $400,000, respectively. The average annual induced flood damages are about $170,000.

Levee and Road Modification--Pleasant Grove Creek Canal and Sankey Road. - 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 would preclude levee failure and flooding into north Natomas from the NCC and the east-side streams. 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-long, 150-foot-wide trapezoidal grass-lined channel from Sankey Road south to 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 is still much less than the water-surface elevations in the NEMDC without the project. The first and annual costs of the mitigation feature are $1.3 million and $115,000, respectively. The average annual induced flood damages are between $50,000 and $100,000.

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 Coon and Pleasant Grove Creeks, (3) construct a detention basin in north Natomas including containment levees and 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 would be required to form the detention basin. Also included would be six 8-foot by 8-foot concrete box culverts with sluice gates in the Pleasant Grove Canal levees. The estimated first and annual costs of the mitigation features are $5.6 million and $540,000, respectively. The average annual induced flood damages are between $50,000 and $100,000.

Natomas Facilities

Natomas can be flooded as a result of levee failures at several locations on the American and Sacramento Rivers. The primary flood threat is from levee overtopping and/or failure along the NEMDC. However, during rare events (in excess of about 200 years), flooding would also be likely from failure of the NCC. The management measures previously described for Natomas were used to develop features that emphasized raising levees along the NEMDC and the NCC or raising the NEMDC levees and constructing levees across the Natomas basin at several locations. One such cross-Natomas option consists of a levee along Del Paso Road. Another alignment bisects Natomas with a cross levee along Elverta Road.

The most feasible plan to protect Natomas is to upgrade levees at several locations on the NEMDC and NCC, resulting in protection for all of Natomas. Detailed descriptions of alternative cross levees are found in the EIS/EIR and Appendix B. Table VIII-4 compares these alternatives.

CREDITABLE AUBURN AREA EXPENDITURES TO DATE

Approximately $237 million in construction expenditures and about $109 million in accrued interest have been applied to the authorized Auburn Dam project to date (October 1990 price levels). An analysis was made of how much, if any, of those funds should be applied to construction of a new flood control project at the site. For this investigation, those previously constructed features, or portions thereof, that would need to be included in a flood control project if it were started from scratch were included in the project cost. All other liabilities

TABLE VIII-4

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) Levee Fill (Million Cubic Yards) Bridge Relocation	4 0.6 Main Ave. @ NEMDC	8 2.8 Main Ave. @ NEMDC	14 7.0 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 ($Millions)2/			
Levee and Related Improvements	21	18	18
Lands 3/ Construction Flowage Easements 4/ Environmental Mitigation	 13 - 6	 22 100 9	 29 200 17
Total With Easements Without Easements	 40 40	 149 49	 274 74
Annual Cost 5/ ($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 • Support by local government and area residents • Lowest cost and highest net economic benefits	• 100-year FEMA protection to area, 2/3 of Natomas • Reduced chace of secondary adverse impacts	• 100-year FEMA protection to developed area • 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 • Would not prevent future developement in unprotected areas	• Little or no economic feasibility • Little support by local area governments and land owners • 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.

are considered as sunk costs. It was also assumed that the interest to date would approximate price increases to current levels, and (consistent with other cost items) no further interest would begin to accrue until initiation of construction. Table VIII-5 summarizes the costs to date, allocation of accrued interest, and an estimate of whether or not the project feature would be required for a flood-control-only project. As noted in the table, project lands are treated separately.

Those costs shown in Table VIII-5 applicable to a flood control project ($75 million, October 1990 price levels) were included as a project financial cost for Federal/non-Federal cost-sharing purposes. These costs, updated to $77.7 million (October 1991 price levels), were credited to the Federal Government's share of the project cost (see Table IX-1) but not included as an economic cost in the economic analysis (see Table VII-2).

TABLE VIII-5

COSTS TO DATE PROPORTIONED TO FLOOD CONTROL
(October 1990 Price Levels)

Program Activity	Total Cost Thru 9/30/90 1/	Percent Cost Applicable to Flood Control Project 2/	Total
Lands and Rights	$ 9,938,273	3/	$ 3/
BLM Mining Claim Study	274,795	100	274,795
Appraisal Contracts	98,495	26	25,608
Clear Dam/Reservoir Area	233,362	100	233,362
Misc. Utilities and Trails	839,981	50	419,991
Seismograph Network	1,273,729	50	636,865
Fire Protection - State Forestry	472,143	100	472,143
Land Resources Management - State Parks	4,481,986	50	2,240,993
Miscellaneous Agreements	577,054	0	0
Water Rights	172,155	0	0
Miscellaneous Equipment Rental	510,079	0	0
Future Visitors Center - Overlooking Park	187,000	0	0
Seismograph Station	23,855	100	23,855
dam Access roads	676,020	80	540,816
Auburn-Forest Hill Road	15,477,051	100	15,477,051
Indian Hill Road	702,950	100	702,950
Pacific Avenue	374,029	100	374,029
Diversion Tunnel	6,525,974	100	6,525,974
Maidu Drive Extension	39,204	100	39,204
Highway 49 ROW thru the city of Auburn	1,081,025	25	270,256
Highway 49 "D" Portion	3,285,689	25	821,422
Highway 49 "D" Portion Sacramento Street Modifications	88,910	0	0
North Fork Road Survey	224,937	0	0
Middle Fork Road Survey	129,530	0	0
Security Force-Rock Quarry	42,537	0	0
Exploratory Tunnels	2,003,279	50	1,001,640
Pioneering Construction Access	190,204	100	190,204
Log Boom Construction	41,104	100	41,104
Revegetation	6,404	0	0
Design of Rock-a-Chucky Bridge	1,449,474	0	0
Earthquake Evaluation	1,683,098	50	841,549
Excavation and Foundation Treatment	94,512,811	13	12,286,665
Minor Contracts	4,555,426	11	501,097
Non-Contract Costs	65,514,095	11	7,206,550
Auburn Dam and Reservoir	$217,716,657		$ 51,148,123
Cofferdam Modifications	38,848	0	0
Diversion Tunnel Repair	63,878	0	0
Maintain Highway 49 - State of California	537,028	0	0
Flood Damage Repairs - Contracts	2,746,446	0	0
Fire Protection - State Forestry 4/	1,101,666	0	0
Placer County Pump Rehabilitation	423,378	0	0
Placer County Pump Removal - 1989	20,001	0	0
Placer County Pump Removal - 1990	25,000	0	0
Costs resulting from Construction Delay	5,231,040	0	0
Auburn Powerplant	8,372,852	0	0
Recreation Facilities	5,668,737	0	0
Permanent Operating Facilities	36,167	0	0
Fish and Wildlife Lands	330,345	0	0
Subtotal - Construction Costs	237,355,798		$ 51,148,123
Interest During Construction	109,393,053	5/	23,573,257
Total Auburn Area Facilities	$346,748,851		$ 74,721,380

1/ Costs incurred by U. S. Bureau of Reclamation for construction of authorized Auburn Dam and related facilities. Includes interest on actual expenditures.
2/ Estimated (percent of total) cost creditable to flood detention dam.
3/ Lands to be evaluated separately by Corps of Engineers
4/ Contract with State Forestry since fiscal year 1970, and construction delayed in fiscal year 1976, so 6/20 of 30 percent of costs assigned to cost of dam
5/ Prorata share based on ratio of total construction costs

CHAPTER IX

PLAN IMPLEMENTATION

This chapter summarizes the procedures and cost sharing required to implement the project.

IMPLEMENTATION REQUIREMENTS

Report Approval

This report will be reviewed by the South Pacific Division who will submit the final report to the Corps' Washington Level Review Center (WLRC), publish a public notice of completion of the study (providing a 30-day review period), and file the final EIS/EIR with EPA. The WLRC will coordinate with the State and Washington level agencies. The Board of Engineers for Rivers and Harbors will make a recommendation on the project to the Chief of Engineers. The Chief of Engineers will submit the report to the Assistant Secretary of the Army, who, in turn, will transmit the report for comments from the Office of Management and Budget before submittal to the Congress.

Engineering and design studies may be initiated after the South Pacific Division public notice of completion of study is published. The results of these studies will be used to prepare plans and specifications for the project. Initially, these studies will be conducted at Federal expense. Ultimately, however, the costs for them will be added to the project construction cost and shared with the non-Federal sponsor (along with the costs of other project features).

Project Authorization

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

If the project is authorized in 1992, construction activities could be started as early as 1995.

Cost-Sharing Requirements

Current Federal regulations require non-Federal participation in the financing of projects. In accordance with the Water Resources Development Act of 1986, the non-Federal sponsor's obligations for this project would include:

Flood Control

- Provide all lands, easements, and rights-of-way needed for project construction and operation.

- Perform relocations and alterations of buildings, utilities, highways, bridges (except railroad bridges), sewers, and other facilities required for construction of the project.

- Provide, during construction, a cash contribution of 5 percent of total project costs.

- If the total value of the above requirement is less than 25 percent of total flood control project cost, provide an additional cash payment during the period of construction to make the total non-Federal cost equal to 25 percent of total project costs.

- The total non-Federal first costs will not exceed 50 percent of total project first costs.

- Operate, maintain, replace and rehabilitation of the project after construction.

Recreation

- Provide 50 percent of the separable first cost plus 100 percent of the OMR&R costs.

A letter specifying the non-Federal sponsor's willingness to meet these obligations is included in Appendix A (Pertinent Correspondence). However, the non-Federal funds will not have to be provided until after the Congress authorizes the project and appropriates construction funds and a local cooperation agreement is signed. Payment of the funds is to be made at intervals during construction.

COST APPORTIONMENT

Table IX-1 shows the estimated Federal and non-Federal costs for the selected plan.

FULLY FUNDED COST ESTIMATE

Costs presented thus far are first costs at October 1991 price levels. This estimate has been inflated to represent the fully funded amount. The fully funded estimate accounts for future inflation and is based on the current first cost, the schedule at which contracts will be awarded, and assumed annual inflation percentages. It better represents the actual costs that Congress will need to appropriate and the local sponsor provide in the future to construct the project. The fully funded cost estimate, including $78 million of creditable expenditures to date, is $912 million. The apportionment of this is $610 million Federal and $302 million non-Federal.

FINANCIAL ANALYSIS

The State and SAFCA will jointly provide the non-Federal requirements of the project.

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

The Reclamation Board and SAFCA, as co-sponsors of the project, will be responsible for the operation, maintenance, repair, replacement, and rehabilitation of the completed project. State law requires the Board to pass on these responsibilities and their costs to the local beneficiaries of the project. Maintenance activities will be provided by SAFCA. SAFCA obtains their funds through an existing benefit assessment district. The Reclamation Board, as a non-Federal sponsor for the feasibility study and non-Federal co-sponsor, for the project, will furnish

TABLE IX-1

COST APPORTIONMENT OF SELECTED PLAN ($1,000)

Item	Flood Control			Recreation			Total		
	Federal	Non-Federal	Total	Federal	Non-Federal	Total	Federal	Non-Federal	Total
First Cost									
Lands and Management	900	73,600	74,500	400	6,400	6,800	1,300	80,000	81,300
Relocations	100	107,300	107,400	-	-	-	100	107,300	107,400
Construction	331,200	-	331,200	1,400	-	1,400	332,600	-	332,600
Cultural Resources	4,700	-	4,700	-	-	-	4,700	-	4,700
Environmental Mitigation Facilities	9,300	-	9,300	-	-	-	9,300	-	9,300
Credible Expenditures to Date 1/	77,700	-	77,700	-	-	-	77,700	-	77,700
E, D, S, and A 2/	63,900	20,700	84,600	600	-	600	64,500	20,700	85,200
Subtotal	487,800	201,600	689,400	2,400	6,400	8,800	490,200	208,000	698,200
Cash Contribution	(34,500)	34,500		2,000	(2,000)		(32,500)	32,500	
Total	453,300	236,100	689,400	4,400	4,400	8,800	457,700	240,500	698,200
Percent of First Cost	65.8	34.2		50.0	50.0		65.6	34.4	

1/ Creditable expenditures to date include some of the costs plus interest incurred by USBR at the Auburn Dam site.
2/ The E, D, S, and A = Engineering, Design, Supervision and Administration.

funds for the State's share of project costs by appropriations made by the State Legislature.

Based on the financing plans of the Reclamation Board and SAFCA, sufficient funds will be available for all non-Federal costs.

FEDERAL - NON-FEDERAL RESPONSIBILITIES

Federal Responsibilities

Pre-Construction Engineering and Design studies will be accomplished by the Corps. Once the project is authorized and a cash contribution, lands, relocations, and assurances are provided by the non-Federal sponsor, the Federal Government will construct the project.

Non-Federal Responsibilities

Non-Federal interests would be responsible to:

- Provide without cost to the United States all lands, easements, and rights-of-way necessary for construction and maintenance of the flood control and associated mitigation measures, including all necessary relocations and alterations of buildings, utilities, roads, bridges (except railroad bridges), sewers, irrigation diversions, and related special features.

- Hold and save the United States free from damages due to the construction and subsequent maintenance of the project, except for damages which are caused by the fault or negligence of the United States or its contractors, and if applicable, adjust all claims concerning water rights.

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

- Provide a cash contribution of 5 percent of the total project cost and an additional cash contribution, if necessary, to bring the non-Federal share to a minimum of 25 percent of the total project cost with credit given for lands, easements, rights-of-way, and relocations. The non-Federal contribution shall be made concurrently and proportionally with Federal expenditures for project construction.

- Comply with the provisions of the "Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970" (Public Law 91-646, 84 Stat. 1894), as amended.

- Comply with the provisions of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Public Law 96-510, 42 USC 9601-9675). Specifically, the non-Federal sponsor must assume complete financial responsibility for the cleanup of any hazardous material located on project lands and regulated under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and be responsible for operating, maintaining, repairing, replacing, and rehabilitating the project in a manner so that liability will not arise under CERCLA.

LOCAL COOPERATION AGREEMENT

Before construction is started, the Federal Government and non-Federal project sponsor will execute a local cooperation agreement. This agreement will define responsibilities of the non-Federal project sponsor for project construction and operation.

PROJECT SCHEDULE

Figure IX-1 shows the proposed project schedule.

PROJECT SCHEDULE

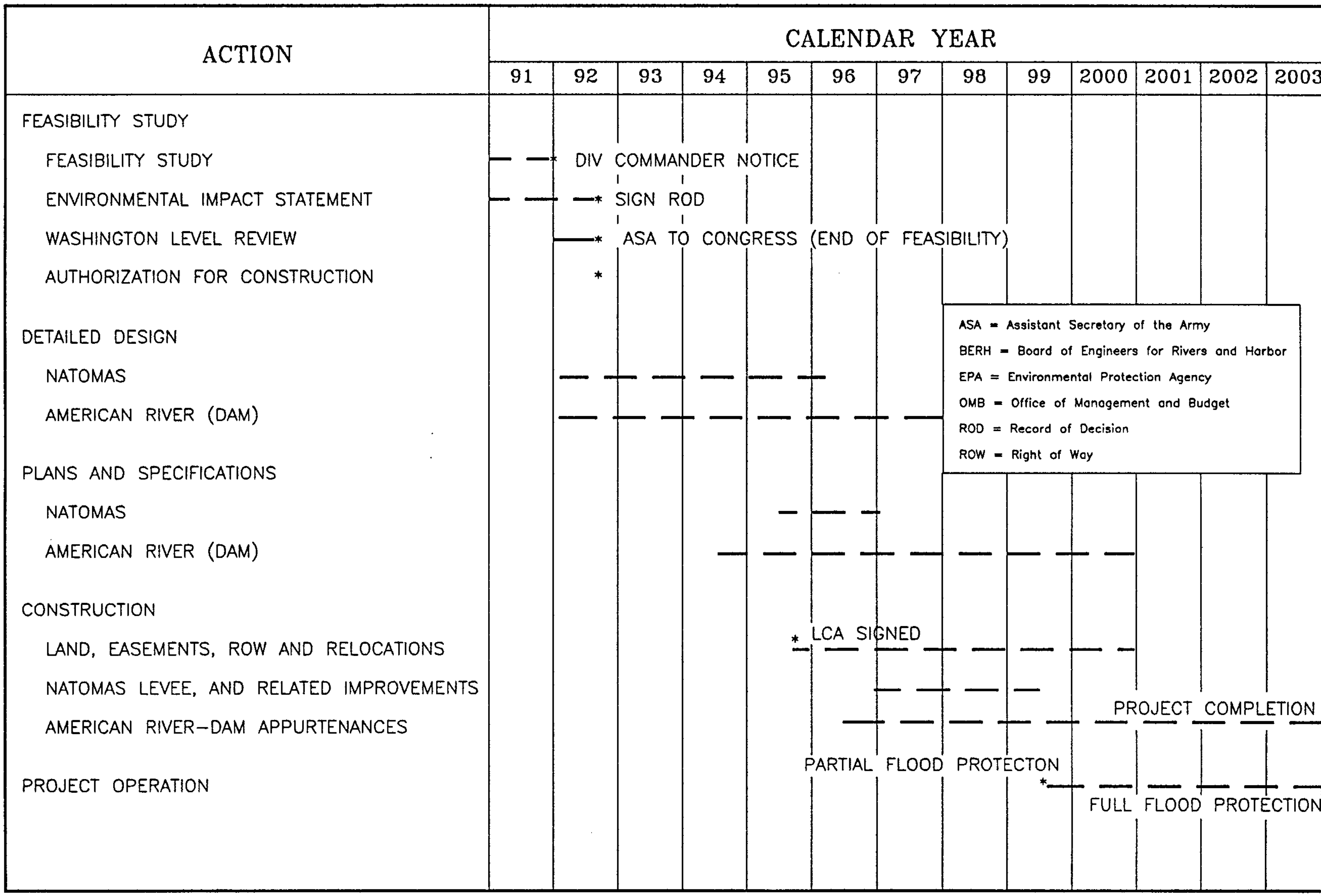

Figure IX-1 Project Schedule

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LATEST UPDATE: 10/28/91

CHAPTER X

STUDY COORDINATION

COORDINATION

This feasibility investigation has involved extensive coordination, including meetings and a variety of correspondence. A list of meetings and pertinent correspondence is contained in the Pertinent Correspondence Appendix.

The draft feasibility report was circulated for public and agency review in April 1991. During April and May, 14 public workshops, 3 public meetings and various presentations about the study were conducted. At the close of the comment period, approximately 1,600 comment letters were received. These comments and their responses are contained in the Comments and Responses Appendix.

VIEWS OF OTHERS

In general, local agencies, organizations, and individuals support the selected plan. Numerous letters and resolutions of support from local agencies are contained in the Pertinent Correspondence Appendix. Others, including various water resource interests and environmental groups/interests oppose the plan. Some prefer construction of a multipurpose dam and reservoir, while others oppose a flood control dam. There has also been, and will continue to be, concern about certain features or effects of elements of the plan.

There is some disagreement between the FWS and Corps on the level of environmental impact and mitigation for inclusion in the selected plan. The issues are presented in Table X-1 and are described in more detail in the EIS/EIR.

TABLE X-1

MITIGATION OPTIONS BY FWS AND CORPS

Resource	FWS Impact	FWS Mitigation Recommendation	Corps of Engineers Impact	Corps of Engineers Mitigation Selection	Remarks
Fishery					
Natomas Area	Fish resources loss at pump station on NEMDC.	Install fish screen at pump station.	Concur with FWS.	Concur with FWS.	
	Potential adverse impacts during construction.	Limit in-channel construction activities to the period of June 1 to August 31.	Concur with FWS.	Concur with FWS.	
Upper American River	Sloughing of banks into river increasing turbidity.	Channel sediment removal and long-term fishery management plan in consultation with CDFG and USFWS.	Generally concur with FWS.	Remove sedimentation if adverse to fishery.	
Wildlife and Vegetation					
Natomas Area	Loss of 290 acres of habitat due to direct construction. 22,914 acres of habitat lost due to long term urban growth.	Acquire 13,900 acres to be managed as wetland/upland to replace loss of 770 acres of wetlands and 22,144 acres of upland. Establish avoidance plan to restore wetlands and optimize habitat for wildlife. Land acquisition to include total of 24,000 acres in Sacramento and Sutter Counties.	Direct levee construction would cause a loss of 290 acres of wildlife habitat. Direct recreation facility construction loss of 25 acres of habitat. Indirect growth-inducing impacts.	Retain 280 acres in Natomas area. Create upland and riparian habitat through planting and watering. During the construction period monitoring will be carried out by the Corps to assure adequate establishment of mitigation features. Non-Federal sponsor implements a long-term mitigation program as part of normal CEQA procedures.	FWS does not separate direct from indirect project impacts. Corps will rely on non-Federal sponsor to implement mitigation of indirect impacts under CEQA.
Upper American River	Loss of 227 acres from direct construction and 1,155 acres from operational impacts.	Manage 51,987 acres along South Fork River to increase and maintain wildlife values and mitigate direct operational impacts. Stream habitat improvements above Lake Clementine and above elevation 800 ft on Middle Fork to mitigate increased sedimentation and habitat degradation that will occur at lower elevations.	1927 acres of habitat loss due to construction and periodic inundation in the detention area. Generally concur with FWS.	Acquire and manage 2,685 acres along South Fork American River. Manage for general wildlife and vegetation values. Adaptive management plan as part of the O&M phase. Replant sloughing zones.	
	Sloughing of banks into river increasing turbidity.	Develop and implement a wildlife management plan for upper canyon inundation area. Channel sediment removal and long-term wildlife and vegetation management plan in consultation with CDFG and FWS.	Generally concur with FWS	Remove sediment if adverse to vegetation.	
	Valley elderberry beetle.	Plant shrubs on 2,700 acres along South Fork American River.	Concur with FWS	Concur with FWS	

CHAPTER XI

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

Major conclusions of studies conducted to date are:

- Hydrologic and reservoir operation analyses indicate that the potential for high flows along the American and Sacramento Rivers is significantly greater than previously believed and that the risk of major flooding in the Sacramento area is substantial.

- Because of the hydrologic interrelationship of Natomas and American River, flood control measures in Natomas need to be considered together with measures along the river. Although economically feasible options have been identified to protect part or all of Natomas, the most cost-effective and otherwise prudent solution is to protect all of Natomas as part of a comprehensive flood control plan that includes the lower American River area.

- Alternatives up to 400-year (and greater) levels of flood protection for the Sacramento area are economically feasible.

- The prospective non-Federal project sponsor has indicated a willingness to participate only in a project capable of providing at least a 200-year level of protection.

- The only way to provide high levels of flood protection (200 years or greater) to areas along the main stem American River includes development of new flood control storage space at or near the Auburn Dam site.

- A plan that maximizes Net Economic Development (NED) benefits in the American River basin would provide a 400-year level of flood protection with a detention dam at the Auburn Dam site and levee and channel improvements in Natomas.

- The non-Federal sponsor has requested that a plan other than the NED be adopted. They have requested a 200-year level of protection with features similar to, but smaller than, the NED plan, based on financial affordability and wider community support.

- Levee improvement features included in the selected plan along lower Dry Creek would also help reduce flooding in Rio Linda (northeast of Natomas).

- Besides flood control, there is a need in the American River basin for additional water supply. However, development of incidental additional water supply yield from Folsom Reservoir, a minimum pool at the flood detention dam at Auburn, or from various water delivery and reservoir projects was found to be either not economically feasible or lacked a potential non-Federal sponsor.

- The selected plan includes mitigation for all significant direct impacts.

- The selected plan has been formulated to neither enhance nor preclude development of the Auburn project site for multipurpose use.

- The Sacramento metropolitan area needs additional recreational facilities, particularly expansion of trail facilities along area watercourses. The selected plan incorporates biking and equestrian trails as part of levee improvements in Natomas.

- Non-Federal interests will pay for a portion of the selected plan and be responsible for the operation and maintenance of the project.

- The selected plan allows for the retention of all Federal lands although the non-Federal sponsor will pay fair market value for easement rights within the detention basin.

- Before construction is started, the non-Federal sponsor will complete a formal action plan for the identification, implementation, monitoring, and management of features to mitigate adverse indirect (growth-inducing) impacts.

- Pursuant to Section 404(r) of the Clean Water Act, a 404(b)(1) evaluation is included with the EIS/EIR to be submitted to Congress for the purpose of obtaining an exemption from further regulation by Federal and State water quality control agencies under Sections 302 and 402 of the Act.

- The selected plan fully meets the non-Federal sponsor's flood control objectives and is supported by them.

- The NED plan is the least environmentally damaging practical alternative. The selected plan is similar to the NED plan and complies with Section 404 of the Clean Water Act.

RECOMMENDATIONS

I recommend that the selected plan providing a 200-year level of flood protection as described in this report be authorized for implementation as a Federal project, with such modifications as in the discretion of the Chief of Engineers may be advisable. I understand that since this project is not the plan that maximized net economic benefits, an exception will need to be granted by the Assistant Secretary of the Army for Civil Works. This selected plan is estimated to have a first cost of $698.2 million (October 1991 price level). Of this cost, about $457.7 million ($453.3 million for flood control and $4.4 million for recreation) will be the responsibility of the Federal Government and $240.5 million ($236.1 million for flood control and $4.4 million for recreation) will be the responsibility of the non-Federal sponsor. The project will include the construction of a flood control detention dam at the Auburn Dam site, levee and channel improvements in and around the Natomas area of Sacramento, and recreation trails on project features in the Natomas area. This recommendation is made with the provision that before implementation, non-Federal interests (non-Federal interests include agencies besides the local cost sharing partners) will, in addition to the general requirements of law for this type of project, agree to comply with the following requirements:

- Provide all lands, easements, and rights-of-way necessary for construction (including mitigation), operation, and maintenance of the project, including suitable borrow and disposal areas, and all necessary relocations.

- Accomplish, without cost to the United States, all necessary alterations and relocations to roads, railroads, bridges (except existing railroad bridges), pipelines, cables, and other facilities, including interior drainage facilities, required by construction of the project.

- Hold and save the United States free from damages due to the construction and subsequent maintenance of the project, except for damages which are caused by fault or negligence of the United States or its contractors, and if applicable, adjust all claims concerning water rights.

- Comply with the provisions of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Public Law 96-510, 42 USC 9601-9675). Specifically, the non-Federal sponsor must assume complete financial responsibility for the cleanup of any hazardous material located on project lands and regulated under CERCLA and be responsible for operating, maintaining, repairing, replacing, and rehabilitating the project in a manner so that liability will not arise under CERCLA.

- Maintain, operate, repair, replace, and rehabilitate all completed work without cost to the United States in accordance with regulations prescribed by the Secretary of the Army, including protecting the channel and other flood control works from future encroachment or obstruction, including sedimentation and vegetation, that would reduce their flood-carrying capacity or otherwise impair them. Monitor the status of completed mitigation and provide periodic reports on its condition, and provide repairs and replacement if needed.

- Operate, maintain, repair, replace, and rehabilitate without cost to the Federal Government for the economic life of the project the recreation areas and all related facilities.

- Provide a cash contribution of 5 percent of the total cost of project features assigned to flood control, and an additional cash contribution, if necessary, so that the non-Federal contribution is not less than a minimum of 25 percent of the costs of project flood control features, with credit given for lands, easements, rights-of-way, and relocations. The non-Federal contribution shall be made concurrently and proportionally with Federal expenditures for project construction.

- Pay 50 percent of the total separable cost of recreation features during construction.

- Participate with and comply with applicable Federal flood plain management and flood insurance programs.

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

- Prevent encroachments within the channels and other project works which would adversely affect the proper functioning or efficient operation and maintenance of the project works.

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

- Assure that construction and maintenance of any non-Federal flood control features do not diminish the flood protection provided by the authorized project plan.

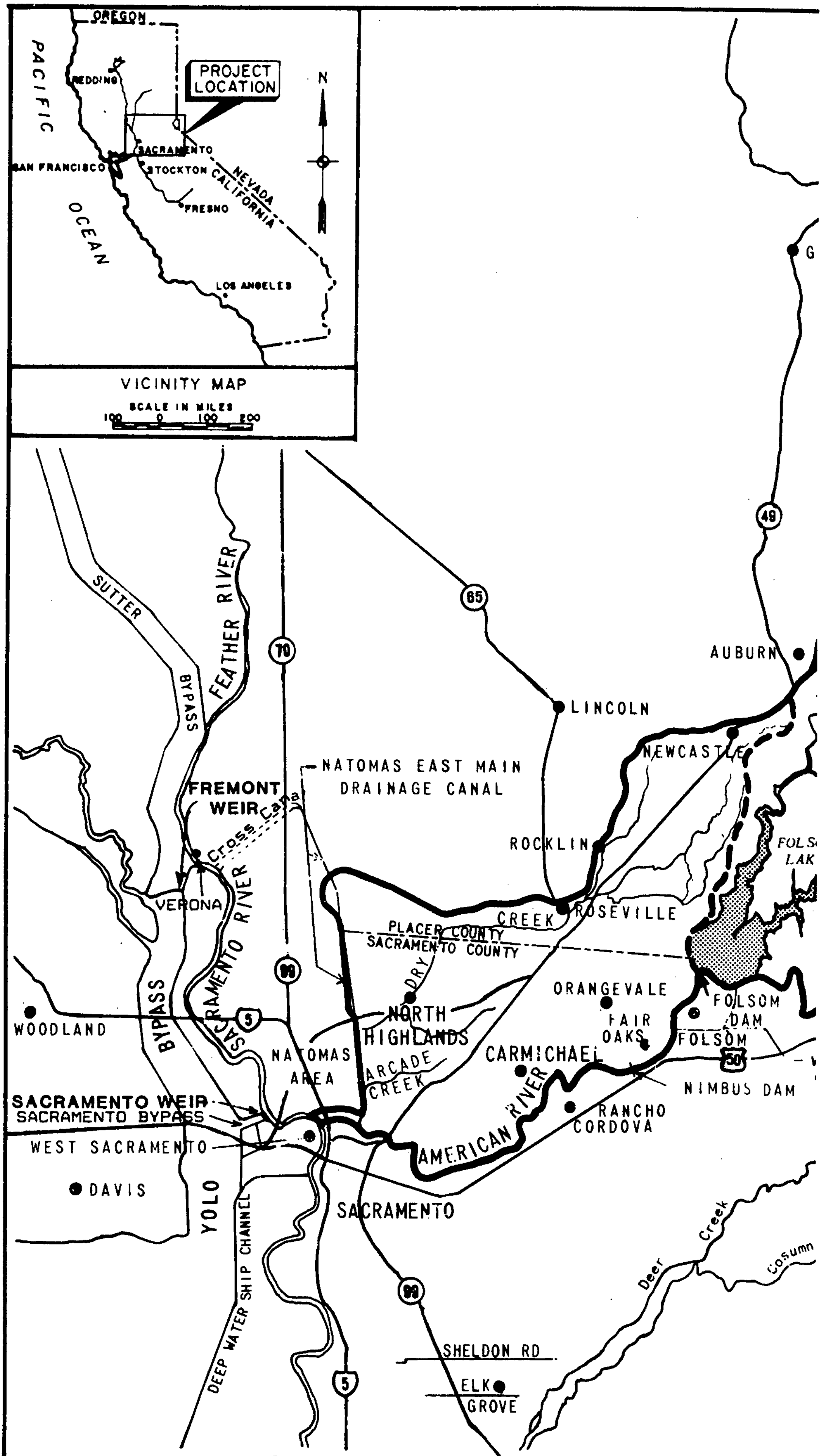
It is intended that the detention dam at Auburn is to be operated for flood control only with uncontrolled outlet facilities with emergency gates. Any modification to this operation will require further Congressional authorization.

If the feasibility report is approved by the Secretary of the Army, the Secretary will recommend that if non-Federal project sponsors construct the work to protect the Natomas area as described in this report, prior to the Army Corps of Engineers receiving appropriations to initiate construction of the authorized project, that such work may be credited toward the non-Federal share of the flood control project and that all facets of the credit are covered in one local cooperation agreement. The amount of credit and the means of crediting shall be determined by the Assistant Secretary of the Army (Civil Works) and be set forth in the local cooperation agreement for the project. In no case will the credit include any interest or be more than the lesser of actual costs incurred by the non-Federal sponsor or the cost that would have been incurred by the Federal Government had the Federal Government accomplished the same work during the same time period. The credit will not relieve non-Federal interest of the requirement to pay 5 percent of the total flood control project cost in cash during construction of the remainder of the project. Approval of the work accomplished by non-Federal interests shall not commit the Federal Government to any type of reimbursement if the Federal project is not undertaken.

These recommendations reflect the information available at this time and current Department of the Army policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national civil works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are sent to the Congress as proposals for authorization and/or implementation funding.

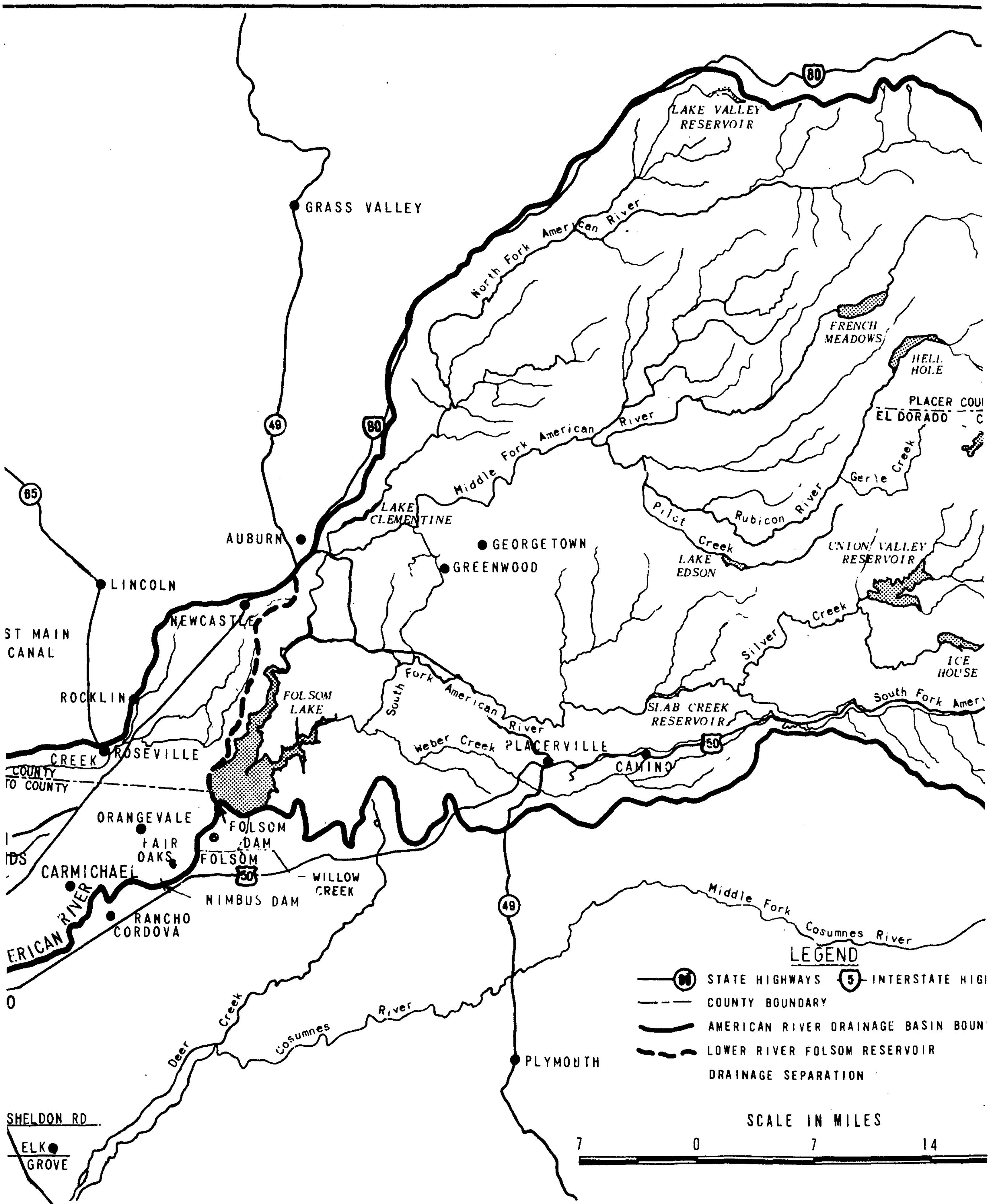
Laurence R. Sadoff

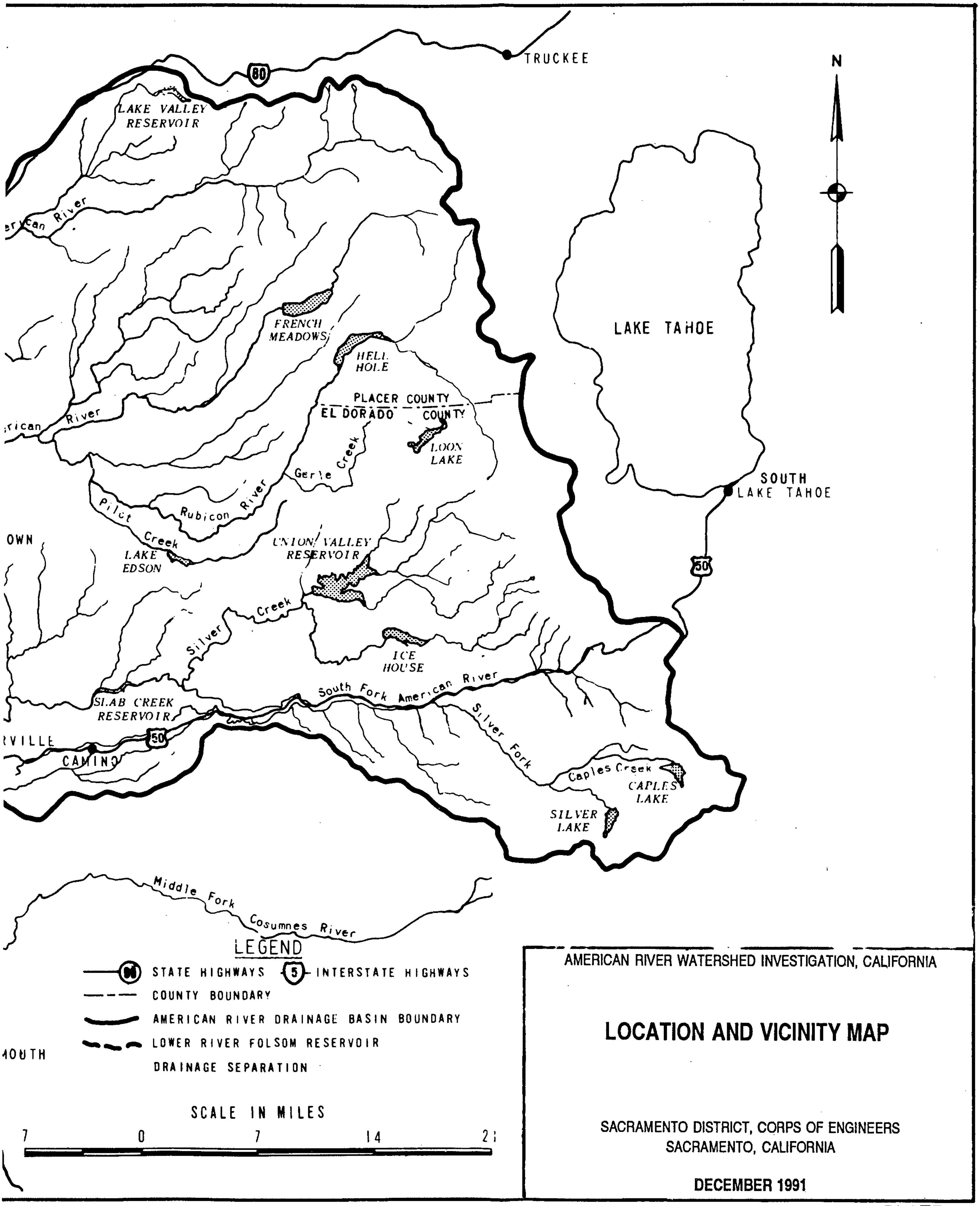
Laurence R. Sadoff
Colonel, Corps of Engineers
District Engineer



OREGON
PACIFIC
OCEAN
REDDING
PROJECT LOCATION
N
SACRAMENTO
SAN FRANCISCO
STOCKTON
NEVADA
CALIFORNIA
FRESNO
LOS ANGELES
VICINITY MAP
SCALE IN MILES
100 0 100 200
SUTTER
BYPASS
FEATHER RIVER
70
65
49
AUBURN
LINCOLN
NEWCASTLE
NATOMAS EAST MAIN DRAINAGE CANAL
FREMONT WEIR
Cross Canal
ROCKLIN
VERONA
SACRAMENTO RIVER
CREEK
ROSEVILLE
PLACER COUNTY
SACRAMENTO COUNTY
DRY
ORANGEVALE
99
5
WOODLAND
BYPASS
NORTH HIGHLANDS
FAIR OAKS
FOLSOM DAM
FOLSOM
50
NATOMAS AREA
ARCADE CREEK
CARMICHAEL
NIMBUS DAM
SACRAMENTO WEIR
SACRAMENTO BYPASS
AMERICAN RIVER
RANCHO CORDOVA
WEST SACRAMENTO
DAVIS
YOLO
SACRAMENTO
DEEP WATER SHIP CHANNEL
Deer Creek
Cosumn
SHELDON RD
ELK GROVE

(1)


LAKE VALLEY RESERVOIR
80
GRASS VALLEY
North Fork American River
FRENCH MEADOWS
HELL HOLE
PLACER COU
EL DORADO
49
80
Middle Fork American River
Gerle Creek
65
LAKE CLEMENTINE
Pilot Creek
Rubicon River
AUBURN
GEORGETOWN
GREENWOOD
LAKE EDSON
UNION VALLEY RESERVOIR
LINCOLN
NEWCASTLE
ST MAIN CANAL
Silver Creek
ICE HOUSE
ROCKLIN
FOLSOM LAKE
South Fork American River
SLAB CREEK RESERVOIR
South Fork Amer
CREEK
ROSEVILLE
Weber Creek
PLACERVILLE
50
CAMINO
COUNTY
TO COUNTY
ORANGEVALE
FOLSOM DAM
FAIR OAKS
FOLSOM
50
WILLOW CREEK
CARMICHAEL
NIMBUS DAM
49
AMERICAN RIVER
RANCHO CORDOVA
Middle Fork Cosumnes River
LEGEND
STATE HIGHWAYS
INTERSTATE HIGH
COUNTY BOUNDARY
AMERICAN RIVER DRAINAGE BASIN BOUN
LOWER RIVER FOLSOM RESERVOIR DRAINAGE SEPARATION
Deer Creek
Cosumnes River
PLYMOUTH
SHELDON RD
ELK GROVE
SCALE IN MILES
7
0
7
14



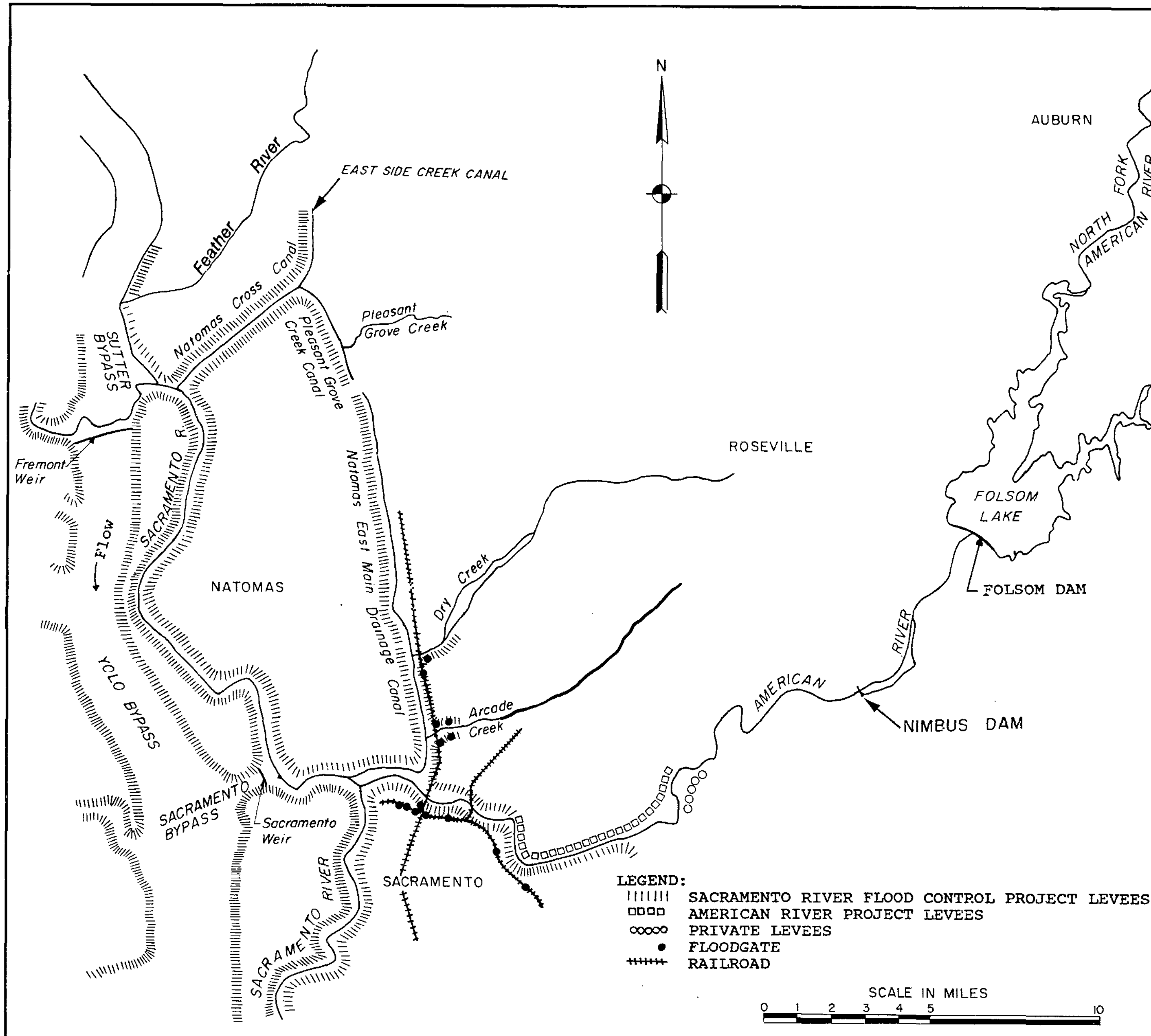
AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

LOCATION AND VICINITY MAP

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE 1



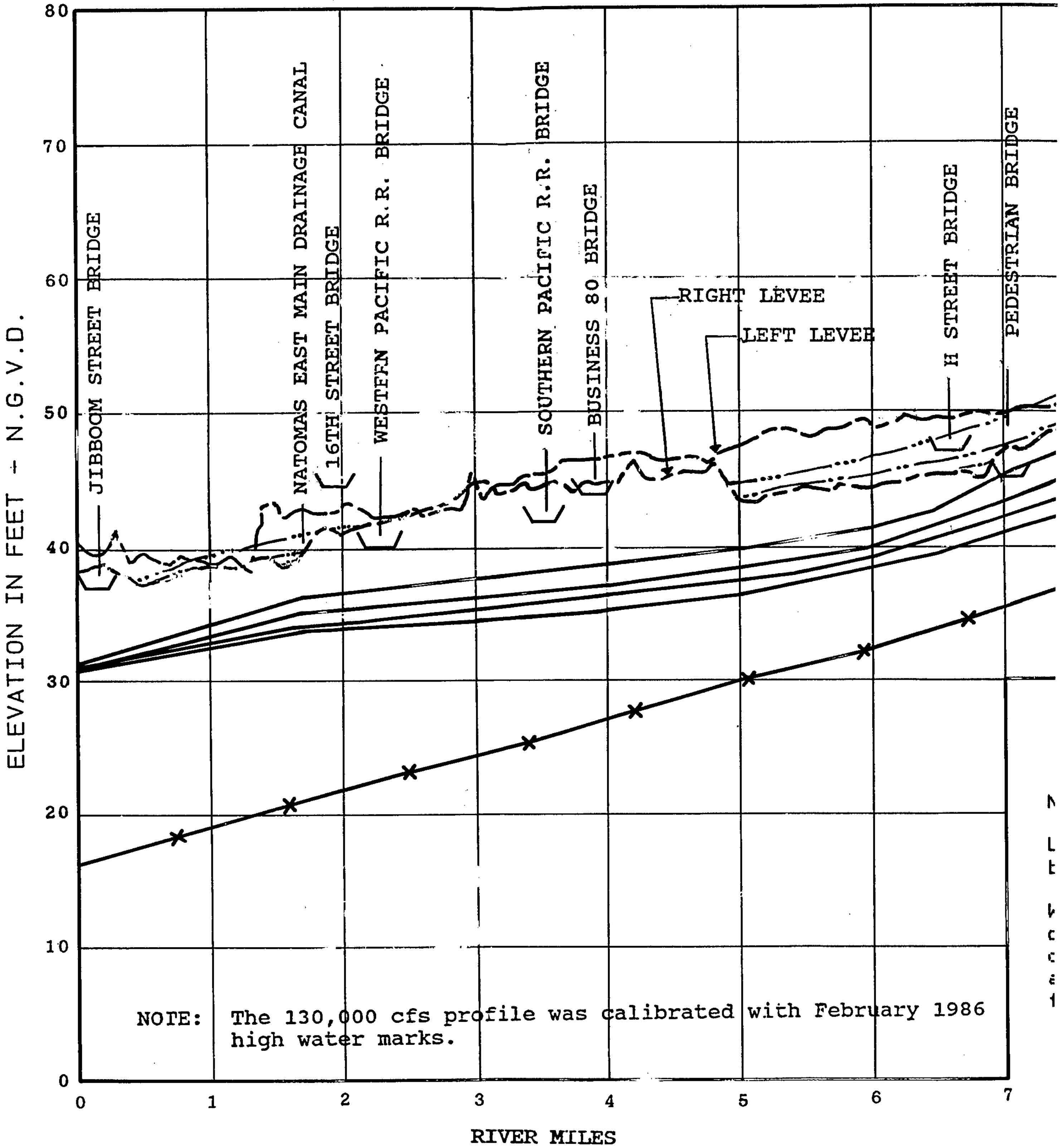
AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

EXISTING FLOOD CONTROL FEATURES IN THE SACRAMENTO AREA

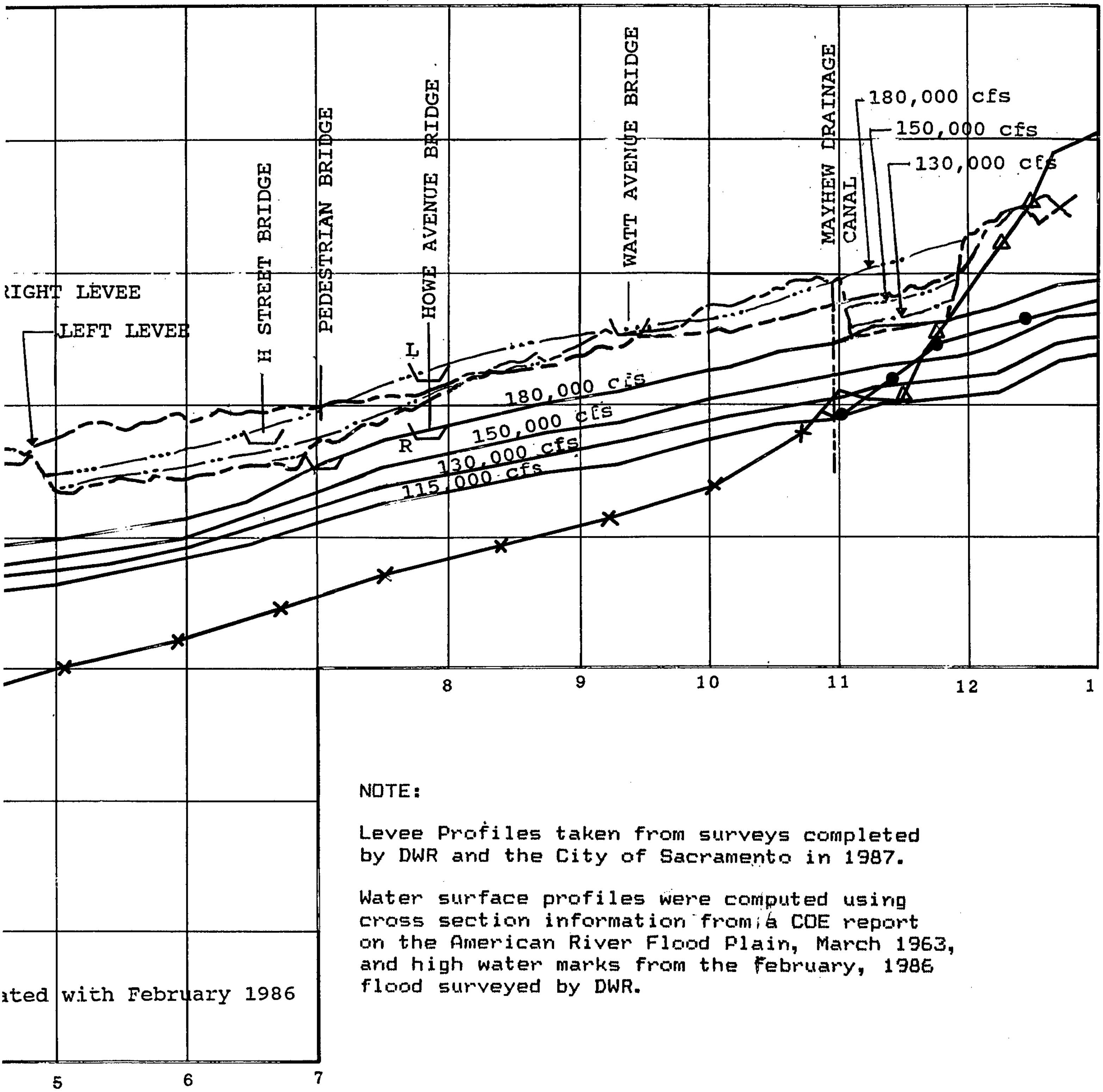
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE 2



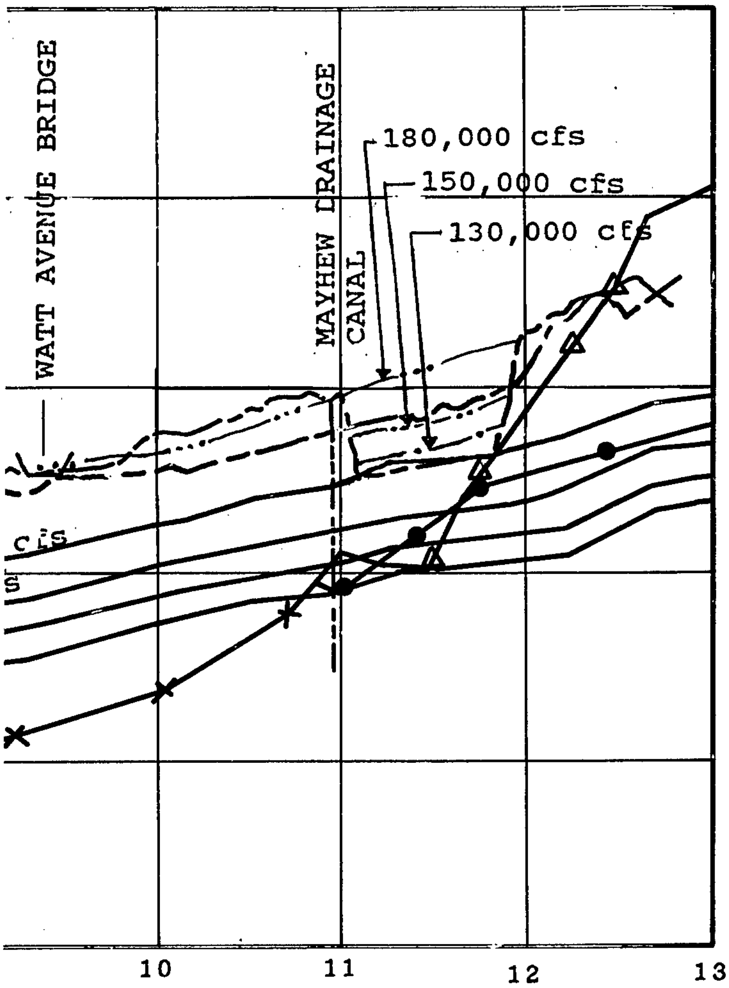
AMERICAN RIVER



NOTE:

Levee Profiles taken from surveys completed by DWR and the City of Sacramento in 1987.

Water surface profiles were computed using cross section information from a COE report on the American River Flood Plain, March 1963, and high water marks from the February, 1986 flood surveyed by DWR.



LEGEND

River Stage for Indicated Flows

Average Natural Ground Adjacent to Levees

Natural Ground Level Adjacent to River - Right Bank

Natural Ground Level Adjacent to River - Left Bank

Bridge Soffit

Top of Levee - Right Bank

Top of Levee - Left Bank

Potential Top of Levee for Channel capacity of 130,000 cfs

Potential Top of Levee for Channel capacity of 150,000 cfs

Potential Top of Levee for Channel capacity of 180,000 cfs

en from surveys completed
y of Sacramento in 1987.

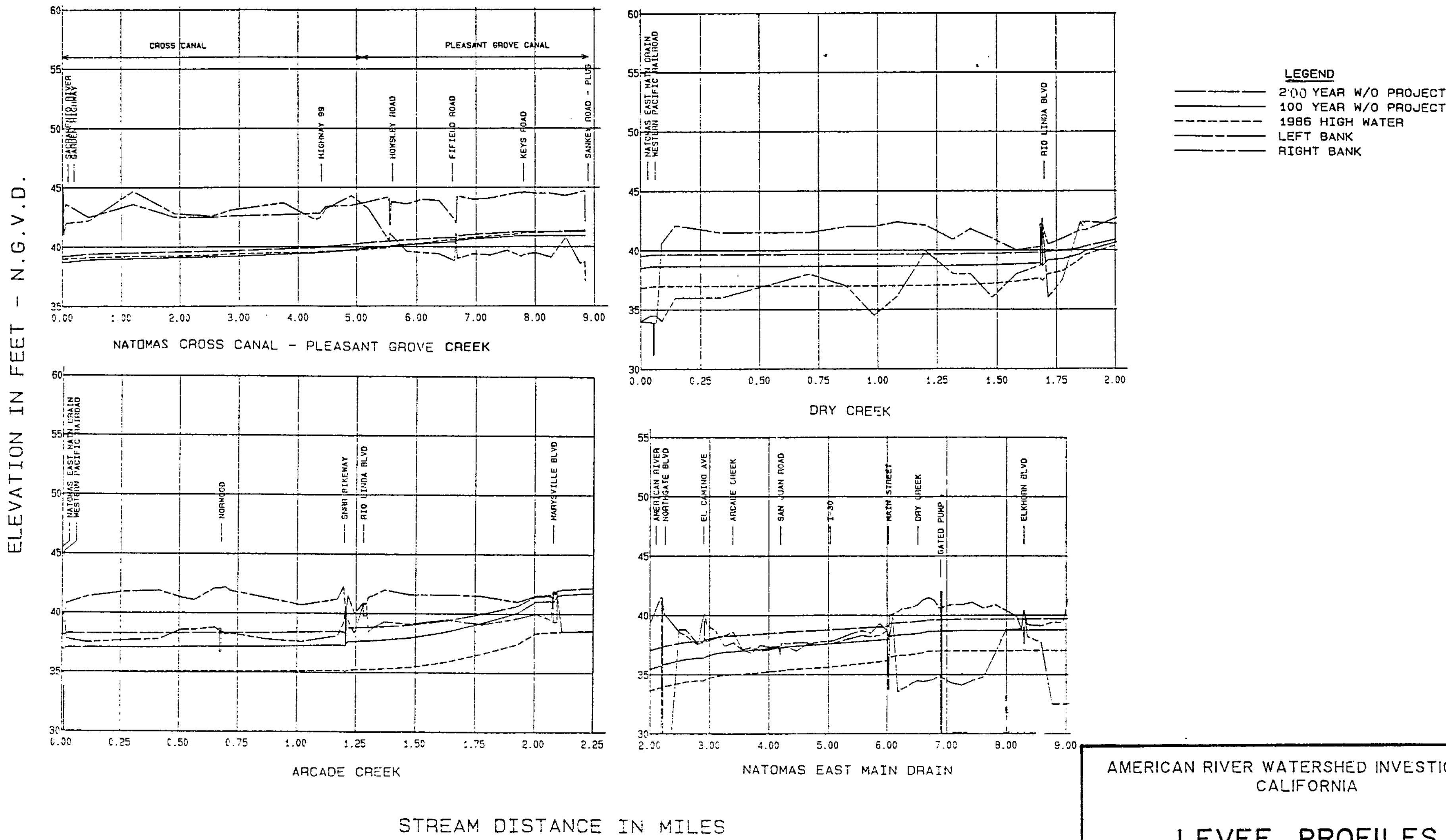
iles were computed using
rmation from a COE report
ver Flood Plain, March 1963,
ks from the February, 1986
DWR.

3

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

LEVEE PROFILES
AMERICAN RIVER

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991



AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

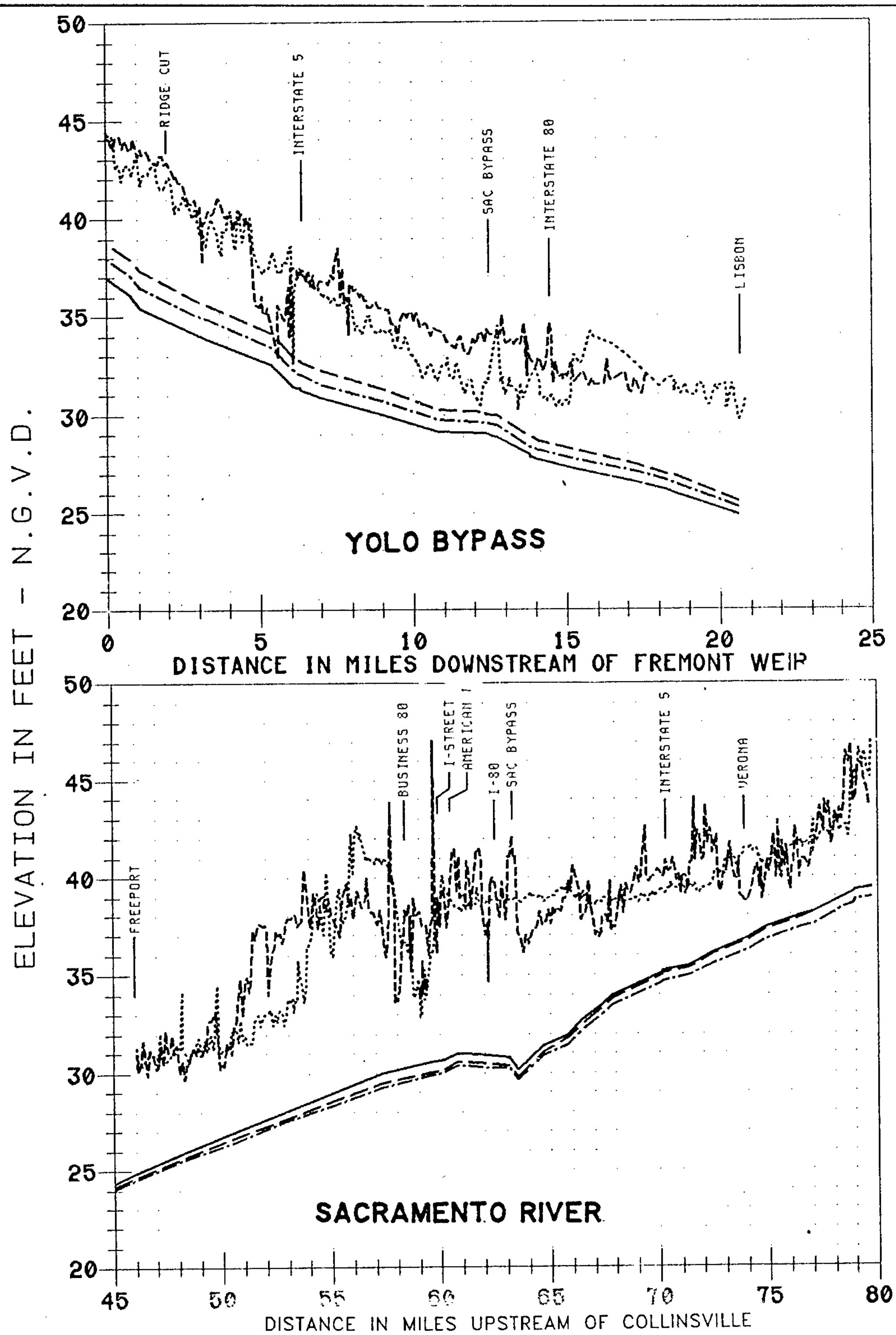
LEVEE PROFILES

NATOMAS EAST MAIN DRAINAGE CANAL
DRY AND ARCADE CREEKS
NATOMAS CROSS CANAL

SACRAMENTO DISTRICT CORPS OF ENGINEERS

DECEMBER 1991

PLATE 4



LEGEND

···················	EAST LEVEE
- - - - - - - - - -	WEST LEVEE
————————	1986 COMPUTED EVENT
—·—·—·—	100 YEAR EVENT
— — — — —	200 YEAR EVENT

NOTE:

Fremont Weir — Existing Width — 30.5 Elevation

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

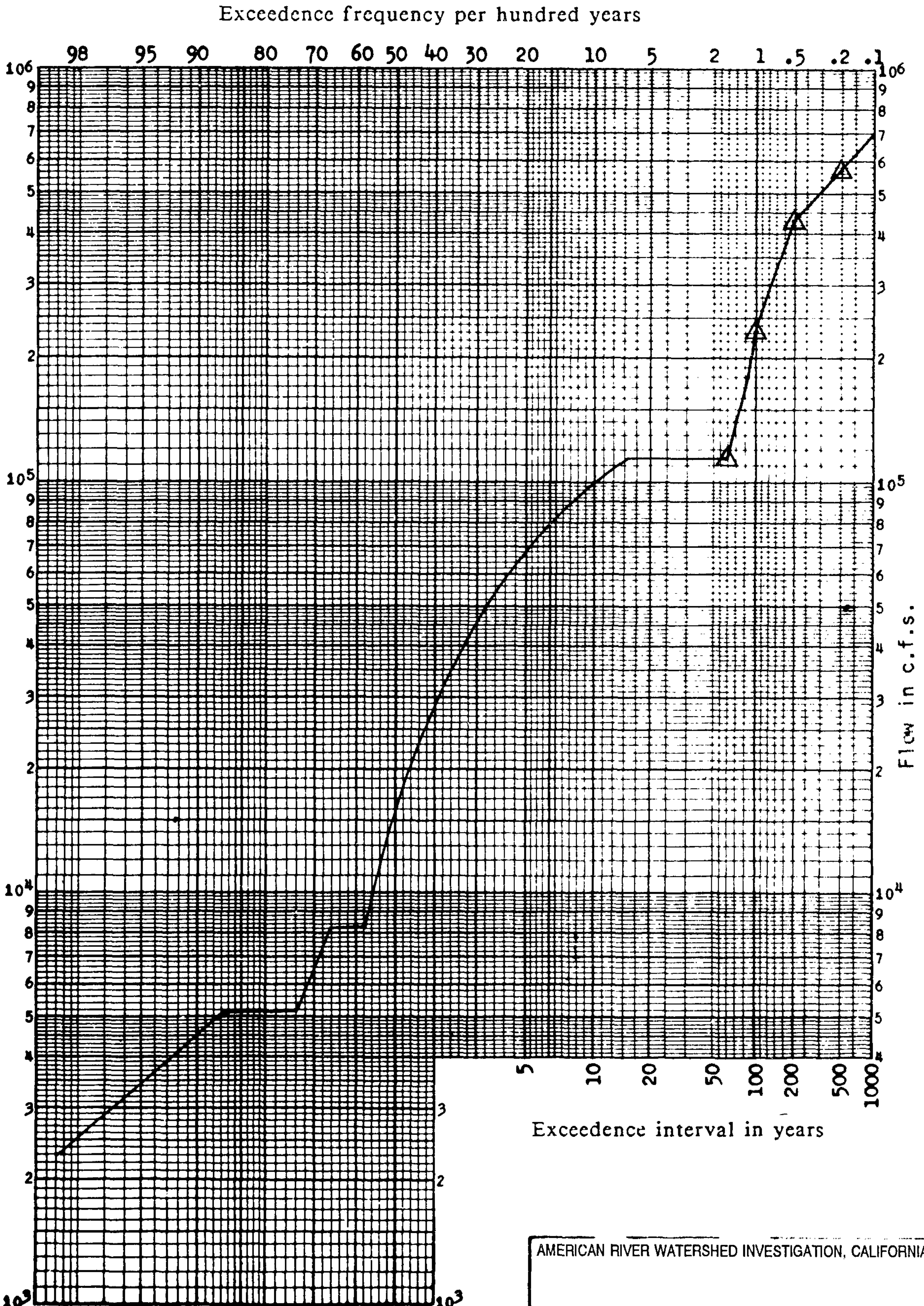
LEVEE PROFILES

SACRAMENTO RIVER AND YOLO BYPASS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

DECEMBER 1991

PLATE 5



Notes:

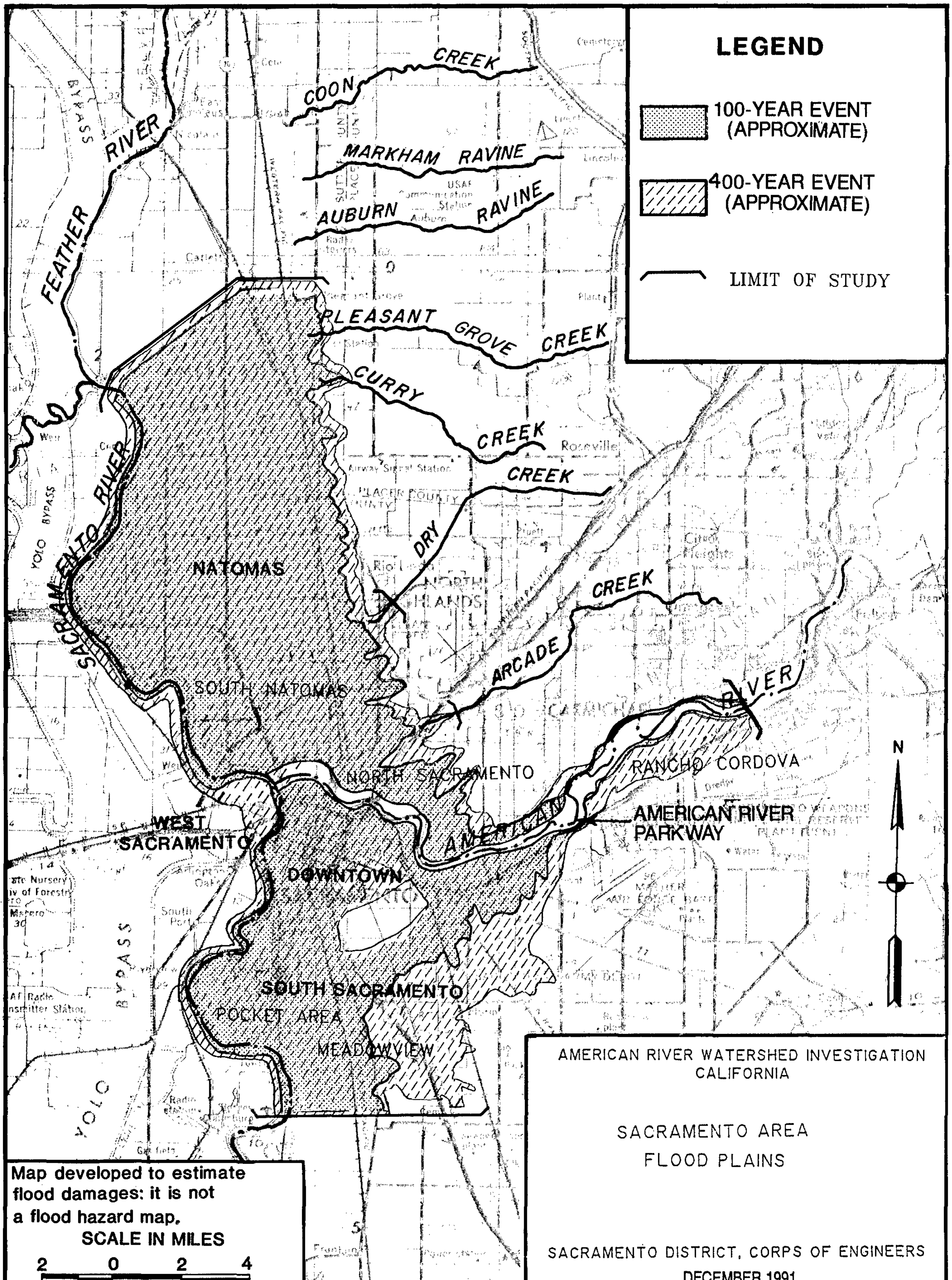
1. The project curves, to the 50 year event, reflects 32 years of record (1955-1986).
2. The remaining portion of the curve reflect the results of hypothetical flood routings as represented by the plotted points.
3. The hypothetical routings used the present authorized flood operation of Folsom Dam.

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

PEAK FLOW – FREQUENCY CURVE
EXISTING CONDITIONS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

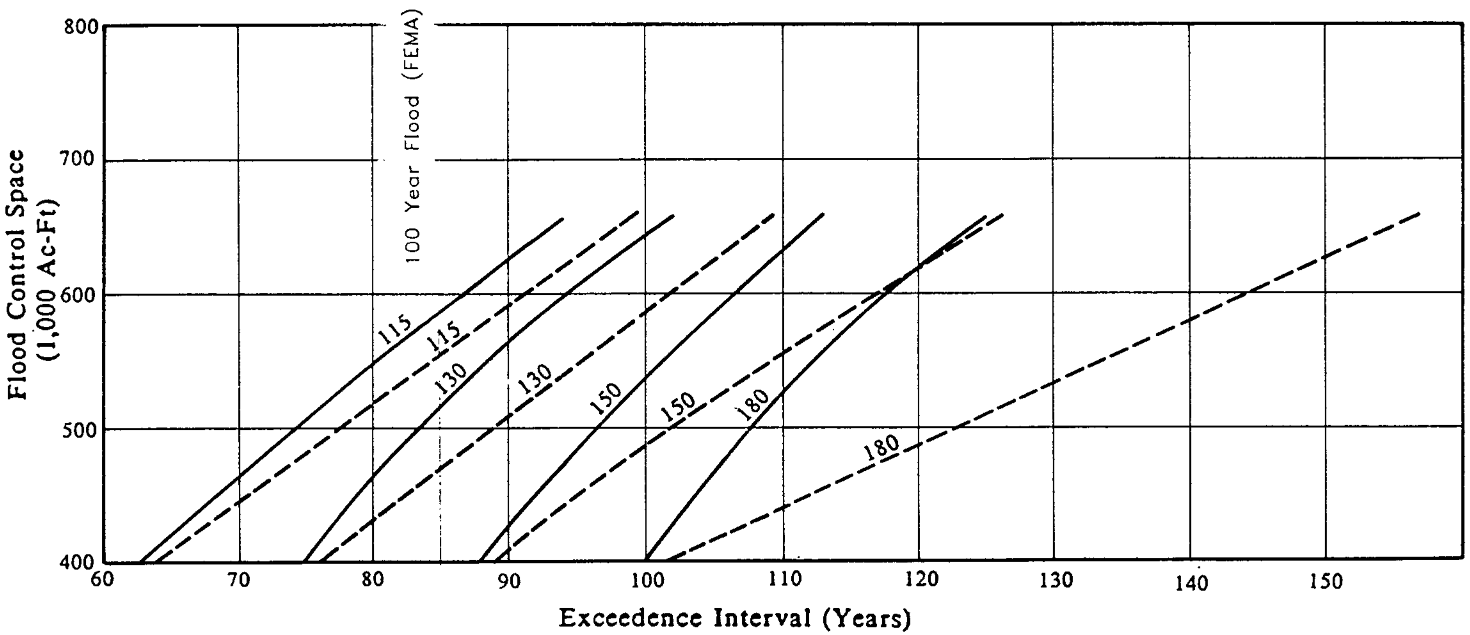
DECEMBER 1991



AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SACRAMENTO AREA
FLOOD PLAINS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991



LEGEND:

115 Channel Capacity (1,000 cfs)
____ Existing Spillway (50,000 acre-feet of surcharge space used)
---- Spillway lowered 15 feet (No surchage space used)

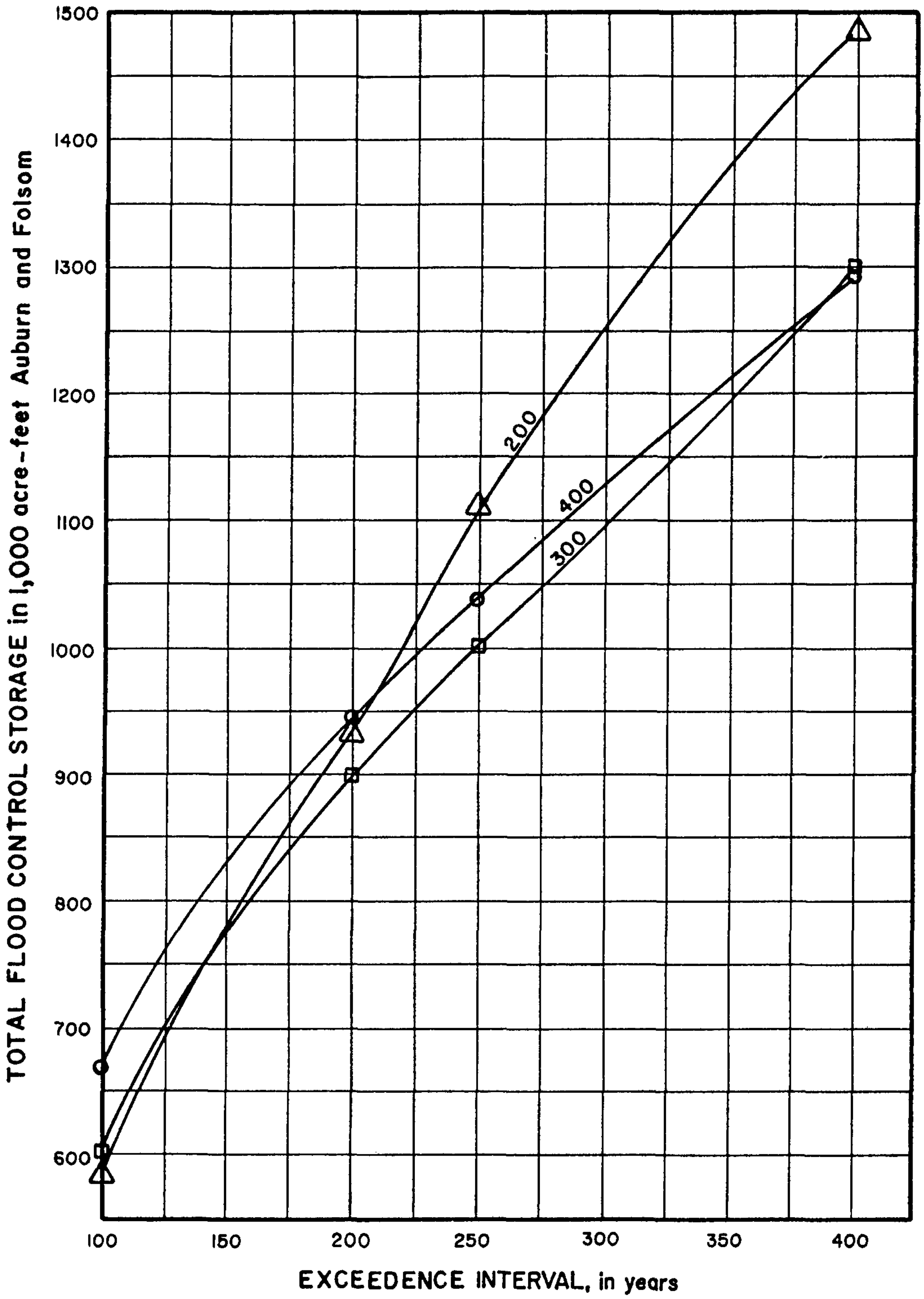
NOTE:

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. at a maximum rate of change of release of 7,500 cfs/hr until channel capacity is reached;
47,000 Ac-Ft of upstream storage space available for exceedence intervals ≤ 100-yrs.

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

FOLSOM DAM OPERATION
FOR
DOWNSTREAM CONTROL

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991



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

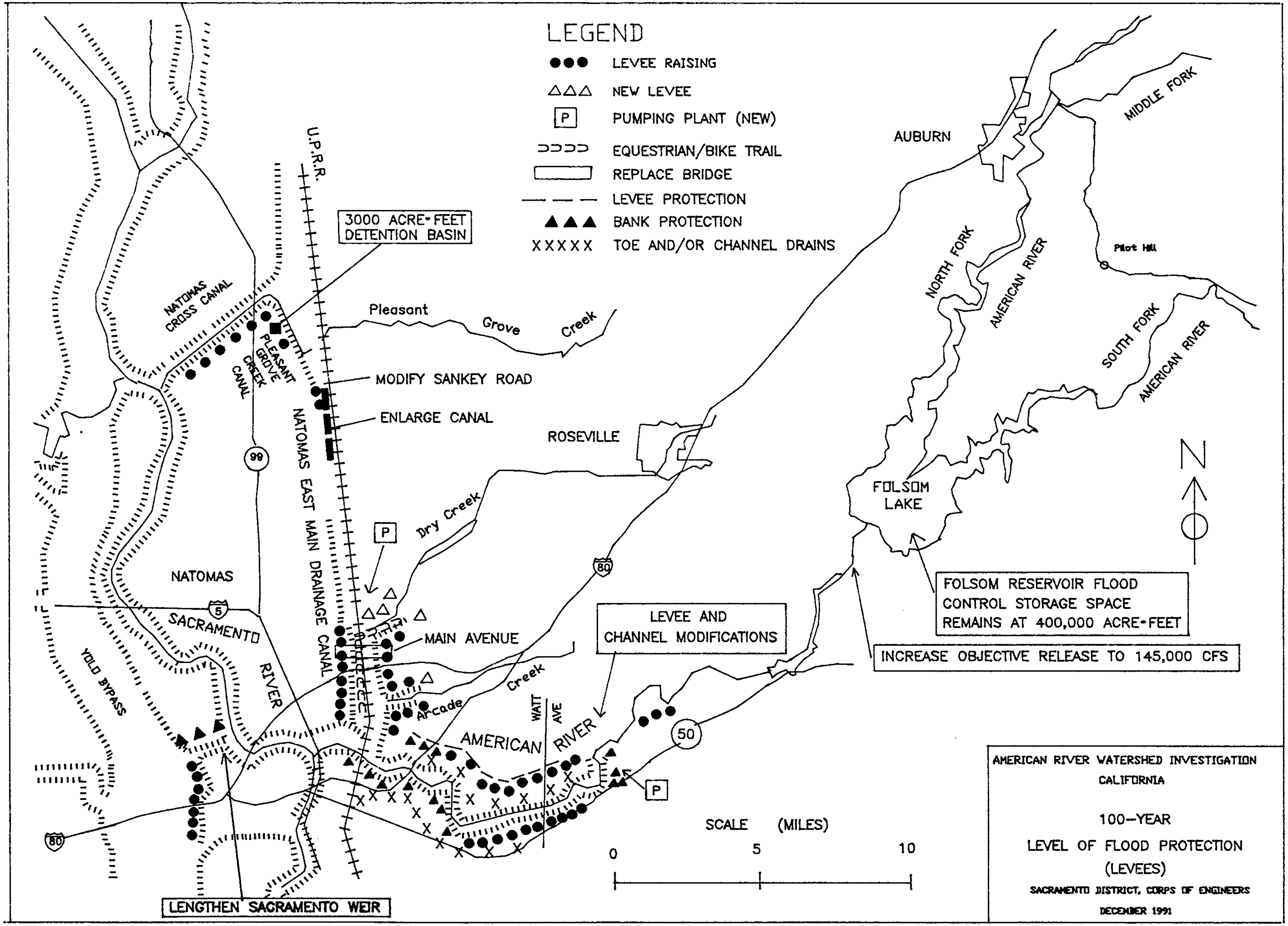

LEGEND
LEVEE RAISING
NEW LEVEE
PUMPING PLANT (NEW)
EQUESTRIAN/BIKE TRAIL
REPLACE BRIDGE
LEVEE PROTECTION
BANK PROTECTION
TOE AND/OR CHANNEL DRAINS
AUBURN
MIDDLE FORK
Pilot Hill
NORTH FORK
AMERICAN RIVER
SOUTH FORK
AMERICAN RIVER
ROSEVILLE
FOLSOM LAKE
N
FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE REMAINS AT 400,000 ACRE-FEET
INCREASE OBJECTIVE RELEASE TO 145,000 CFS
LEVEE AND CHANNEL MODIFICATIONS
U.P.R.R.
3000 ACRE-FEET DETENTION BASIN
Pleasant Grove Creek
MODIFY SANKEY ROAD
ENLARGE CANAL
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK CANAL
99
NATOMAS EAST MAIN DRAINAGE CANAL
Dry Creek
P
MAIN AVENUE
Arcade Creek
WATT AVE
AMERICAN RIVER
50
80
NATOMAS
5
SACRAMENTO RIVER
YOLO BYPASS
LENGTHEN SACRAMENTO WEIR
SCALE (MILES)
0
5
10
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
100-YEAR
LEVEL OF FLOOD PROTECTION
(LEVEES)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 10

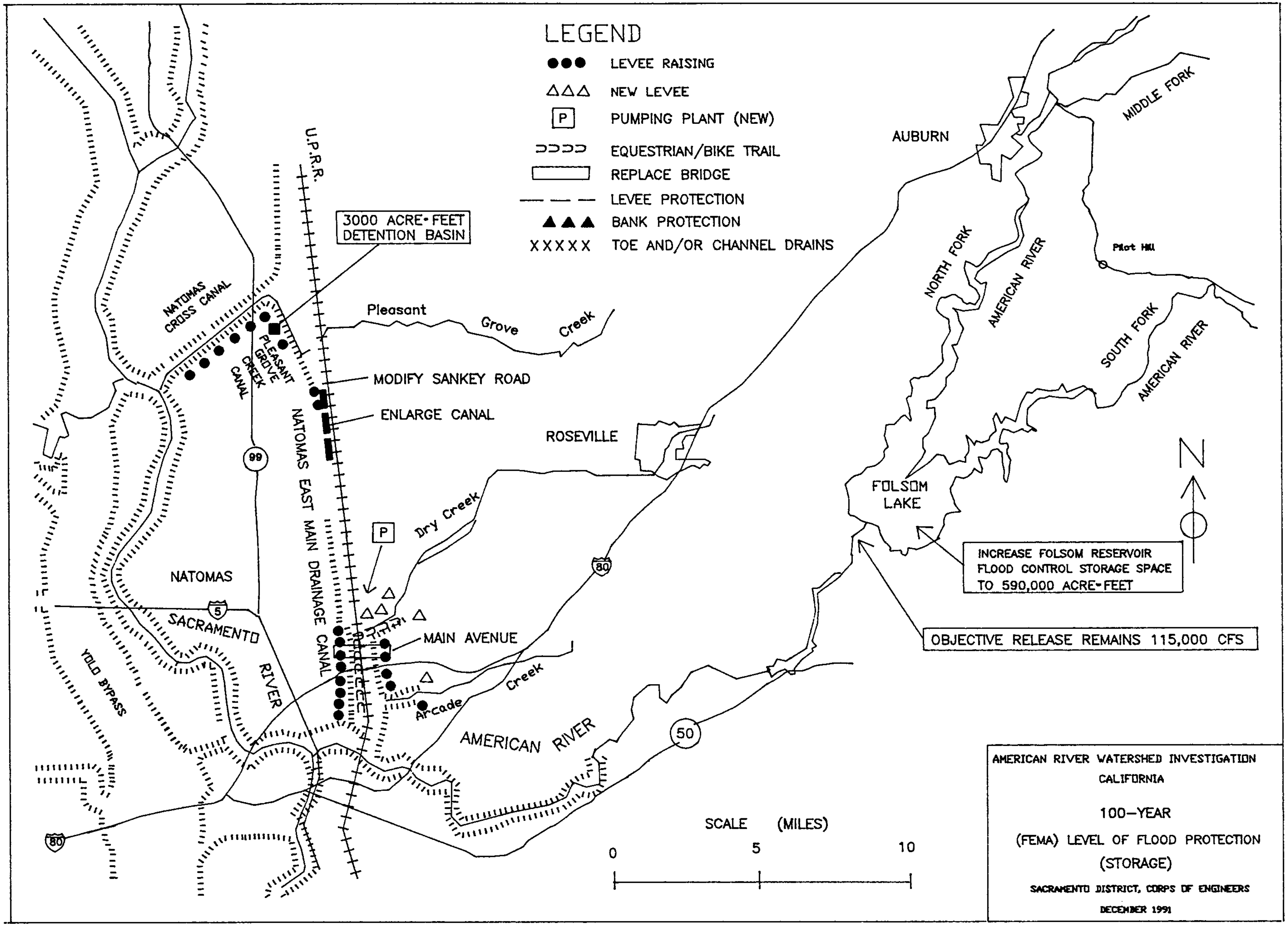
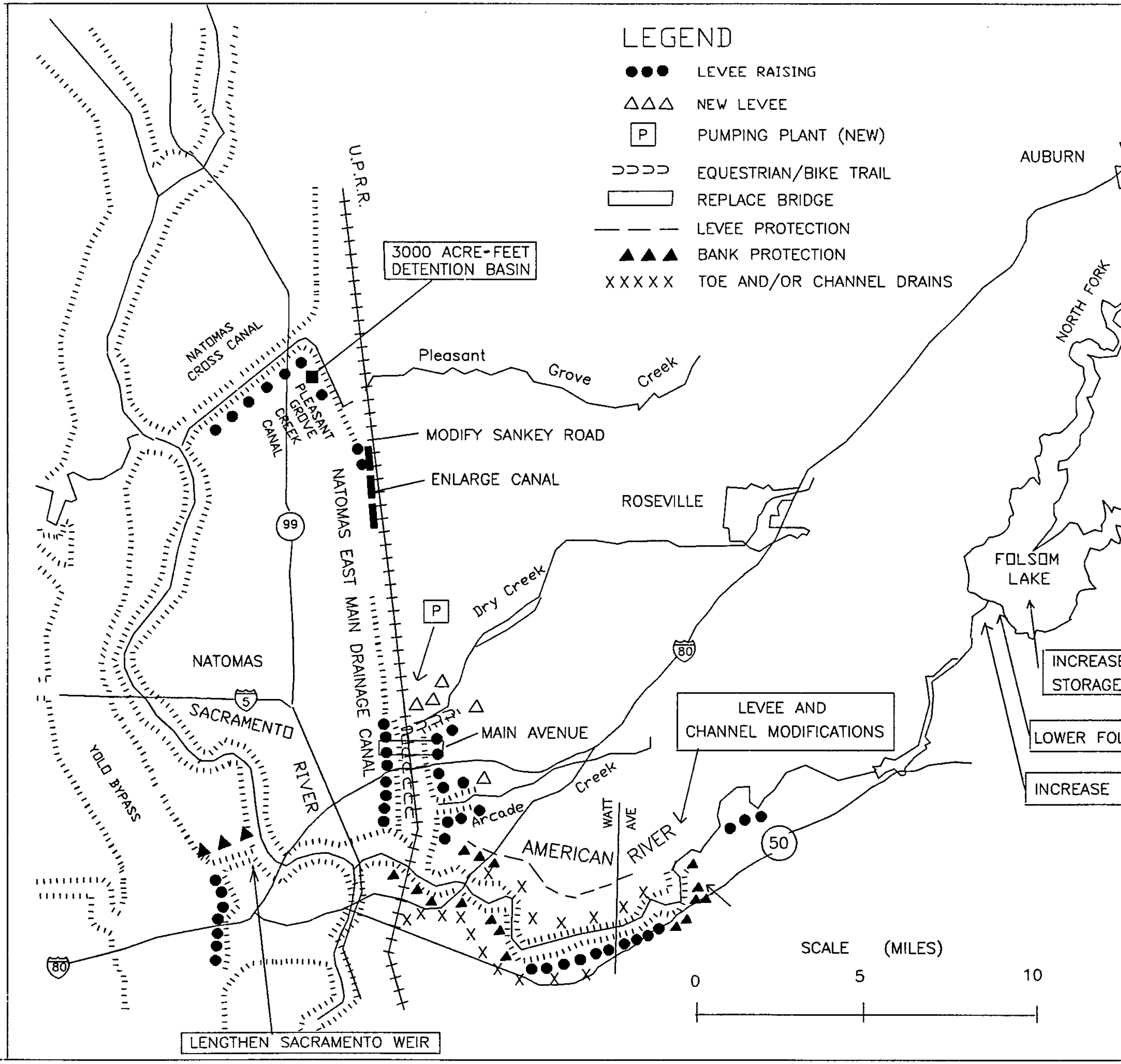

LEGEND
LEVEE RAISING
NEW LEVEE
PUMPING PLANT (NEW)
EQUESTRIAN/BIKE TRAIL
REPLACE BRIDGE
LEVEE PROTECTION
BANK PROTECTION
XXXXX TOE AND/OR CHANNEL DRAINS
AUBURN
MIDDLE FORK
NORTH FORK
AMERICAN RIVER
Pilot Hill
SOUTH FORK
AMERICAN RIVER
U.P.R.R.
3000 ACRE-FEET DETENTION BASIN
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK CANAL
Pleasant Grove Creek
MODIFY SANKEY ROAD
ENLARGE CANAL
ROSEVILLE
NATOMAS EAST MAIN DRAINAGE CANAL
99
FOLSOM LAKE
N
Dry Creek
P
INCREASE FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE TO 590,000 ACRE-FEET
80
NATOMAS
5
SACRAMENTO RIVER
MAIN AVENUE
OBJECTIVE RELEASE REMAINS 115,000 CFS
YOLO BYPASS
Arcade Creek
AMERICAN RIVER
50
80
SCALE (MILES)
0
5
10
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
100-YEAR
(FEMA) LEVEL OF FLOOD PROTECTION
(STORAGE)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 11



AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

100-YEAR
LEVEL OF FLOOD PROTECTION
(LEVEES/STORAGE AND SPILLWAY)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 12

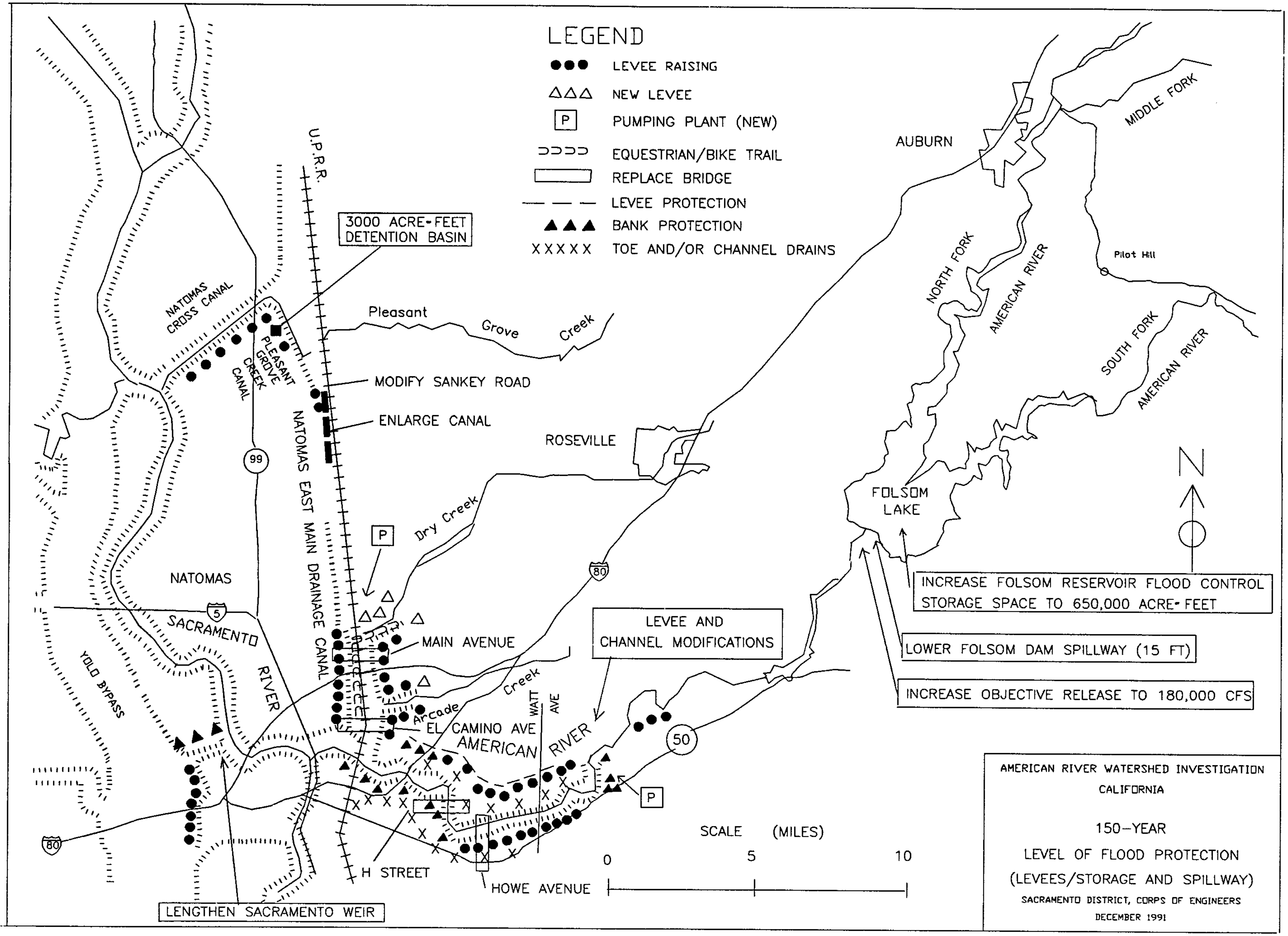
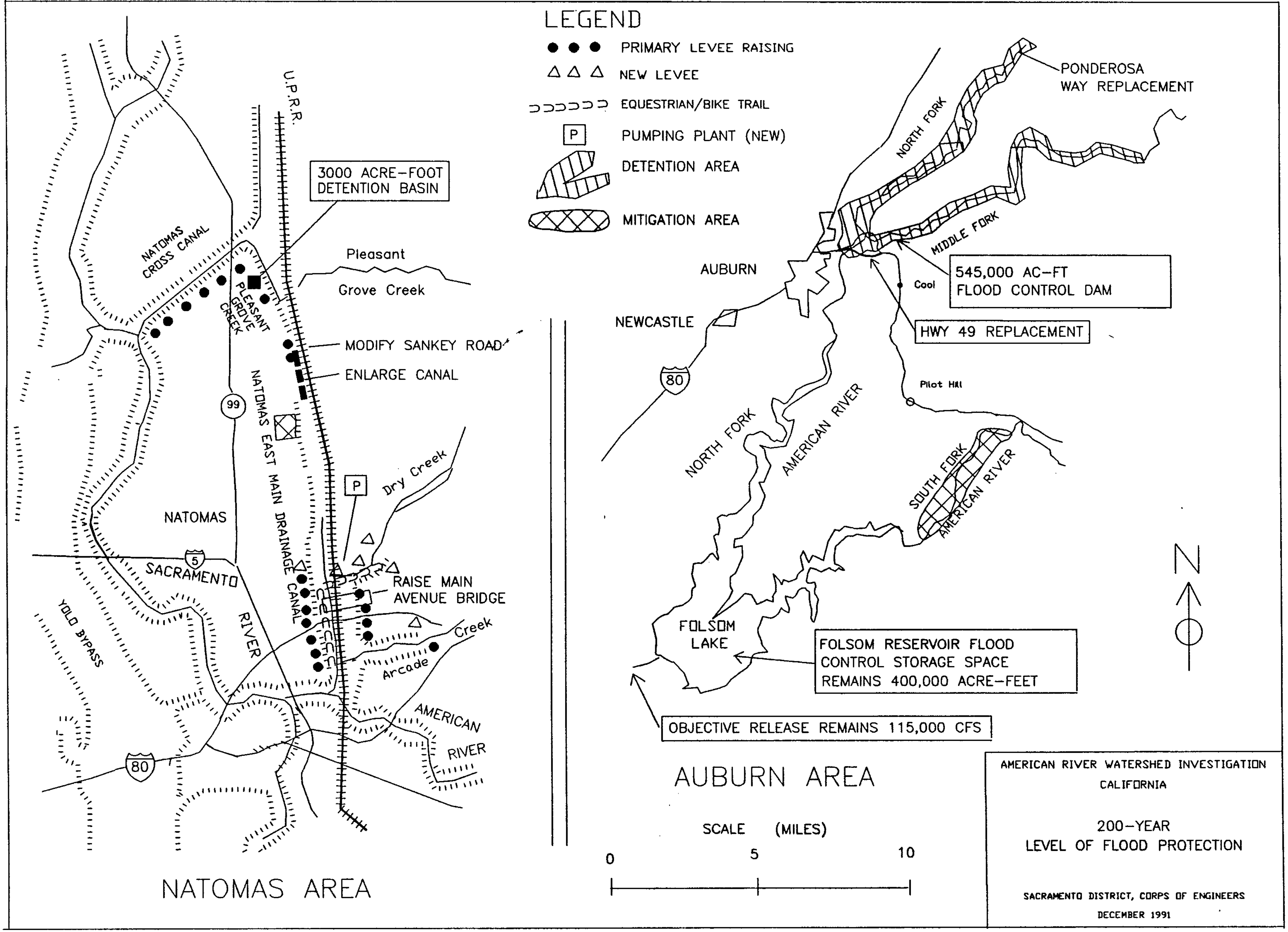

LEGEND
LEVEE RAISING
NEW LEVEE
PUMPING PLANT (NEW)
EQUESTRIAN/BIKE TRAIL
REPLACE BRIDGE
LEVEE PROTECTION
BANK PROTECTION
TOE AND/OR CHANNEL DRAINS
AUBURN
MIDDLE FORK
NORTH FORK
AMERICAN RIVER
Pilot Hill
SOUTH FORK
AMERICAN RIVER
FOLSOM LAKE
N
INCREASE FOLSOM RESERVOIR FLOOD CONTROL STORAGE SPACE TO 650,000 ACRE-FEET
LOWER FOLSOM DAM SPILLWAY (15 FT)
INCREASE OBJECTIVE RELEASE TO 180,000 CFS
U.P.R.R.
3000 ACRE-FEET DETENTION BASIN
NATOMAS CROSS CANAL
PLEASANT GROVE CREEK CANAL
Pleasant Grove Creek
MODIFY SANKEY ROAD
ENLARGE CANAL
ROSEVILLE
99
NATOMAS EAST MAIN DRAINAGE CANAL
P
Dry Creek
80
NATOMAS
5
SACRAMENTO RIVER
YOLO BYPASS
MAIN AVENUE
LEVEE AND CHANNEL MODIFICATIONS
Creek
Arcade
WATT AVE
EL CAMINO AVE
AMERICAN RIVER
50
P
H STREET
HOWE AVENUE
SCALE (MILES)
0
5
10
LENGTHEN SACRAMENTO WEIR
80
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA
150-YEAR
LEVEL OF FLOOD PROTECTION
(LEVEES/STORAGE AND SPILLWAY)
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 13

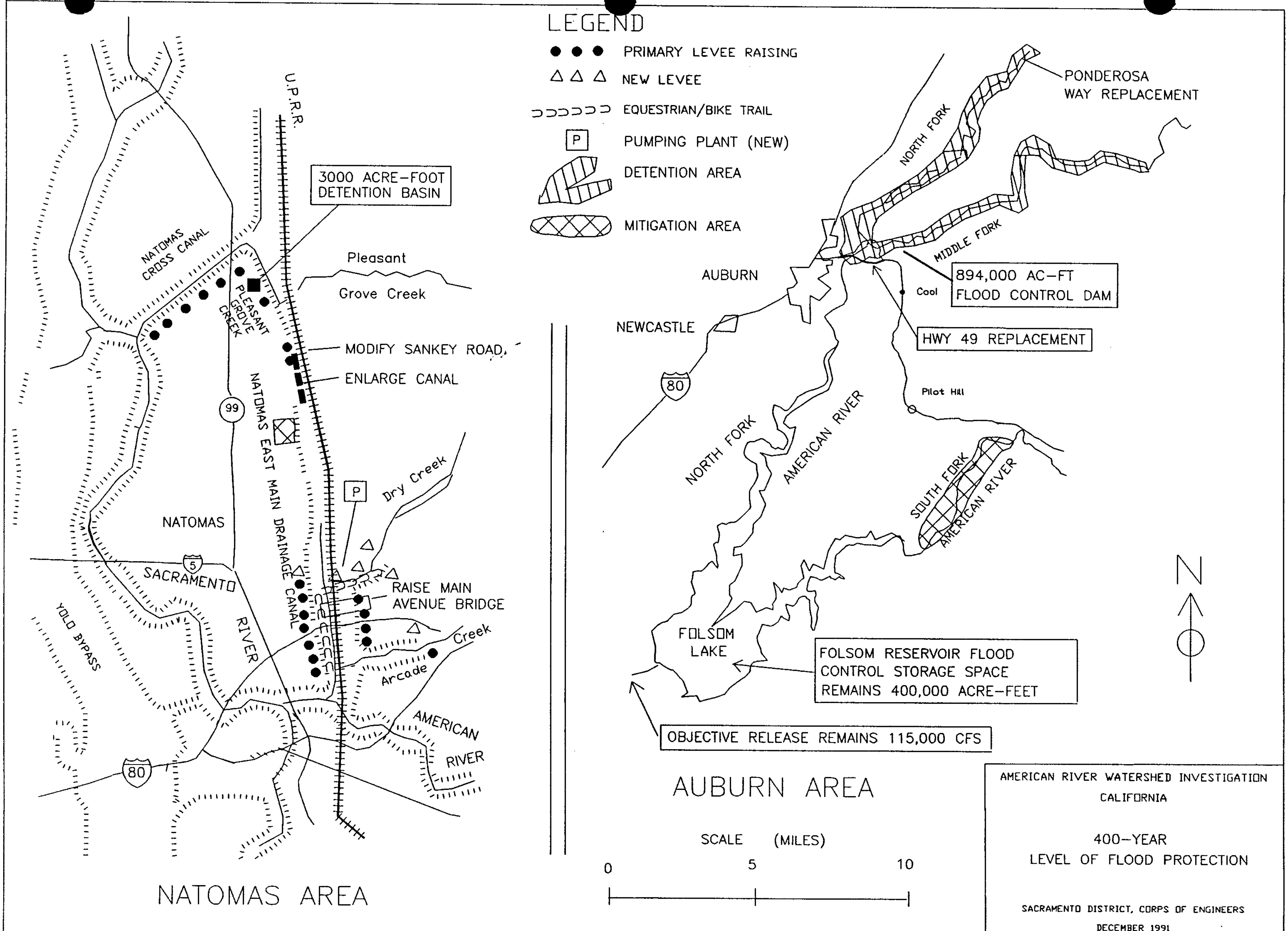


AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

200-YEAR
LEVEL OF FLOOD PROTECTION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 14

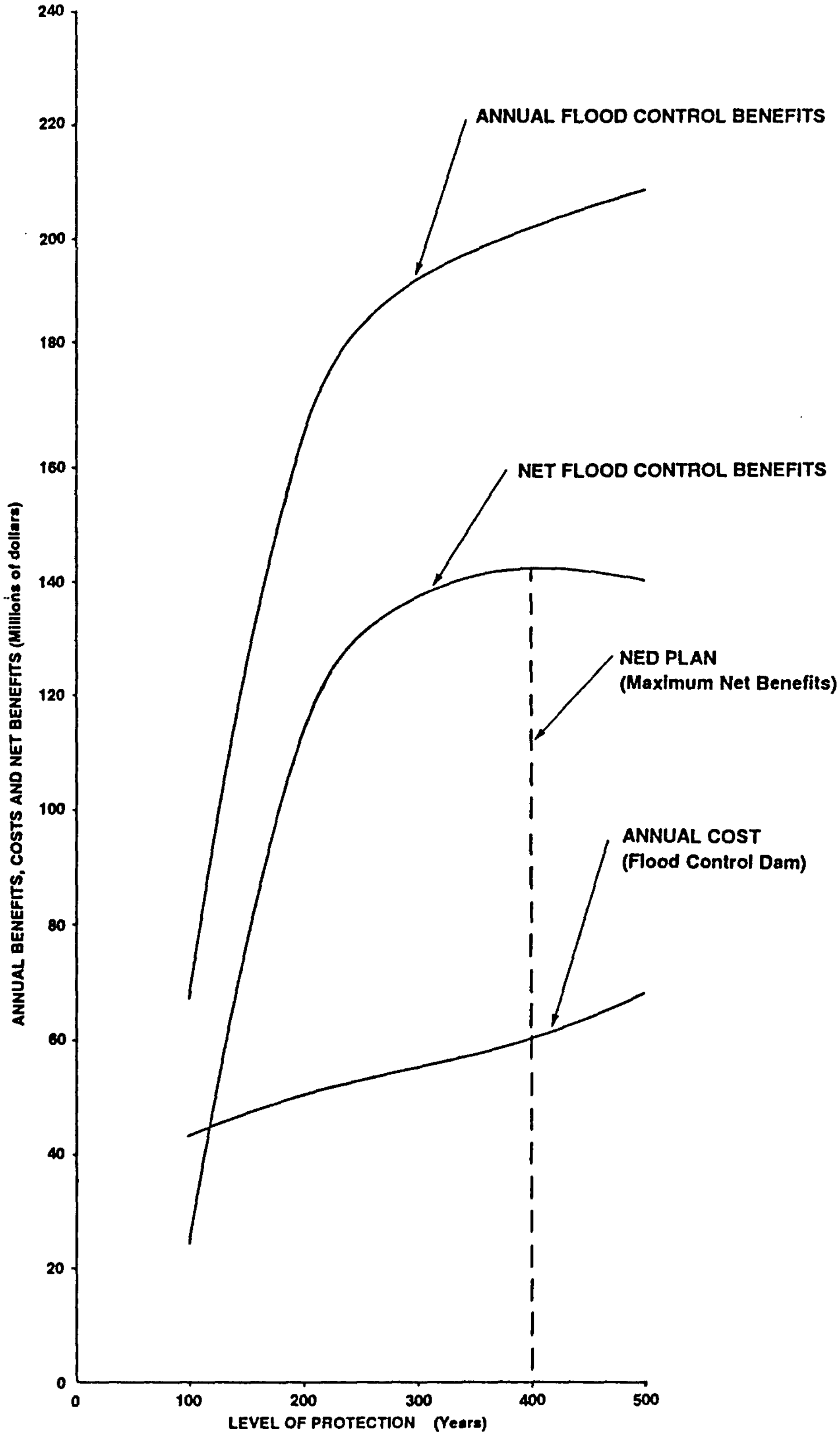


AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

400-YEAR
LEVEL OF FLOOD PROTECTION

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 15



- OCTOBER 1991 PRICE LEVELS

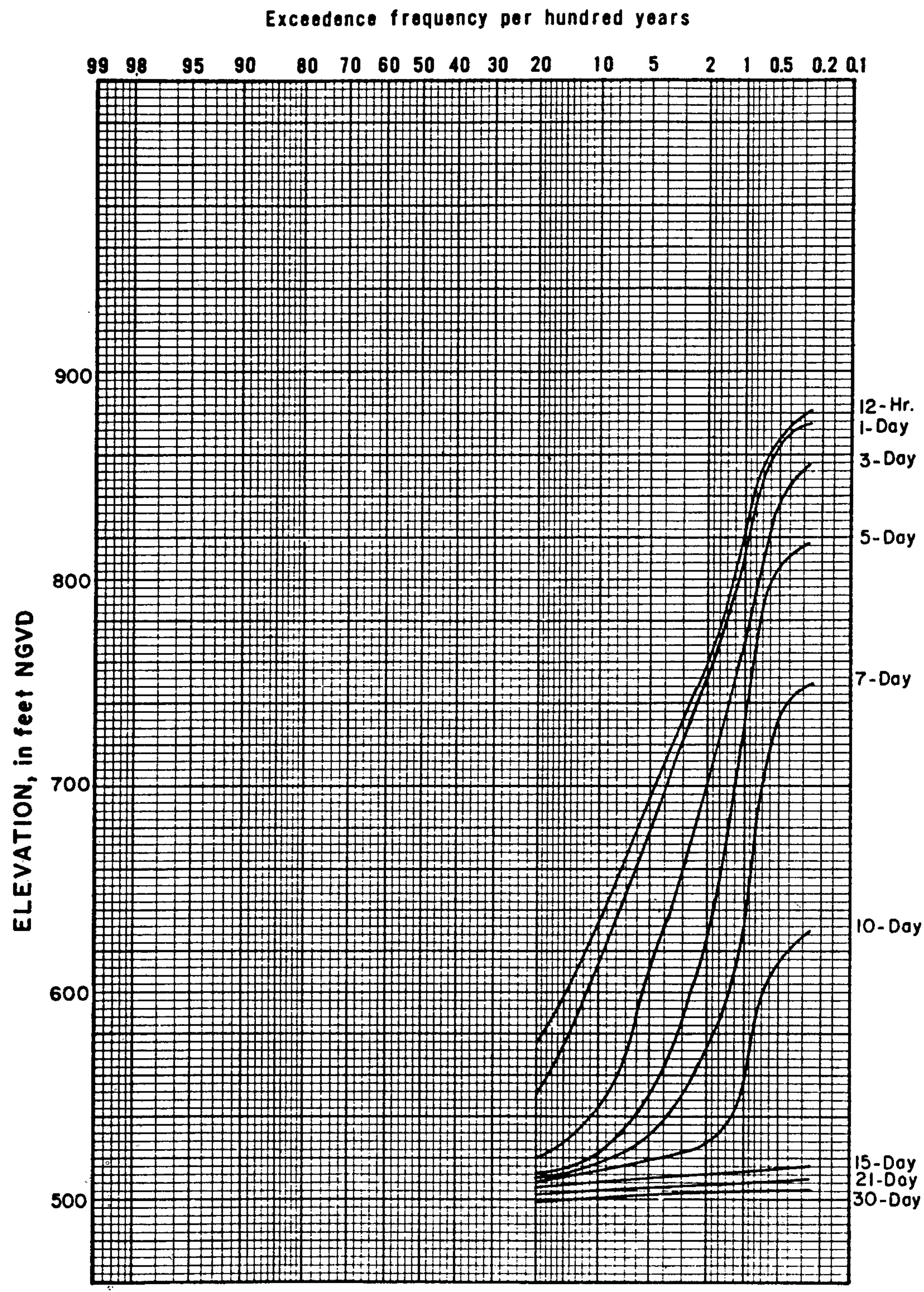
-100 YEAR PROJECT LIFE AND 8-3/4 PERCENT DISCOUNT RATE

-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



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 115,00 cfs objective release.

2. Top of inactive pool – elevation 490

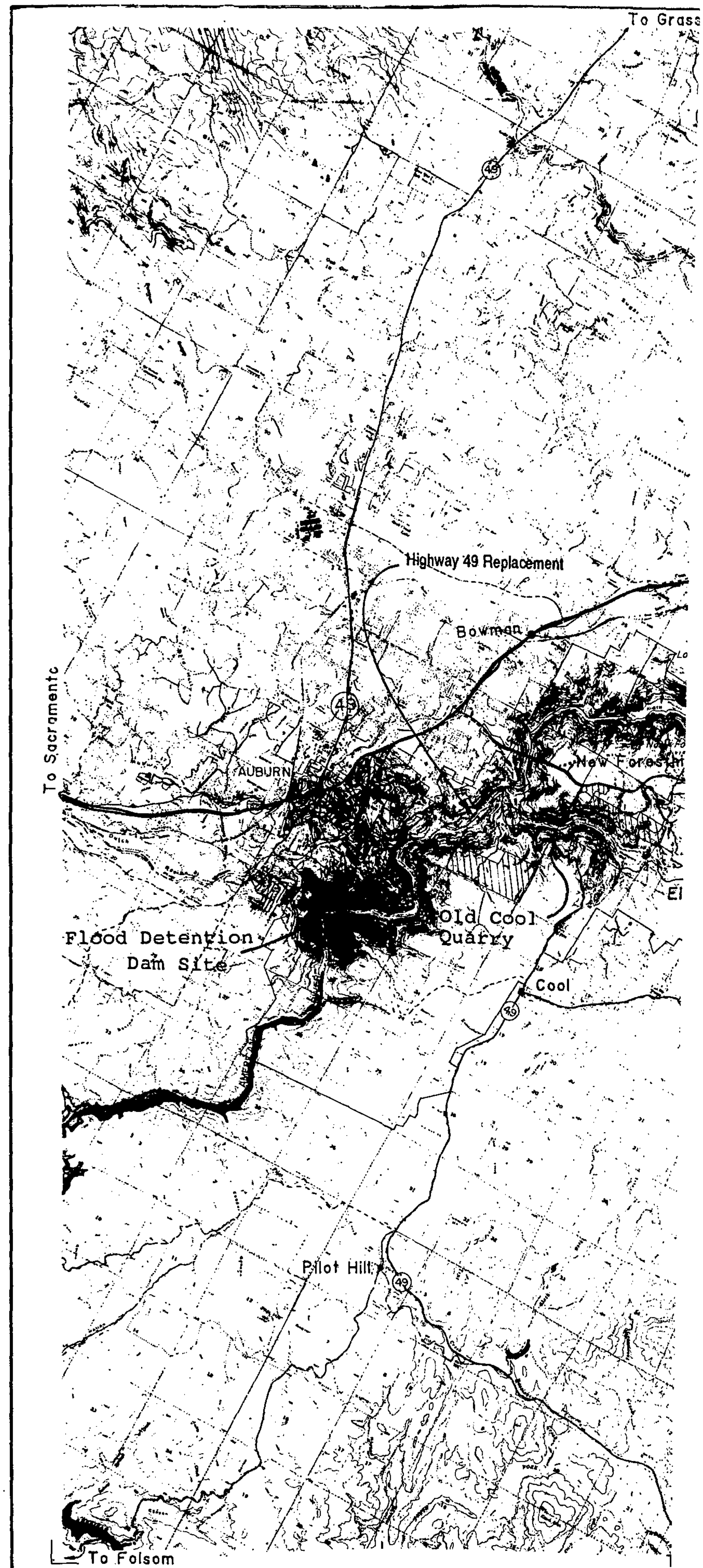
3. Curver define the duration of time elevation is equalled or exceeded.

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

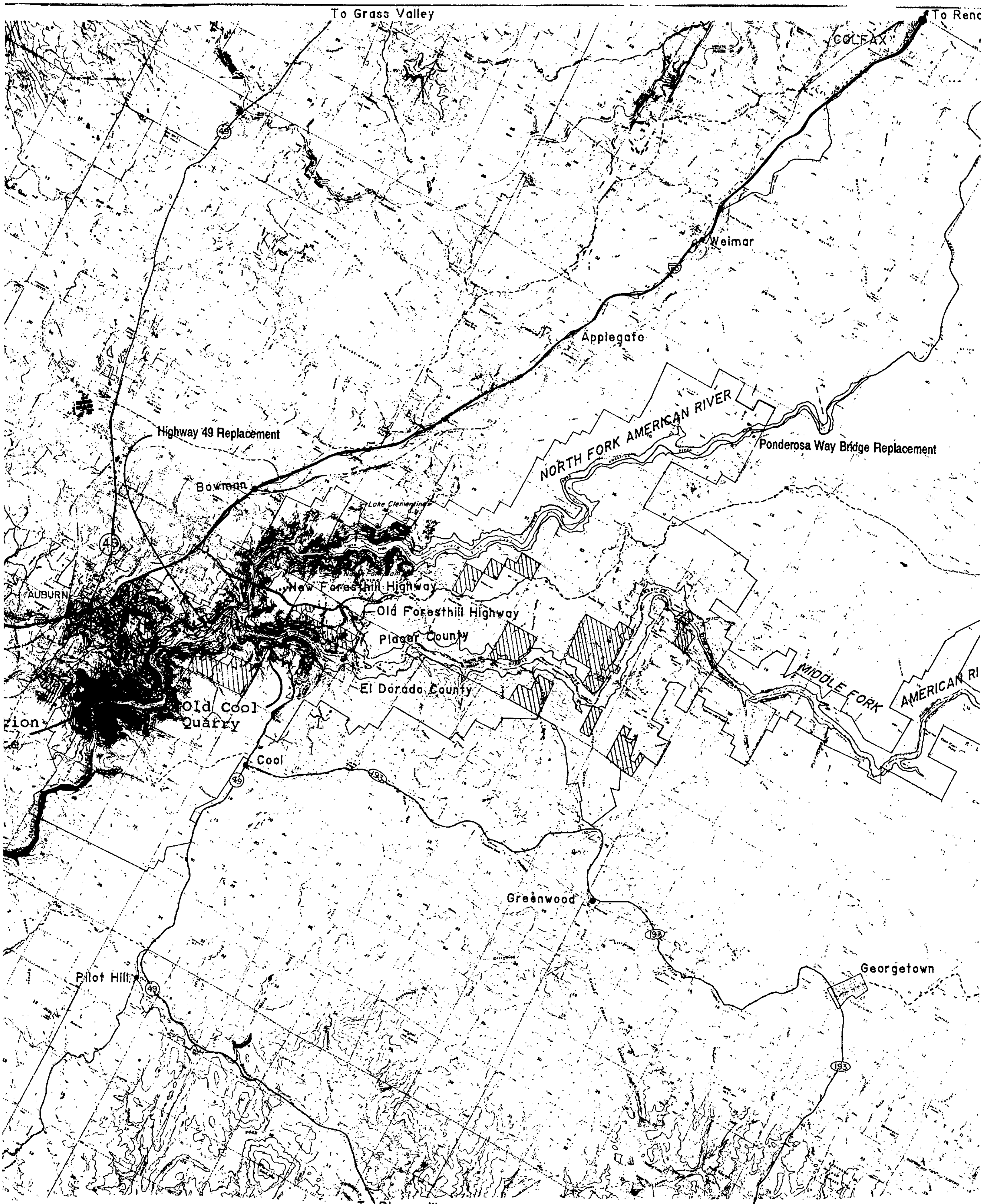
ELEVATION-FREQUENCY-DURATION FLOOD CONTROL DAM ALTERNATIVE (200-YEAR PROTECTION)

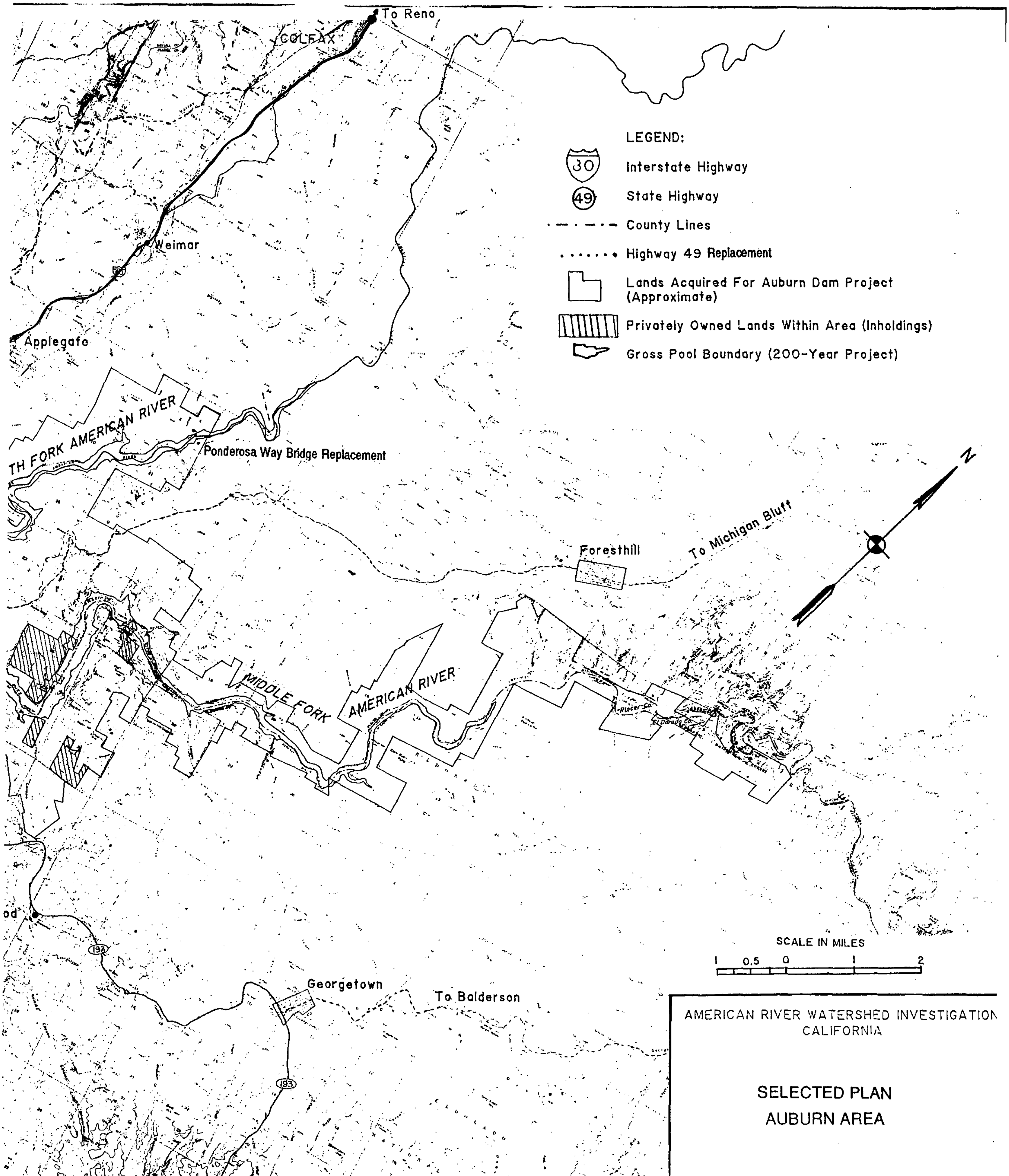
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991


To Grass
Highway 49 Replacement
Bowman
To Sacramento
AUBURN
New Foresthi
Old Cool
Quarry
Flood Detention
Dam Site
Cool
Pilot Hill
To Folsom

(1)


To Grass Valley
To Reno
COLFAX
49
Weimar
80
Applegate
Highway 49 Replacement
NORTH FORK AMERICAN RIVER
Ponderosa Way Bridge Replacement
Bowman
Lake Clementine
49
AUBURN
New Foresthill Highway
Old Foresthill Highway
Placer County
El Dorado County
MIDDLE FORK
AMERICAN RI
Old Cool
Quarry
Cool
49
193
Greenwood
193
Georgetown
Pilot Hill
49
193
To Placerville
To Placerville



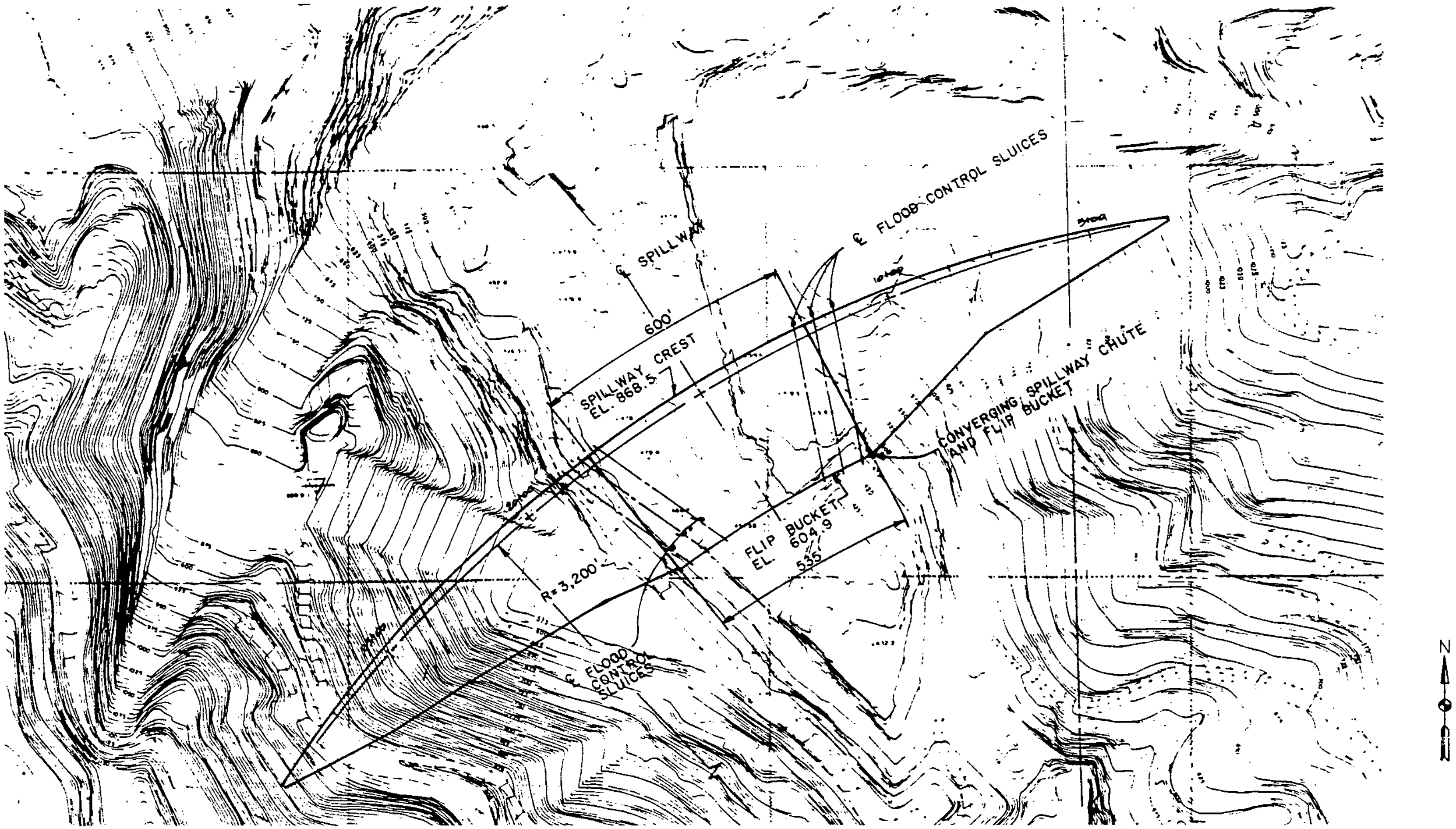
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SELECTED PLAN
AUBURN AREA

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 18

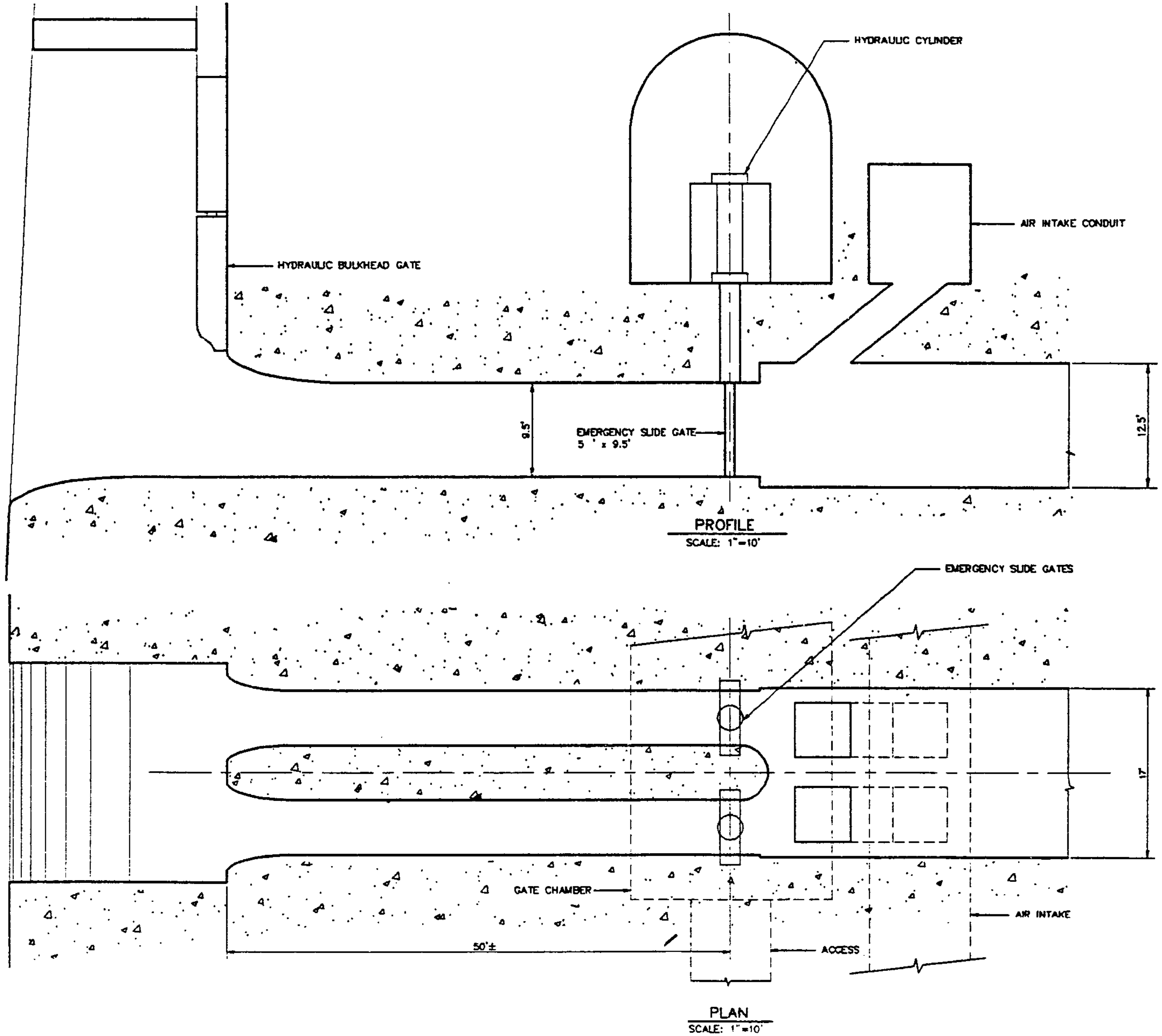
3



AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

SELECTED PLAN
DAMSITE PLAN
RIVER MILE 20.1

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA
DECEMBER 1991



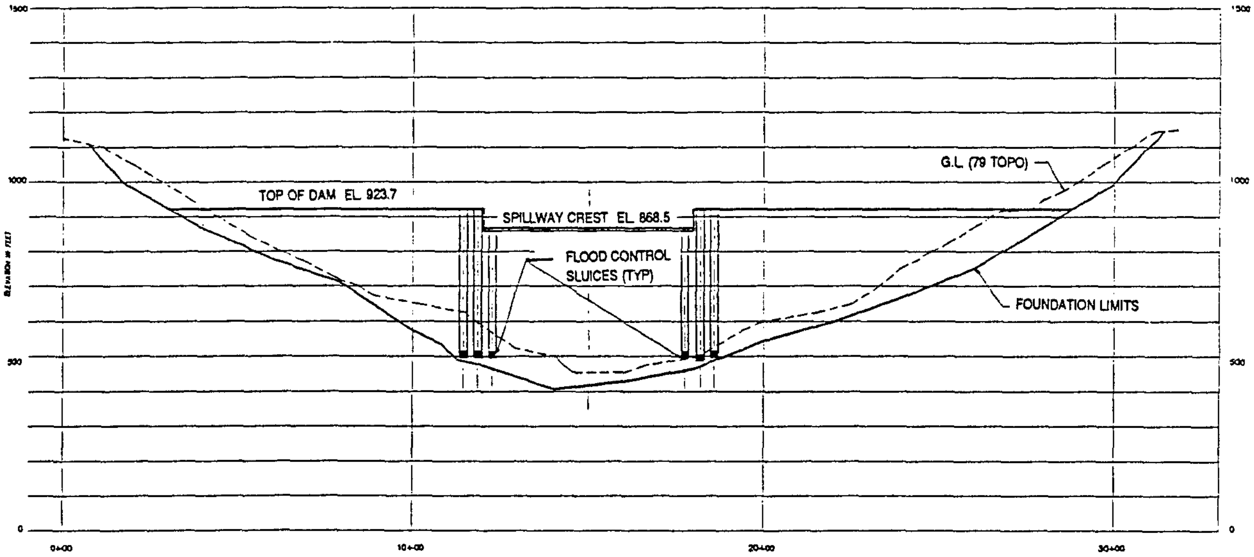
AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

SELECTED PLAN
OUTLET WORKS TUNNEL
INTAKE STRUCTURE

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

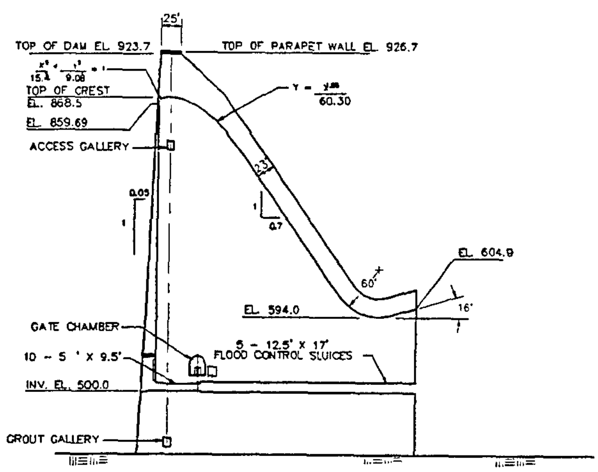
DECEMBER 1991

PLATE 20

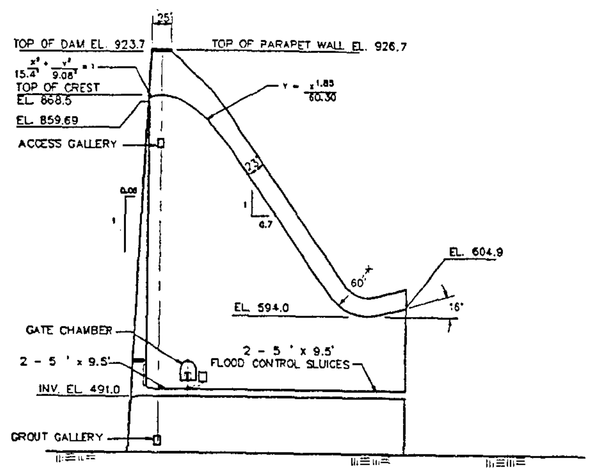


PROFILE OF UPSTREAM FACE

SCALE: 1"=300'

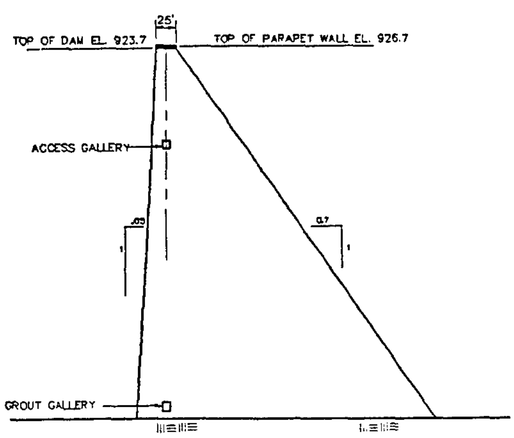


SPILLWAY SECTION



SPILLWAY SECTION

NTS



TYPICAL NON-OVERFLOW SECTION

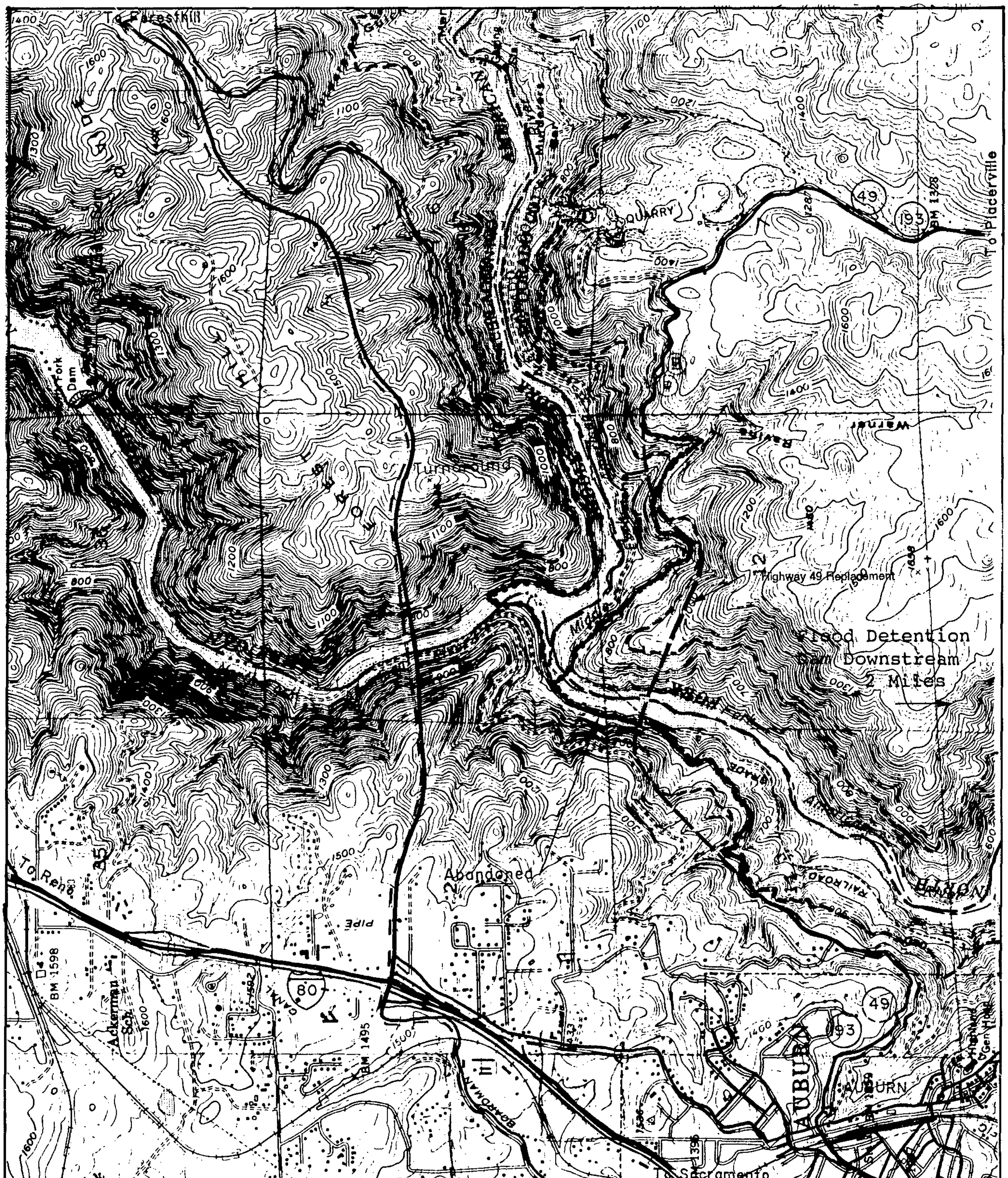
NTS

AMERICAN RIVER WATERSHED INVESTIGATION, CALIFORNIA

SELECTED PLAN
DAM AND SPILLWAY
PROFILE AND SECTIONS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER, 1991



SCALE IN MILES

0.0 0.5 1.0

LEGEND:

Road Replacement

Abandoned Road

Max Pool Limit

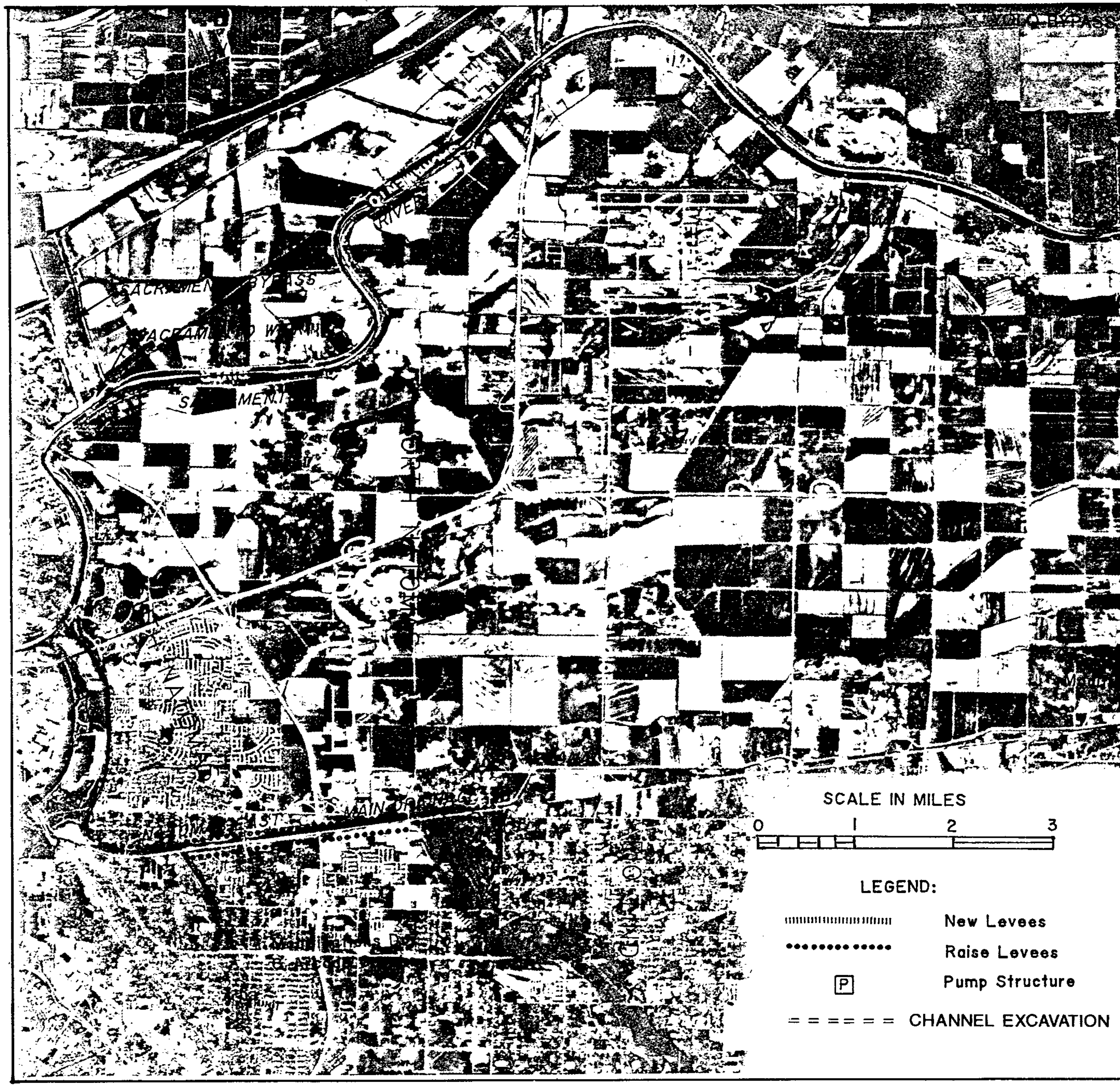
N

AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

HIGHWAY 49 REPLACEMENT

SACRAMENTO DISTRICT, CORPS OF ENGINEERS

DECEMBER 1991



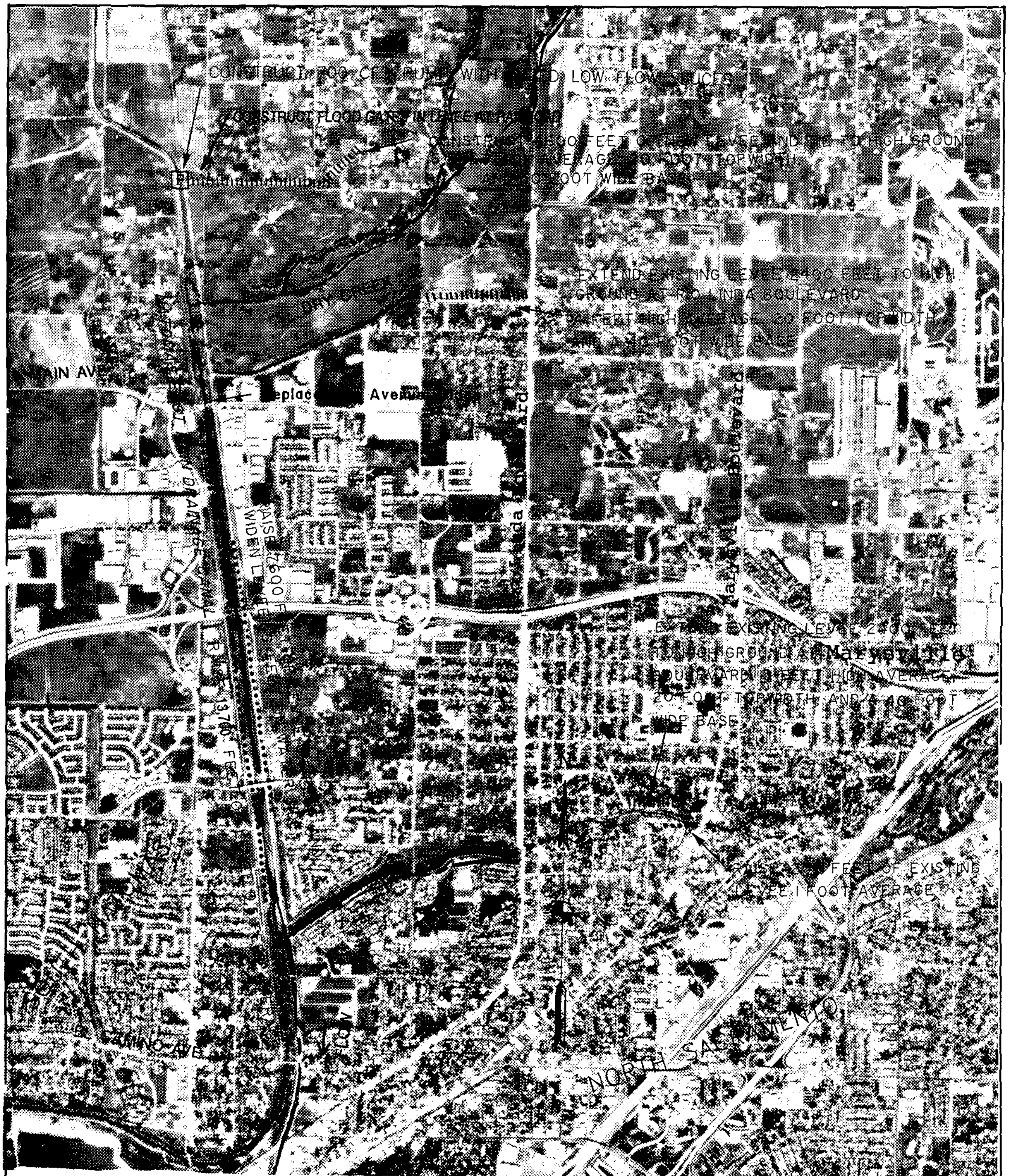
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SELECTED PLAN

NATOMAS ELEMENTS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 23



SCALE IN MILES

0.5 0.0 0.5 1.0

P PUMP STRUCTURE

••••• RAISE LEVEES

IIIIIIIII NEW LEVEES

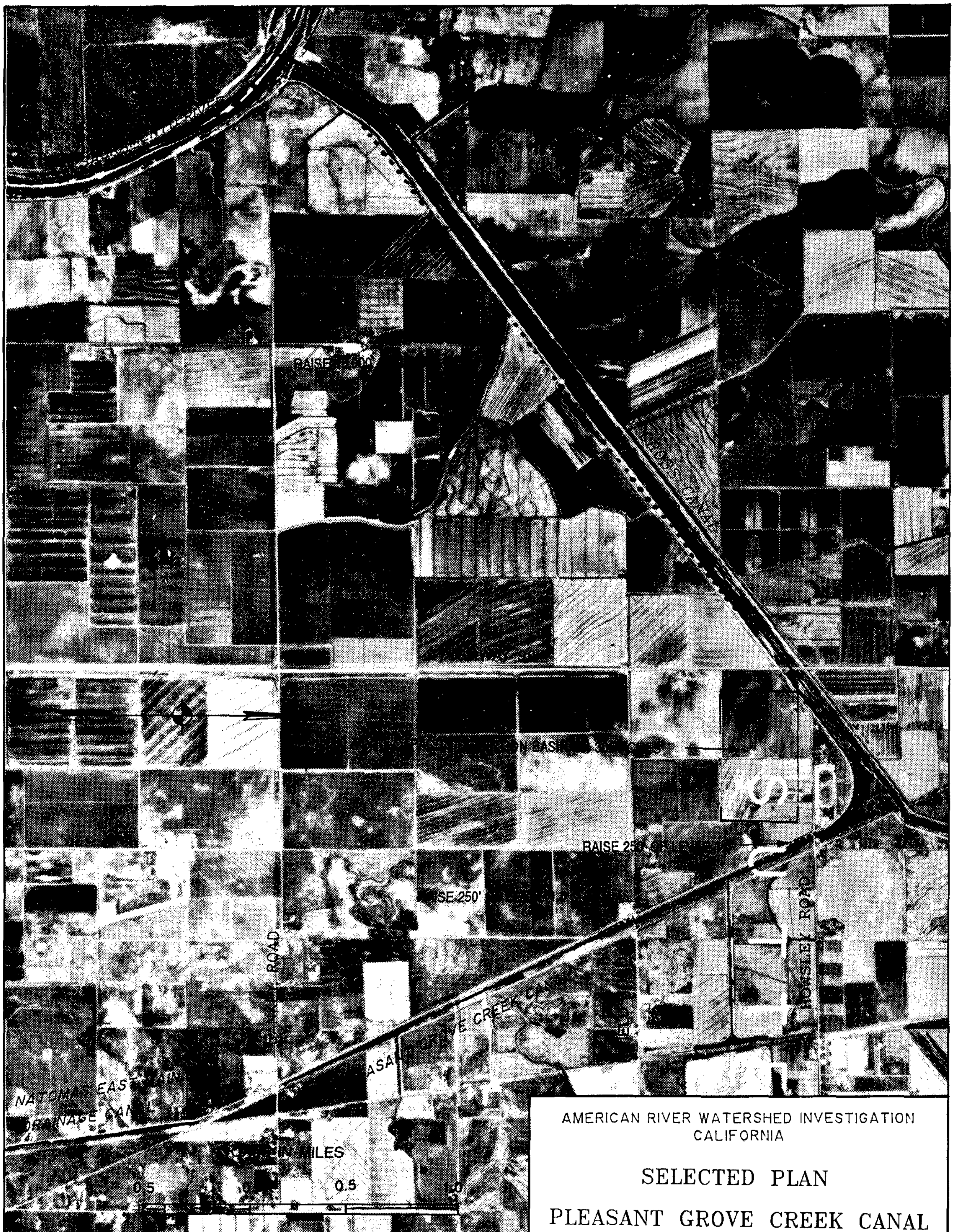
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SELECTED PLAN

NATOMAS EAST MAIN DRAINAGE CANAL AND VICINITY MODIFICATIONS

SACRAMENTO CORPS OF ENGINEERS
DECEMBER 1991

PLATE 24



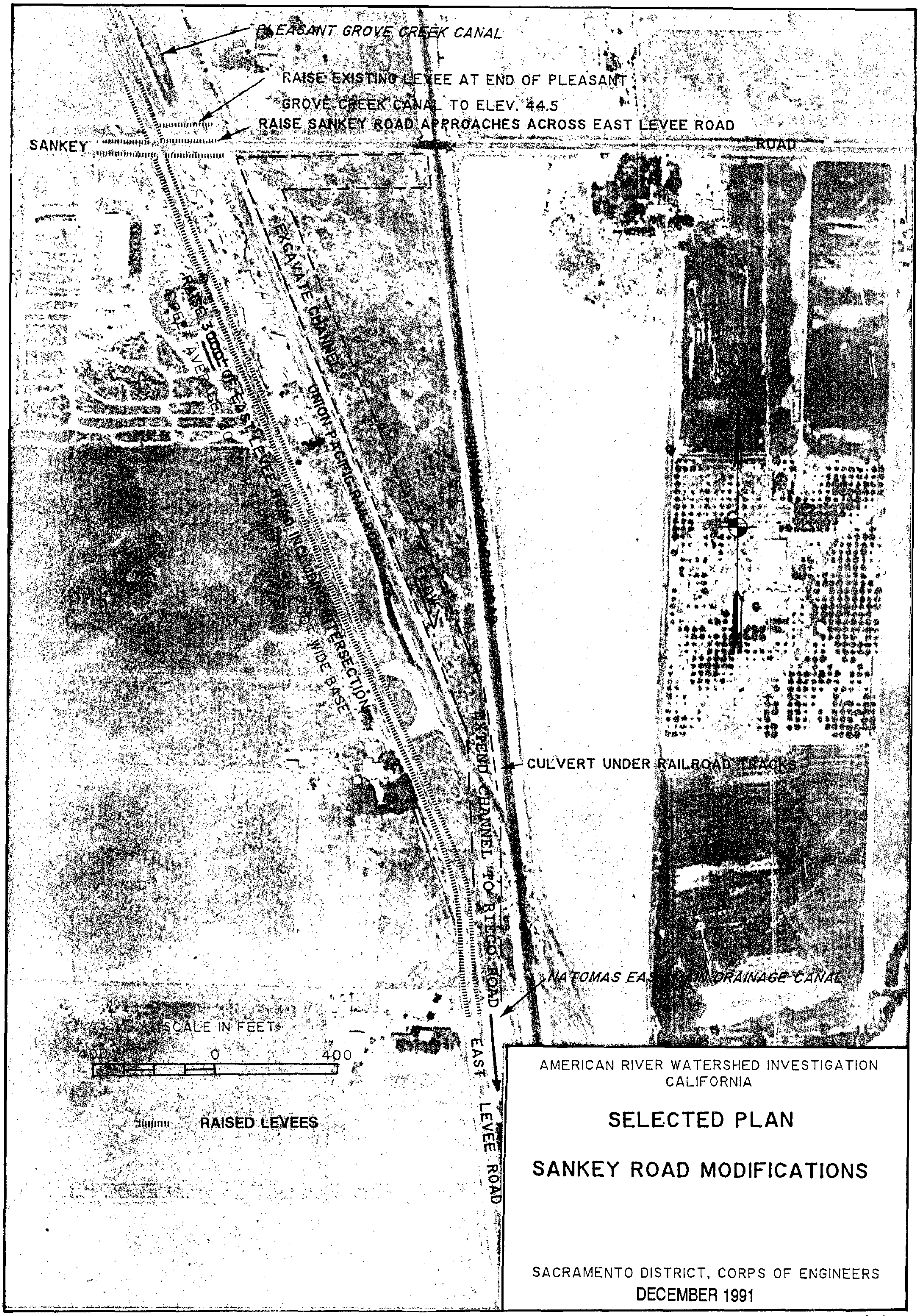
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SELECTED PLAN

PLEASANT GROVE CREEK CANAL AND NATOMAS CROSS CANAL MODIFICATIONS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991

PLATE 25

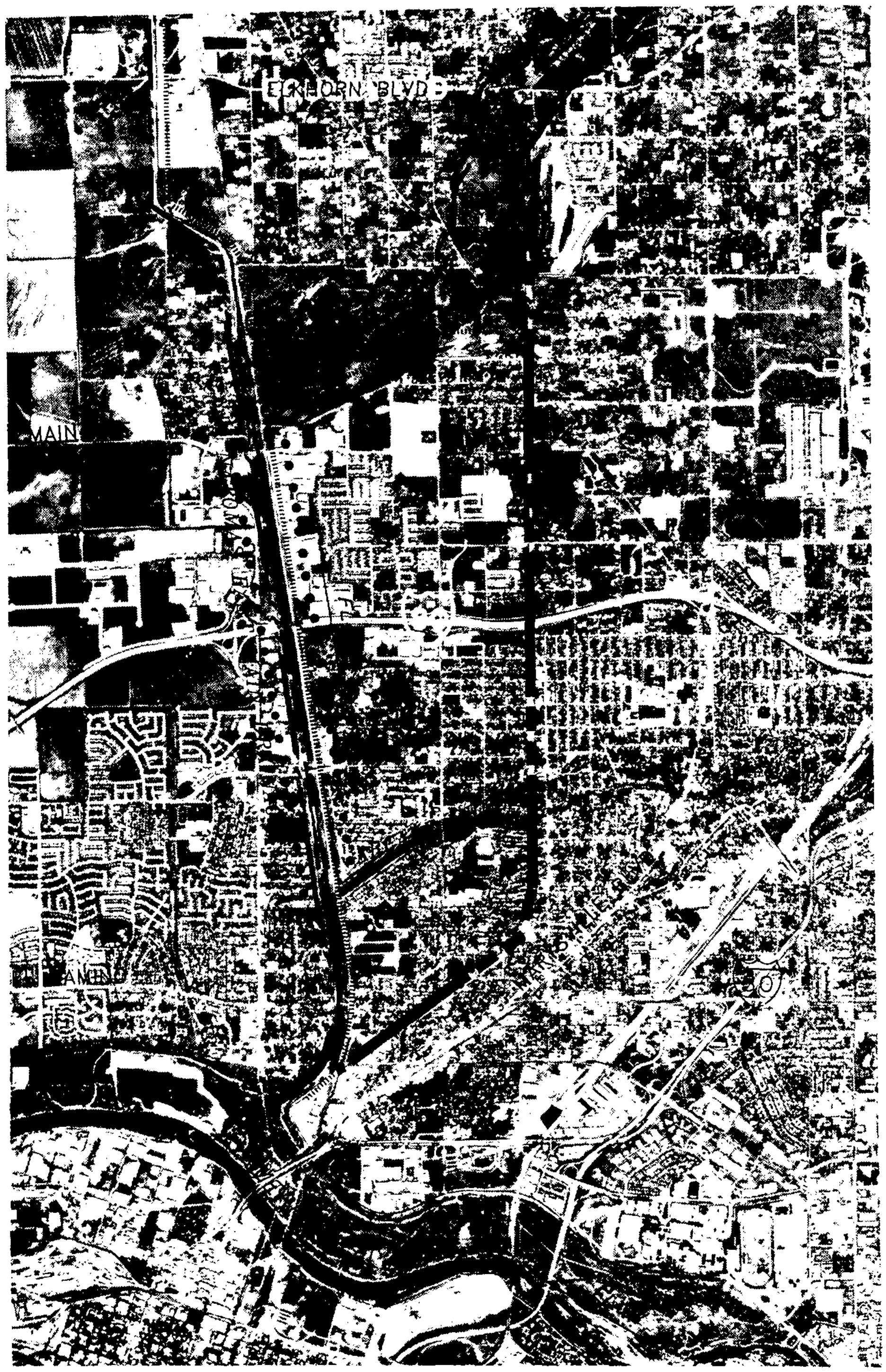


AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SELECTED PLAN

SANKEY ROAD MODIFICATIONS

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
DECEMBER 1991



SCALE IN MILES

0.5 0.0 0.5 1.0

PEDESTRIAN/BIKE TRAIL (PROPOSED)

EQUESTRIAN TRAIL (PROPOSED)

SACRAMENTO NORTHERN TRAIL (EXISTING)

LEVEE MODIFICATIONS

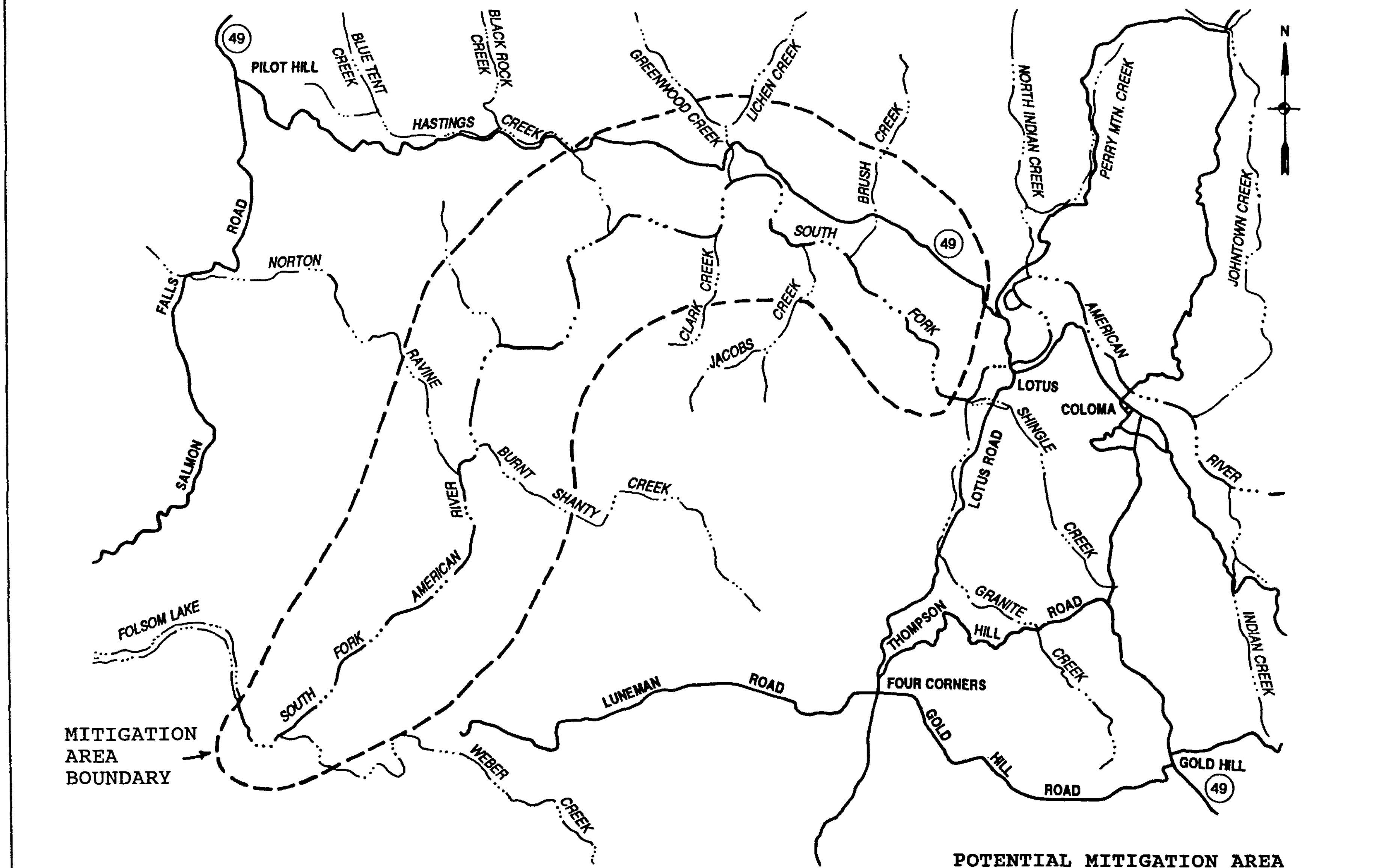
AMERICAN RIVER WATERSHED INVESTIGATION
CALIFORNIA

SELECTED PLAN

RECREATION FEATURES

SACRAMENTO CORPS OF ENGINEERS
DECEMBER 1991

PLATE 27



NOTE: Mitigation lands will be located within the area boundary

POTENTIAL MITIGATION AREA
SOUTH FORK AMERICAN RIVER

SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

DECEMBER 1991

PLATE 28

American River Watershed Investigation, California

Part II

Environmental Impact Statement/ Environmental Impact Report

FINAL
ENVIRONMENTAL IMPACT STATEMENT/
ENVIRONMENTAL IMPACT REPORT
AMERICAN RIVER WATERSHED INVESTIGATION
SACRAMENTO, CALIFORNIA

December 1991

( ) Draft Environmental Impact Statement and Environmental Impact Report

(X) Final Environmental Impact Statement and Environmental Impact Report

The responsible offices are: U.S. Army Engineer District, Sacramento, 1325 J Street, Sacramento, California 95814-2922 and The Reclamation Board, State of California, 1416 Ninth Street, Room 455-6, Sacramento, California 95814.

1. **Action:** ( ) Administrative (X) Legislative

2. **Purpose:** The purpose of this Final Environmental Impact Statement and Environmental Impact Report is to present environmental impacts and mitigation data and solicit comments from interested parties. Comments received will be used by reviewers at the Office of the Chief of Engineers; the Office of the Assistant Secretary of the Army (Civil Works); the Office of Management and Budget; and ultimately by Congress to assist in making decisions concerning the authorization of this project.

3. **Abstract:** The selected plan is designed to prevent flooding of Sacramento from the American River from storms with a return frequency of about once every 200 years. Existing flood control facilities provide protection from storms with a return frequency of only about once in 63 years. The added level of protection would be achieved through the construction of a flood control dam with a capacity of 545,000 acre-feet near Auburn, California, to augment the existing flood storage at Folsom Reservoir. The new dam would temporarily store floodwaters and protect all areas of metropolitan Sacramento within the American River flood plain. However, if only additional storage of floodwaters is provided, portions of Sacramento, including the developed areas of the Natomas basin, could be flooded from high flows in local streams and drainage systems. Thus, the selected plan also provides levee improvements around the perimeter of Natomas. The new dam and levee improvements would have adverse impacts on fish and wildlife and other resources of the American River near Auburn and of the Natomas basin. Mitigation is proposed to offset these impacts. The proposed Federal project will be sponsored by the State of California and Sacramento Area Flood Control Agency, which will cost-share in its construction and operate and maintain the completed project. The first cost of the project is currently estimated at $698 million.

If you need further information, please contact Mike Welsh at (916) 557-6718.

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ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
ANSI	American National Standards Institute
APCD	Air Pollution Control District (Sutter County)
AQMP	Air Quality Management Plan
ARB	California Air Resources Board
ARWI	American River Watershed Investigation
ASPIS	Abandoned Sites Program Information System
ASRA	Auburn State Recreation Area
BLM	U.S. Bureau of Land Management
BOD	biological oxygen demand
BPM	best management practice
Caltrans	California Department of Transportation
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation and Liability Information System
CNEL	Community Noise Equivalency Level
CO	carbon monoxide
CTC	California Transportation Commission
CVP	Central Valley Project
CVRWQCB	Central Valley Regional Water Quality Control Board
DCAR	Draft Coordination Act Report
DFG	California Department of Fish and Game
DO	dissolved oxygen
DPR	California Department of Parks and Recreation
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
ECOS	Environmental Council of Sacramento
EDCAPCD	El Dorado County Air Pollution Control District
EDF	Environmental Defense Fund
EIR	environmental impact report
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
FC1	Federal Category 1
FC2	Federal Category 2
FCWA	Federal Clean Water Act
FEMA	Federal Emergency Management Agency
FIP	Federal Implementation Plan
FIRMS	Flood Insurance Rate Maps
FWS	U.S. Fish and Wildlife Service
GPA	General Plan Amendment
GPU	General Plan Update
HEP	Habitat Evaluation Procedures

HSI	Habitat Suitability Index
HTW	hazardous and toxic waste
LOS	level of service
MOU	memorandum of understanding
NAAQS	National Ambient Air Quality Standards
NCC	Natomas Cross Canal
NCMWC	Natomas Central Mutual Water Company
NED	national economic development
NEMDC	Natomas East Main Drainage Canal
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NGVD	National Geodetic Vertical Datum
NNCDS	North Natomas Canal Drainage System
NOI	notice of intent
NOP	notice of preparation
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NWAD	Natomas West Assessment District
OHV	off-highway vehicle
PCAPCD	Placer County Air Pollution Control District
P&G	Principles and Guidelines
RCC	roller-compacted concrete
ROD	Record of Decision
ROG's	reactive organic gases
RWQCB	Regional Water Quality Control Board
SACOG	Sacramento Area Council of Governments
SAFCA	Sacramento Area Flood Control Agency
SCAPCD	Sacramento County Air Pollution Control District
SCE	State Candidate Endangered Species
SCS	U.S. Soil Conservation Service
SCT	State Candidate Threatened Species
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SMA	Sacramento Metropolitan Airport
SMAQMD	Sacramento Metropolitan Air Quality Management District
SNCP	South Natomas Community Plan
SWRCB	State Water Resources Control Board
THM	trihalomethanes
UAM	urban airshed model
UPB	Urban Policy Boundary
USB	Urban Service Boundary
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
V/C	vehicle-to-roadway capacity
VOC	volatile organic carbon
YSAPCD	Yolo-Solano Air Pollution Control District

LETTER SYMBOLS FOR UNITS OF MEASURE

cfs	cubic foot per second
dB	decibel
°F	degree Fahrenheit
gWh	gigawatthour
km	kilometer
kWh	kilowatthour
mg/l	milligrams per liter
Mgal/d	million gallons per day
mi	mile
ml	milliliter
pH	hydrogen ion concentration
ppm	parts per million
ug/l	micrograms per liter

CHAPTER 1

SUMMARY

PROJECT LOCATION

The American River Watershed Investigation (ARWI) addresses flooding and flood problems in the American River basin. This basin drains about 2,100 square miles along the western slope of the Sierra Nevada in northern California and forms a flood plain covering roughly 110,000 acres near the confluence of the American and Sacramento Rivers. The flood plain includes most of the developed portions of the City of Sacramento and virtually all of the 55,000-acre Natomas basin, an agricultural reclamation area adjacent to the two rivers which is rapidly being urbanized. In developing flood protection alternatives for the people and property currently occupying the flood plain, the ARWI has focused on (1) the system of levees, weirs, and bypasses along the Sacramento River and its tributaries in the vicinity of Natomas; (2) Folsom Dam and the levees along the lower American River downstream from the dam; and (3) the reach of the river above Folsom near the city of Auburn where flood storage capacity could be added to the existing system through construction of a flood control dam at or near the site of the U.S. Bureau of Reclamation's uncompleted multipurpose Auburn Dam project.

For analytical purposes, the study area has been divided into three parts. The upper American River area includes the damsite, the 42,000 acres of land around the damsite which are within the Bureau of Reclamation's authorized project limits, areas along the South Fork American River suitable for mitigating impacts to fish and wildlife resources, and the communities in Placer and El Dorado Counties surrounding the Auburn State Recreation Area. The lower American River area includes Folsom Dam, the 5,000-acre American River Parkway, and the area of metropolitan Sacramento lying within the American River flood plain outside of Natomas. The Natomas area includes the levees and canals which form the northern, eastern, and southern boundaries of the basin; the land lying within these boundaries; and the levees located just outside the basin at the mouths of Dry and Arcade Creeks.

PLAN FORMULATION AND SELECTION

BACKGROUND

In February 1986, large floodflows in the American River basin caused record inflow to Folsom Reservoir. Releases from Folsom Dam into the lower American River were as high as 130,000 cubic feet per second (cfs) and exceeded the maximum design release of 115,000 cfs from the dam for about 2 days. High floodflows also occurred in the Sacramento River. Floodwater encroached into levee freeboard at several points in both rivers and in the drainage canals surrounding Natomas, causing significant levee damage throughout the system. Had these floodflows increased or continued much longer, major levee failure and extensive flooding would have been likely along the American and Sacramento Rivers and the Natomas East Main Drainage Canal (NEMDC), which forms the eastern boundary of Natomas.

Over 350,000 people currently live in areas subject to flooding either caused or affected by flows in the American River. This flood plain includes some $37 billion in damageable property. Consequently, in the aftermath of the near disaster caused by the 1986 flood, the 1987 Appropriations Act authorized the Corps of Engineers to initiate the ARWI. The reconnaissance phase of this study defined flood problems in the watershed, identified alternative solutions, and recommended an array of plans for flood protection. The reconnaissance report, completed in January 1988, concluded that:

- o A significant flood threat exists along the American River.
- o Feasible flood control alternatives exist.
- o Feasibility-phase studies should be undertaken.

Accordingly, in July 1988, the Continuing Appropriations Act (Public Law 100-202) authorized the Corps to commence the feasibility phase of the ARWI on a cost-shared basis with the California Department of Water Resources/Reclamation Board (State). The State in turn entered into an arrangement with local agencies interested in the project to act as local sponsors. These agencies included Placer County, which contributed funds to the feasibility study in its initial phases, and the agencies which now comprise and are represented by the Sacramento Area Flood Control Agency (SAFCA): City of

Sacramento, Sacramento County, Sutter County, Reclamation District 1000, and the American River Flood Control District.

PLAN FORMULATION

As part of the feasibility-phase studies, the Corps considered a wide range of potential flood control measures. These measures are summarized in Chapter IV of the Main Report and are discussed in detail in the Plan Formulation Appendix (Appendix B). From the outset, it was recognized that the level of flood protection provided to the people and property currently occupying the Natomas basin could not be substantially increased without combining measures to control flows in the American River with measures to protect Natomas from high flows in the tributary streams east of the basin.

With respect to controlling American River flows, the following measures were found to be feasible:

- Construct a flood detention dam at Auburn.
- Increase the amount of storage allocated to flood control on a seasonal basis at Folsom.
- Lower the spillway at Folsom to permit more efficient use of the space allocated to flood control.
- Increase the design release from Folsom into the lower American River channel.

For Natomas, it was determined that the most feasible way to protect existing development is to improve the existing levee system which extends around the perimeter of the basin. These American River and Natomas measures were then combined into a series of 27 alternatives designed to achieve 400-year, 200-year, 150-year, and 100-year (FEMA) levels of flood protection. Each of these alternatives assumed that the levee improvements needed to protect Natomas would be sized to match the level of protection provided along the main stem of the American River.

400-Year Protection

Alternatives were developed at the 400-year level in order to identify the plan providing the greatest net economic benefit during the assumed 100-year life of the project. This national economic development (NED) standard is based on measuring the difference between the cost of the project, including environmental mitigation, and the benefits it will generate in the form of inundation and other damages avoided. Since achieving a 400-year level of protection requires additional flood storage capacity, the alternatives analysis at this level focused on the economic and environmental consequences of relying exclusively on a new flood detention facility at Auburn versus combining such a facility with measures to increase the capacity of the existing system. This analysis showed that exclusive reliance on new storage was cheaper and less environmentally damaging. As a result, only the 400-year flood control dam alternative was carried forward as one of the final group of alternatives evaluated in the EIS/EIR.

200-Year Protection

Alternatives were developed at the 200-year level to satisfy the non-Federal sponsor's stated objective of achieving at least a 200-year level of protection for the people and property currently subject to flooding from the American River. This objective cannot be met without adding new flood storage to the system. Thus, the alternatives analysis at this level also focused on the economic and environmental effects of relying exclusively on new storage versus combining new storage with existing system improvements. Once again, this analysis showed that exclusive reliance on a new flood control dam was cheaper and less environmentally damaging, and only the 200-year flood control dam alternative was carried forward.

150-Year Protection

Several alternatives were developed to provide a 150-year intermediate level of protection. One 150-year alternative was developed by combining all of the measures which would improve the existing system in a manner designed to create the most protection theoretically achievable without adding new flood storage capacity at Auburn. The analysis at this level focused on defining the maximum amount of effective flood storage achievable at Folsom Reservoir and the maximum carrying capacity of the lower American River. This alternative was carried forward as one of the final group considered in this EIS/EIR.

100-Year (FEMA) Protection

Finally, a number of 100-year (FEMA) alternatives were developed because this level represents the minimum protection needed to relieve Sacramento of the flood insurance and flood plain development restrictions imposed under the National Flood Insurance Program. Because of differences in the methodologies used by FEMA and the Corps to calculate flood frequencies, what FEMA regards as a 100-year alternative would provide about an 85-year level of protection under the Corps' methodology. Thus, the 100-year (FEMA) alternatives would provide only a small increase in protection over the existing 63-year level.

The alternatives analysis at the 100-year (FEMA) level focused on exclusive Folsom storage, combinations of Folsom storage with downstream measures, and reliance on downstream measures alone. This analysis showed that, for this level of protection, reliance on downstream measures alone was cheaper and less environmentally damaging. Accordingly, three 100-year (FEMA) alternatives were carried forward. The 100-year (FEMA) levee alternative relies exclusively on levee improvements in the lower American River to permit increased design releases from Folsom Reservoir. The 100-year (FEMA) storage alternative relies exclusively on increasing the amount of storage allocated to flood control on a seasonal basis at Folsom. The 100-year (FEMA) levee/storage and spillway alternative combines all of the feasible downstream measures into a plan very similar to the 150-year alternative.

PLAN SELECTION

The six alternatives carried forward for comparative analysis in the EIS/EIR are displayed in Table 1-1 and described in greater detail in Chapters 2 and 3. In accordance with criteria established under applicable Federal planning principles and guidelines, these alternatives were evaluated on the basis of the following categories:

- Economic efficiency as measured by national economic development (NED) benefits produced
- Environmental effects
- Public health and safety
- Acceptability to the local sponsor

Based on these evaluation criteria, the 200-year level of flood protection alternative has been identified as the selected plan which will be recommended for submittal to Congress for authorization.

TABLE 1-1. **Summary of Physical and Structural Components of the Flood Control Alternatives**

COMPONENT	ALTERNATIVE					
	200-Year	400-Year	150-Year	100-Year (FEMA) Levees	100-Year (FEMA) Storage	100-Year (FEMA) Levee/Storage and Spillway
Increase Folsom Storage from 400,000 AF to:	N/A	N/A	650,000 AF	N/A	590,000 AF	470,000 AF
Lower Folsom Dam Spillway New Gates Required	N/A	N/A	15 ft YES	N/A	N/A	15 ft YES
Folsom Release and American River Capacity:	No Change 115,000 cfs	No Change 115,000 cfs	180,000 cfs	No Change 145,000 cfs	115,000 cfs	130,000 cfs
Raise/replace bridge at:	Ponderosa Way Main Avenue	Ponderosa Way Main Avenue	Numerous Bridges	Numerous Bridges	Main Avenue	Numerous Bridges
Raise Yolo Bypass Levees	NO	NO	YES	YES	NO	YES
Raise/New Levees: Natomas	YES	YES	YES	YES	YES	YES
Natomas Detention Basin	3,000 AF	3,000 AF	3,000 AF	3,000 AF	3,000 AF	3,000 AF
American River:	N/A	N/A				
Slurry Wall			4.1 mi	0.9 mi		0.7 mi
Toe Trench			7.8 mi	2.7 mi		0.6 mi
New Levee			1.0 mi	1.0 mi		0.9 mi
Levee Raising			11.4 mi	2.7 mi		0.0 mi
Riprap on Bank			1.5 mi	1.5 mi		1.5 mi
Riprap on Levee			5.3 mi	5.3 mi		5.3 mi
Riprap Bank & Levee			3.2 mi	3.2 mi		3.2 mi
Total Length			34.3 mi	17.3 mi		12.2 mi
Lengthen Sacramento Weir	NO	NO	3,600 ft	1,400 ft	NO	500 ft
Build Dam at Auburn: Storage Capacity Dam Height	YES 545,000 AF 425 ft	YES 894,000 AF 495 ft	NO	NO	NO	NO
Replace Highway 49, Replace Bridge	YES	YES	NO	NO	NO	NO
Recreation Trails in Natomas	YES	YES	YES	YES	YES	YES

Economic Efficiency

With respect to economic efficiency, it was determined that the 400-year alternative would maximize net economic benefits and would thus constitute the NED plan under applicable Federal planning principles and guidelines. The cost effectiveness of this plan is based on the heavily developed character of the flood plain; the relatively low level of protection afforded by the existing flood protection system; and the topography of the American River area, which accentuates potential flood damages along the lower American River and provides a feasible site for adding flood storage capacity in the upper American River near Auburn. The 200-year alternative would generate slightly fewer net economic benefits than the NED plan but substantially more than the 150-year or 100-year (FEMA) alternatives.

Environmental Effects

With respect to environmental effects, both the 200-year and the 400-year alternatives would increase flood protection along the American River by permitting winter floodwaters to be periodically and temporarily contained in the canyons of the North and Middle Forks of the river. It is assumed that this upstream containment would adversely affect the environmental quality of the canyon area by triggering vegetation mortality and soil slippage along the canyon walls within the inundation zone. Due to its higher design release and more rapid drawdown of stored waters, the 200-year alternative could result in a slightly greater risk of soil slippage than the 400-year without any offsetting decrease in vegetation mortality. Nevertheless, both dam alternatives would avoid the adverse effects on aquatic and recreational resources in the lower American River that would result from constructing levee improvements in the American River Parkway and/or increasing the space currently allocated to flood control at Folsom Reservoir. Furthermore, both the 200-year and 400-year alternatives would substantially reduce the risk of flooding and flood-related environmental impacts in the urbanized portions of the flood plain.

Public Health and Safety

Without added flood protection, the consequence of a major flood in Sacramento would be severe. By 1992, it is estimated that over 300,000 people and $23 billion worth of damageable property will occupy the 100-year flood plain. In the event of a levee failure, waters from the American River could inundate portions of this flood plain up to a level of 5 feet in many places and 15 feet or more in the Natomas and Pocket areas of the City. Depending on the size and circumstances of the failure, flooding could be swift and extensive, placing a heavy strain on local evacuation capabilities. Even with a relatively long warning time prior to the break (more than 5 hours), a major flood could cause many fatalities. If the warning time is short (2 hours), the loss of life could reach catastrophic proportions.

The risk of flooding is heightened in this case by the community's reliance on long earthen levees to contain American River floodwaters within a relatively narrow floodway. Under these conditions, large storms produce high-velocity flows which have the potential to erode and breach the containment system. This problem is magnified by the uncertainties associated with hydrologic forecasting in the American River basin. During the past 35 years, unexpectedly large storms have caused flood officials to downgrade the level of protection which the existing system was thought to provide. Because of its dependence on levees to contain high velocity flows, this system contains a limited margin of safety to adjust for such unexpected events.

Finally, under existing local and Federal flood plain management regulations, all of the alternatives carried forward in this report would provide a sufficient level of protection to permit development to proceed in Natomas and elsewhere in the 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. In this context, 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.

Local Acceptability

Under current cost-sharing arrangements, the project cannot proceed without non-Federal participation. In this case, the non-Federal sponsor has determined, based on the public safety considerations discussed above, that a high level of protection (that is, 200 years or greater) is needed for the areas subject to flooding from the American River. Achieving a high level of flood protection would be consistent with the aim of flood protection planning along the American River for most of the past 40 years and would provide Sacramento with protection comparable to other similarly situated cities.

As between the 400-year and 200-year alternatives, the 200-year alternative has achieved more widespread community acceptance for two reasons. First, the 200-year alternative is less costly by nearly $100 million. Second, the dam proposed in the 400-year alternative is perceived by members of the environmental community as a facility which would be more easily convertible to multipurpose use than the smaller 200-year dam.

The concern in this regard is that the 400-year dam would be large enough to accommodate a permanent minimum pool for water storage while still providing the minimum 200-year level of flood protection to which the non-Federal sponsor is committed. In deference to this perception and in consideration of the cost savings which could be realized with a smaller structure, the non-Federal sponsor has recommended that the Corps consider selection of the 200-year alternative for recommendation to Congress. The Corps has accepted this recommendation provided the Assistant Secretary of the Army grants an exception to the normal practice of recommending the NED alternative.

ENVIRONMENTAL IMPACTS

BACKGROUND

For analytical purposes, the environmental impacts of the various alternatives have been classified as "direct" impacts, "indirect" impacts, and "residual flood damage" impacts. Direct impacts include both the impacts that would result immediately from constructing the various features of the project and the impacts that would result from operating and maintaining these features. Indirect impacts are those that would result from the effects of the project on regional growth patterns in the upper American River, lower American River, and Natomas areas. Impacts related to residual flooding are those that would result from inundation of the developed portions of the flood plain. In most cases, all of these impacts have been measured by comparing environmental conditions with the project to the conditions likely to prevail without the project. For purposes of this comparison, a 100-year period of analysis was used. The results of this comparative analysis are summarized below and discussed in detail in the chapters that follow.

It should be clear to the reader that, for all categories of impacts other than those associated with construction of project features, projections of future with- and without-project conditions entail a certain degree of speculation. For example, given the current state of knowledge, to forecast the impacts associated with the operation of a flood control dam in the canyon area, certain judgements must be made with respect to flood frequency, flood tolerance of vegetation not normally subjected to inundation, and the effects on soil stability of periodically filling and emptying the canyon. A flood-frequency curve has been developed based on the existing 85-year record of flows in the American River, and studies to determine the potential for vegetation mortality and slope failure have been undertaken by the State and consultants retained by the State. Nevertheless, data applicable to the conditions likely to be created in this case are sparse, and the assessment of inundation impacts in the canyon area has had to account for analytical uncertainties.

Similarly, in order to forecast the impacts associated with increasing the space allocated to flood control in Folsom Reservoir, it is necessary to develop assumptions regarding operations not only of Folsom, but of the entire Central Valley Project (CVP) far into the next century. For this purpose, data on future operations have been provided by the Bureau of Reclamation. However, it is difficult, even with this input, to produce any precise quantification of impacts to aquatic and riparian resources likely to result under future conditions with and without the increases in flood storage proposed under several of the alternatives.

With respect to evaluating the (indirect) impacts related to growth facilitated by the project, much speculation is required because these impacts will depend largely on future actions taken by agencies other than those sponsoring the ARWI. Accordingly, in areas of the flood plain where adopted local plans have addressed the timing, extent, and character of the growth likely to result from the project, the impacts related to this growth are identified with some degree of specificity. These impacts are discussed by impact category in the main body of this EIS/EIR. In each case, the discussion relies heavily on data presented in previous environmental documents adopted in connection with the following local projects:

- South Natomas Community Plan Update and Related Projects
- North Natomas Community Plan
- Sacramento County Special Planning Area
- City of Sacramento General Plan Update
- North Natomas Community Drainage Plan
- North Natomas Freeway Improvements on I-80 and I-5
- City of Sacramento Land-Use Planning Policy Within the 100-year Flood Plain

o Sacramento Metropolitan Airport Master Plan

However, in areas of the flood plain such as the unincorporated portions of the Natomas basin where the project could facilitate growth not anticipated under approved local plans, a less detailed assessment of impacts is presented in Chapter 18 (Growth-Inducing Impacts). This assessment is based on the assumption that growth will occur in accordance with local plan modifications currently under consideration by the boards of supervisors of Sacramento and Sutter Counties. Chapter 18 also contains a qualitative discussion of the potential of the two dam alternatives to affect growth trends in northwestern El Dorado County by accelerating the relocation and upgrading of Highway 49.

Finally, because the alternatives carried forward for analysis in this EIS/EIR would avoid to a greater or lesser extent the impacts associated with flooding, an effort has been made to identify these impacts based on data collected in connection with the 1986 flood, studies regarding flood damages in other parts of the country, and inundation damage projections included as part of the economic analysis contained in the Main Report. These flood-related impacts are discussed by impact category under the no-action alternative in each chapter of this EIS/EIR. This discussion provides a general measure of the environmental consequences of flooding in Sacramento so as to more clearly identify the environmental tradeoffs associated with each of the alternatives being evaluated.

DIRECT IMPACTS IN THE NATOMAS AREA

Construction of the project features proposed under all of the alternatives in the Natomas area would cause a variety of short-term impacts, the most important of which are to air quality and transportation. Construction-related impacts to regional air quality are considered significant and unavoidable because of Sacramento's status as a nonattainment area for ozone. Temporary transportation impacts during the construction phase would add to existing congestion problems on some Natomas roadways. Impacts of levee construction and associated work on fish and wildlife habitats will be mitigated by the acquisition and improvement of habitat values on a 280-acre parcel. Material for the required levee improvements would be obtained from a 125-acre site south of the airport. Any long-term impairment of the agricultural productivity of this parcel will be avoided through implementation of an appropriate reclamation plan.

Water-quality impacts would be minimal because most levee construction work would occur away from active channels or on top of the existing levees. During major storms affecting the Natomas basin, activation of the proposed pump station on the NEMDC, maintenance of levees, and diversion of additional water into the detention basin in northeast Natomas would not result in any significant environmental impacts.

DIRECT IMPACTS IN THE LOWER AMERICAN RIVER AREA

Two of the 100-year (FEMA) alternatives and the 150-year alternative require construction along the lower American River. Under these alternatives, increasing the channel capacity of the river would require extensive levee and bank protection along the lower 14 miles of the channel and in the Yolo and Sacramento Bypasses. This work would have significant long-term impacts on recreation; visual resources; and fish, vegetation, and wildlife resources. These impacts would affect the values which caused the river to be designated as a component of the State and Federal Wild and Scenic Rivers system.

Based on data provided by the Bureau of Reclamation, the 150-year and two of the 100-year (FEMA) alternatives would cause significant impacts to the lower American River as a result of the permanent reoperation of Folsom Reservoir. To accommodate additional flood storage during the flood season, the space allocated to flood control behind Folsom Dam would have to be increased by lowering the surface level of the reservoir. Accordingly, normal flows in the American River would be greater in the fall and reduced in the spring. This could lead to a long-term reduction of wetlands and riparian vegetation and could damage the anadromous fishery along the lower American River. Water-surface levels in Folsom Reservoir would fluctuate more widely, and summer levels could be lower during dry years. This would cause adverse impacts to resident fish species and reservoir recreation and would result in lost water and power generation. Adjustments of CVP operations to account for these losses could in turn alter the flow regime in the Sacramento River and imperil the already endangered fishery in the Delta and Sacramento River.

DIRECT IMPACTS IN THE UPPER AMERICAN RIVER AREA

With the selected plan and the 400-year alternative, construction impacts would occur at and around the existing multipurpose Auburn Dam site. Construction activities would include aggregate extraction and crushing, transport of the crushed material to the damsite, onsite mixing of aggregate and other cementitious material to produce concrete, construction of the concrete gravity dam, and disposal of excess or unsuitable material in connection with preparing the dam foundation. The impacts associated with this process would be diminished because the damsite is already severely degraded and the aggregate needed to construct the dam would be obtained from an existing quarry operation near the damsite. Material removed from the dam foundation would be used to fill the keyway constructed as part of the multipurpose project. Any excess material would be placed at the foot of an existing uncompleted boat ramp which parallels the keyway. These activities would produce short-term adverse impacts on visual resources (Chapter 16), transportation (Chapter 11), air quality (Chapter 12), noise (Chapter 13), and water quality (Chapter 6). Some recreational uses (Chapter 14) in the canyon could also be adversely affected, although the canyon area's most noteworthy activity, whitewater rafting, would not be disturbed. Additional impacts during the construction phase could occur with the replacement of the Highway 49 bridge, including increased air pollutant emissions and noise levels and temporary disruption of local transportation patterns.

Operation of a flood control dam near Auburn would temporarily alter the visual and recreational quality of the inundation zone. During a large flood event, this area would become a reservoir for several days depending on the size of the storm. These infrequent temporary inundation events could result in gradual changes in the composition of the plant communities within the inundation zone due to the physiological effects of flooding. Periodic filling and emptying of the canyon could also cause soil slips along the canyon walls in the inundation zone. These slips would destroy vegetation, mar the physical appearance of the canyon, and disturb existing archeological sites. Although these changes would have no immediate effect on whitewater rafting, the overall quality of the recreational experience in the canyon could be significantly reduced if the slips were not repaired.

INDIRECT IMPACTS IN THE NATOMAS AND LOWER AMERICAN RIVER AREAS

With all of the alternatives, the metropolitan Sacramento area, including the Natomas basin, would be protected from flooding from the American River 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. Depending on local land use plans, this protection would facilitate regional growth 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 (Chapter 4) from open space and agriculture to urban uses in these areas would produce significant impacts on housing, population, traffic, air pollutant emissions, sewage generation, and demands on public services. Urbanization would cause the loss of significant amounts of agricultural land, much of which is designated prime or unique farmland (Chapter 10) in the Natomas basin. Cultural resources (Chapter 9), endangered species (Chapter 8), wetlands, and fish and wildlife habitats (Chapter 7) in the area would also be adversely affected. In particular, development would imperil two resident State-listed species, the giant garter snake and Swainson's hawk. Under the State Endangered Species Act, the State is constrained from participating in this project unless local agencies controlling development in the affected areas provide assurances that they will exercise their authority in such a manner as to avoid jeopardy to the these species.

INDIRECT IMPACTS IN THE UPPER AMERICAN RIVER AREA

Both of the dam alternatives would require replacement of Highway 49. Based on the in-kind/in-place replacement identified as part of the selected plan, this replacement would not significantly alter existing commute times or other local traffic patterns. This replacement would thus have little effect on the pattern of regional growth in the foothills. However, replacement 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 replacement by the California Transportation Commission. It is possible, therefore, that the replacement ultimately adopted by the State may differ from the one identified as part of the project and may produce a more substantial effect on regional growth in the foothills.

RESIDUAL FLOOD IMPACTS

The impacts likely to result from uncontrolled flooding in Sacramento include contamination due to flood-induced releases of hazardous and toxic waste materials (Chapter 5); loss of fish, vegetation, and wildlife resources (Chapter 7); social and economic (Chapter 15) dislocation due to the death and injury of flood plain occupants, inundation of transportation facilities, damage to automobiles and other means of transport, and destruction of capital equipment; generation of significant quantities of landfill due to the need to dispose of flood-related debris; and consumption of the environmental resources needed to replace damaged structures.

Each of the action alternatives would reduce the risk of incurring these impacts. However, since the reductions would vary, the residual flood damages associated with each of the alternatives would be different. The Main Report and the Economics Appendix (Appendix C) provide figures indicating the extent to which each of the alternatives would reduce the flood inundation damages likely to occur under the without-project (or no-action) condition. These figures take into account both the probability of a major flood and its severity. They thus permit a comparison between alternatives based on the potential for residual flood damages.

For purposes of this comparison, a 100-year time period is used. During this period, flood inundation damages under the no-action condition, expressed in an annualized form, 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. Assuming these figures constitute a useful measure of environmental impacts avoided, the alternatives providing lower levels of flood protection would produce far more extensive impacts over the long-term life of the project than the alternatives providing higher levels of protection.

ENVIRONMENTAL COMMITMENTS

Mitigation for all direct impacts of the project will be a joint responsibility undertaken by the Corps and the non-Federal sponsor on a cost-shared basis. The direct impacts which are considered significant and the mitigation measures identified to avoid, minimize, or compensate for these impacts are summarized in Tables 1-2 through 1-14 (at the back of this EIS/EIR). Table 1-15 lists the principal indirect impacts likely to result from the project and indicates the mitigation measures necessary to avoid, minimize, or compensate for these impacts. Implementation of these measures will be the responsibility of the affected local agencies. As discussed in the memorandum of understanding contained in Chapter 22, more specific environmental commitments and appropriate monitoring programs for indirect impacts will be developed during continuing coordination between the non-Federal project sponsor and the appropriate local regulating agencies.

Environmental commitments are defined as the measures, particularly mitigation measures, incorporated into projects as approved by the Corps. Commitments include those related to the mitigation measures and environmental monitoring program described in this report (land use; air quality; fish, vegetation, and wildlife; recreation, etc.).

The summary tables at the back of the EIS/EIR list the measures needed to mitigate direct impacts on all affected resources. During later phases of the project, these tables will facilitate the monitoring and enforcement of the commitments adopted for this project and will serve to measure the results obtained from carrying out these commitments.

Commitments related to direct environmental impacts will be undertaken in connection with one or more of the following activities: (1) preconstruction engineering and design (PED) and land acquisition, (2) project construction, or (3) operation and maintenance (O&M). Each of these three categories is further defined in the following paragraphs, and the agency responsibilities are listed.

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

2. **Project Construction.** The Corps is responsible for administering project construction contracts and for ensuring that the mitigation measures included in these contracts are appropriately carried out. The costs of contract administration are jointly shared with the local sponsors in the same manner as the costs of the overall project.

3. **Operation and Maintenance.** The Corps will prepare the O&M Manual which the non-Federal sponsor is responsible for implementing. The O&M Manual will include requirements for annual inspections by qualified specialists to review and evaluate all mitigation features and ensure compliance. The non-Federal sponsor will be responsible for conducting semiannual inspections and reporting on all project features. The Corps has continuing oversight responsibilities to review the local sponsor's semiannual reports and ensure mitigation compliance and issue orders to the sponsor for corrective actions if necessary.

The following are the environmental commitments needed to mitigate the direct impacts of the project. The most important of these commitments are summarized in Table 1-16.

LAND USE

Natomas

- Develop a reclamation/restoration plan for the borrow site in accordance with the lease agreement with the landowner. If appropriate, the plan will include provisions to remove and replace topsoil to ensure future agricultural productivity.

HAZARDOUS AND TOXIC WASTE

Natomas and Upper American River

- Require submittal of a plan for the proper handling and management of all hazardous materials (including petroleum products) to minimize the possibility of spills which could contaminate soil and adjacent water bodies during construction.

- Complete a Phase 1 site assessment to determine existing onsite contamination at each construction site and respond appropriately if possible contaminants are discovered.

- Collect and appropriately dispose of all debris and trash.

DRAINAGE AND WATER QUALITY

Natomas and Upper American River

- Develop and implement an erosion and sediment control plan to divert natural streamflows from the active construction and storage sites or to convey sediment-laden flows into temporary settling basins.

- Also see the commitments above for hazardous and toxic waste.

Upper American River

- Confine or route Salt Creek in the vicinity of the disposal sites to minimize sedimentation.

AIR QUALITY

Natomas and Upper American River

- Regularly use water trucks to reduce dust and particulate generation at the construction sites.

- Equip pump station diesel engines with the best available control technology to reduce combustion emissions when possible.

- Fit vehicles with emission-reduction equipment where feasible.

FISH, VEGETATION, AND WILDLIFE

Natomas

- o Install protective screens to avoid impacts to fishes at the NEMDC pump station.
- o Allow in-water construction of the pumping station only between June 1 and August 31.
- o Acquire and restore 280 acres of land on the east side of Natomas near the Sacramento/Sutter County line. Establish a 3-year monitoring program.

Upper American River

- o Conduct environmental studies and make a full public disclosure of any proposal to alter the operation of the flood control facilities.
- o Acquire 2,685 acres adjacent to the South Fork American River. These lands will be managed to provide compensation for general fish and wildlife habitat values lost as a result of construction and operation of the project.
- o Develop and implement an Adaptive Management Plan for the upper canyon.

ENDANGERED SPECIES

Natomas

- o Revegetate Swainson's hawk habitat temporarily disturbed during construction.
- o Defer any construction located within 1/2 mile of Swainson's hawk nesting sites until after August 1.
- o Exclude grading, excavating, or filling in or within 30 feet of existing giant garter snake habitat between October 1 and May 1 unless authorized by the California Department of Fish and Game (DFG).
- o Consult with DFG before placement of dams or other water diversion structures in the giant garter snake habitat.

- o Revegetate giant garter snake habitat.
- o Dewater giant garter snake habitat between November 1 and April 1.
- o Require giant garter snake surveys by DFG; surveys must be completed and approved prior to dewatering.
- o Remove all water from the existing habitat by April 15 or as soon thereafter as weather permits; the habitat must remain dry for 15 consecutive days after April 15 prior to excavating or filling of dewatered habitat. Dry period will be determined by DFG.
- o There is no mitigation requirement for the valley elderberry longhorn beetle in Natomas. However, elderberry shrubs will be mixed in with the plantings in the 280-acre site being used to mitigate general fish and wildlife impacts.

Upper American River

- o A total of 32,336 elderberry shrubs will be planted throughout the 2,700 acres of land on the South Fork American River being acquired for the purpose of providing for mitigation to valley elderberry longhorn beetle habitat resulting from construction and operation of the detention dam.

CULTURAL RESOURCES

Natomas and Upper American River

- o Identify significant and valuable resource findings from qualified experts on archeological, architectural and engineering, and historical documentation and activities.

Natomas

- o Perform field inspections of fossiliferous sediments during levee, weir, and channel modifications and pumping plant construction.
- o Provide periodic inspections (weekly) of spoil piles to uncover spoil finds by qualified paleontologists during

construction. This will ensure collection and documentation of fossils.

Upper American River

- Complete a field survey by a paleontological resource management team to determine if potentially fossiliferous sediments can be avoided by project activities. Implement a mitigation plan to salvage and interpret representative samples from affected units.

- Conduct a field survey by a paleontological resource management team to identify and recover representative samples of fossiliferous Tertiary units and Quaternary cave and fissure fills. Implement a mitigation plan to identify and recover representative samples before any construction occurs on these sites. Avoid construction and borrow sites where possible.

AGRICULTURE/PRIME AND UNIQUE FARMLANDS

Natomas and Upper American River

- Develop a reclamation/restoration plan for the borrow site prior to construction.

TRANSPORTATION/TRAFFIC

Natomas and Upper American River

- Restrict contractors where possible from public roads when hauling materials to construction sites. Require contractors to submit a transportation plan to identify haul routes and a traffic engineering analysis to reduce congestion problems where the use of public roads is unavoidable.

- Where possible, restrict contractors from hauling on public roadways during weekday peak traffic periods, especially in developed areas. Require contractors to submit a traffic engineering study to meet acceptable levels of service where weekday peak traffic periods are unavoidable.

Natomas

- Develop advertisements and signing advising motorists of alternative routes around the construction sites and promote the use of alternative transportation.

- Close to through traffic during construction, the East Levee Road between Sotnip Road and the NEMDC pumping station site, except for local traffic.

- Construct frontage roads with access off of Northgate Boulevard and Pell Drive on both the north and south sides of Main Avenue.

- Reroute traffic using East levee Road onto Sorento Road.

Upper American River

- Submit an aggregate transportation plan for approval.

- To the extent possible, avoid using construction vehicles in the Auburn area during peak commute hours.

NOISE

Natomas

- Unless specifically authorized, construction activities will be limited to between the hours of 7 a.m. and 5 p.m. Monday through Friday and identified on the grading permit.

- Provide mufflers for all project-related heavy construction equipment and stationary noise sources.

- Locate stationary noise sources at least 300 feet from occupied residences or provide noise-reducing enclosures for engine housing.

- Locate water tanks and equipment warmup and storage areas as far from existing residences as possible.

- Equip all on-road mobile construction vehicles with mufflers.

- Use designated haul roads for all dump' trucks.

- o Limit dump truck haul trips through residential areas between the hours of 8 a.m. to 6 p.m.
- o Enclose NEMDC pumping station engines.

Upper American River

- o Limit blasting in the quarry area to daytime hours.

RECREATION

Natomas

- o Mitigation for constructing the recreation features is included in the 280-acre site in Natomas.

Upper American River

- o Reclaim construction areas to preproject conditions to the extent practicable.
- o Reroute Western States Trail during construction.
- o Repair any trail damage after construction.
- o Repair existing trails and access roads damaged as a result of inundation.
- o Develop and implement Adaptive Management Plan for impacts to visual resources.
- o Install submersible warning system at Lake Clementine dam.

SOCIOECONOMICS

- o Limit construction traffic to designated haul routes, avoiding major arterial routes during peak commute hours.

VISUAL RESOURCES

Natomas

- Implement a reclamation plan to reestablish agricultural activities at the borrow site.
- Install landscape screening at the pumping station.
- Restore vegetation on modified levees and establish vegetation on new levees.

Upper American River

- Remove conveyor system when construction is completed and restore vegetation in disturbed areas.
- Develop and implement a comprehensive reclamation/ revegetation plan.
- Use irregular rock surface and revegetate where possible for Highway 49 and Ponderosa Way.

TABLE 1-16. Summary of Commitments to Mitigate Major Direct Construction and Operational-Related Impacts for the Selected Plan

IMPACT	MITIGATION
Construction of dam (includes) Aggregate mining Gravel processing Gravel transport Concrete mixing Replacement of Highway 49	- Revegetate 2,685 acres near South Fork American River with native plant species. - Fence the area to prevent livestock grazing. - Restore aggregate processing site(s) to preproject contours and revegetate with native plant species. - Restore aggregate transport route to preproject conditions and revegetate with native plant species. - Restore concrete mixing plant sites to preproject contours and natural conditions by grading and planting native species. - Monitor revegetated areas for 3 years to ensure survival. Replace plants lost. - Conduct postflood geotechnical evaluations for earth slides or slips and revegetate as appropriate. - Incorporate elderberry shrubs into the planting mix for all revegetation areas.
Levee improvements in Natomas area, including 300-acre detention basin	- Revegetate 280-acre site near at the Sacramento-Sutter County line to create a wetland/upland complex using native wetland and upland riparian plant species (including elderberry shrubs). - Monitor revegetated areas for 3 years to ensure survival. Replace plants lost as needed.
Construction of the pump/plug facility in NEMDC	- Allow in-water construction only between June 1 and August 31 to avoid migrating salmon. - Install fish screen on the pump intake structure.
Endangered Species	- Acquire an additional 2,700 acres on the South Fork and plant 32,336 elderberry shrubs mixed with native riparian species to compensate for impacts to the valley elderberry longhorn bettle. - Monitor the revegetated areas to ensure an 80-percent survival rate at the end of 10 years.
Cultural and Paleontological Resources	- Adhere to stipulations contained in a Programmatic Agreement between the Corps, USBR, non-Federal sponsor, ACHP, and SHPO - Perform periodic inspections during construction to identify significant and valuable resources

AREAS OF CONTROVERSY AND UNRESOLVED ISSUES

The Corps and non-Federal sponsor of the proposed project have carefully considered the views obtained from other agencies, organizations, and the public on the issues raised by the project. Except for the unresolved issues, the Corps and non-Federal sponsor believe that they have reached substantive and reasonable conclusions. Although some people will continue to have strong opposing views on the conclusions that have been reached, most of the issues in controversy have been adequately explored and the concerns raised have been resolved to the extent possible by the selected plan. As explained below, only three issues remain unresolved with the potential for further administrative action or analysis.

There will be an additional opportunity for public review and comment on the final Feasibility Report during the Washington-level review process.

The issues, refinements from the draft made for the final, and information explaining their resolution are addressed in detail in the Main Report, in Chapters 2 through 23 of the EIS/EIR, and in the various appendixes.

The following "areas of controversy" were identified during the preparation of this study as a result of the public review process:

- The appropriate level of flood protection along the main stem of the American River
- Application of the 404(b)(1) Guidelines to the analysis of project alternatives
- Full versus partial flood protection for the Natomas basin
- Relationship between the short-term and long-term impacts of the project on regional growth, air quality, and transportation
- Relationship between the project and the authorized multipurpose Auburn Dam

- o The extent of environmental impacts which will result behind the dam from temporary inundation during large storm events

- o The difference between the Corps mitigation plan and the FWS mitigation recommendation for impacts behind the detention dam

- o Short-term and long-term impacts of the project on Federally listed and State-listed threatened or endangered species

- o Impacts to the environment which would result from securing the aggregate needed to construct the flood detention dam

- o Potential conflicts with existing recreation uses in the North and Middle Forks of the American River

- o Potential impacts to cultural and paleontological resources as a result of construction and operation of the proposed project

- o The hydrologic assumptions and methods of analysis used in determining which flood control measures are feasible and how these measures should be combined into alternative flood control plans

- o The relationship between the impacts of the ARWI alternatives and the impacts which would result from temporary reoperation of Folsom Dam and Reservoir.

- o The appropriate assumptions and methodologies to be used in identifying growth-related impacts in the American River flood plain and the extent of responsibility in mitigating these impacts.

The Corps and non-Federal sponsor have spent considerable effort attempting to resolve the issues below. All relevant views were carefully considered. The following "unresolved issues" could result in further administrative action or shall receive supplemental analysis:

- o The relationship between Principles and Guidelines and Section 404 of the Clean Water Act, including the requirements of and the effects of compliance with Section 404(r).

- The appropriate assumptions and methodologies to be used in identifying inundation-related impacts in the canyon area and determining the mitigation requirement for these impacts.

- The appropriateness of integrating the threatened-species planting within the South Fork wildlife and vegetation mitigation area.

CHAPTER 2

PROJECT DESCRIPTION

The selected plan is designed to control flooding along the American River from floods with a return frequency of about once every 200 years. This level of protection would be achieved through the construction of a flood detention dam near Auburn to augment the existing flood storage at Folsom Dam. Pertinent data for the selected plan are in Table VII-1 of the Main Report.

Although a flood control detention dam would protect areas of metropolitan Sacramento within the American River flood plain, some portions of Sacramento, including the developed areas of the Natomas basin, would remain exposed to the effects of high flows and stages, primarily in the Natomas East Main Drainage Canal and Natomas Cross Canal. To protect existing development in Natomas, the selected plan would provide, in addition to the upstream facility, levee improvements at various locations around Natomas.

FLOOD CONTROL DAM ON THE AMERICAN RIVER

The main feature of the selected plan is a flood control dam on the North Fork American River at mile 20.1 near Auburn, near the site of the Bureau of Reclamation's (USBR) authorized multipurpose Auburn Dam Project. The dam would be a peak-flow detention dam of concrete gravity design that would not permanently store water. An overview of the Auburn area, damsite plan, outlet works tunnel intake structure, and dam and spillway profile and sections are shown on Plates 18 through 21, respectively, in the Main Report.

The dam could impound about 545,000 acre-feet of water. During a 200-year flood, water would reach a maximum elevation of 868.5 feet m.s.l. and cover about 4,000 acres. From streambed, the dam would be about 425 feet high and detain floodwaters up to 370 feet deep. The crest of the dam would be 2,600 feet long (about 1/2 mile). The dam would be about 400 feet wide at its base, decreasing to about 25 feet at the dam crest. The foundation of the dam would extend about 50 feet below the ground surface of the streambed.

Construction of the dam would require about 4.6 million cubic yards of aggregate material, which would be mined from the existing Old Cool Quarry. The aggregate would be transported to the damsite by conveyor. The conveyor system would be located over land on the south side of the canyon away from the river.

Dam construction would require removing from the foundation approximately 6.6 million cubic yards of unsuitable material. This material would be placed in the keyway constructed in connection with the multipurpose project and banked at the foot of the uncompleted boat ramp paralleling the keyway adjacent to Salt Creek.

Outlet capacity for the proposed structure would be provided by twelve 5-foot by 9.5-foot rectangular box sluices. The maximum outlet capacity of the outlet works would be about 87,000 cubic feet per second (cfs). The sluices would include emergency closure gates. The conditions under which the sluices could be closed are outlined in more detail in Chapter VIII of the Main Report.

The existing tunnel (constructed by the USBR for its Auburn Dam Project) would be used to divert streamflows around the damsite during the construction process. Following completion of the detention dam, a watertight bulkhead gate would be installed on the tunnel entrance to seal off the tunnel.

A spillway is provided for dam safety in the event of a flood greater than 200 years. The 600-foot-long spillway would be located in the center of the dam and have a design capacity of 860,000 cfs. Floodwater would first pass over the spillway when the water level behind the dam reached within 55 feet of the top of the dam.

About 6,032 acres of land in the Auburn area would be required for construction, operation, and maintenance of the proposed dam and related facilities, including 52 acres to replace Highway 49 and Ponderosa Way. The 6,032-acre total includes 5,267 acres in Federally owned property, 8 acres in State ownership, and 757 acres curently held in private ownership. All Federally owned property would remain in Federal ownership.

The Corps would obtain a joint use permit on 100 acres of Federal land for the dam foundation and appurtenances. Within the detention area, the non-Federal sponsor would obtain temporary easements on 99 acres for construction of the dam and permanent road easements on 52 acres for road replacements. The non-Federal sponsor and the Corps would obtain flowage easements on 5,932 acres. A total of 2,685 acres would be acquired in fee for fish and wildlife mitigation.

Allowance for a "dead pool" space for sediment would not be included in the dam, primarily because only small amounts of sediment would be expected to reach the facility. Most of the sediment that would be transported to the damsite would pass through the outlet works.

BRIDGE ACROSS THE NORTH FORK AMERICAN RIVER

The portion of Highway 49 replaced would be about 1.8 miles long, with a bridge about .6 mile long crossing the North Fork at river mile 23.0. The replacement would be designed to current standards, contain no enhancements, and make no allowance for future traffic projections. The right-of-way would require about 47 acres. From about the town of Cool, the relocated route would extend northwesterly across the North Fork American River at river mile 23.0 at about elevation 1,000 feet. The alignment would intersect High Street in Auburn.

The non-Federal sponsor is responsible for all relocations. State regulations will probably require route adoption studies to review alternatives for upgrading and realigning the highway in accordance with future traffic projections. These studies may result in the selection of a route other than the one identified by the Corps for the selected plan. If the State ultimately selects an alternative plan, separate environmental and related analyses will have to be completed by the State in order to proceed with that plan.

In addition to the replacement of Highway 49, about .8 mile of the two-lane Ponderosa Way and its bridge crossing would be replaced. The required river crossing would be accomplished through the construction of a concrete bridge about 1,200 feet long.

LEVEE IMPROVEMENTS IN NATOMAS BASIN

Construction of a flood control dam alone would not protect the developed portions of Natomas. Additional levee improvement work would be required. The selected plan would provide full protection for existing Natomas development through modification of existing levees in various locations around the perimeter of the Natomas basin.

Plates 23 through 26 in the Main Report show the plan features to be constructed in the Natomas area. (A detailed discussion is provided in Appendix B.) The selected plan includes the following flood control features for the Natomas area:

Natomas East Main Drainage Canal (NEMDC):

- Raise 13,700 lineal feet of the west NEMDC levee an average of 0.5 foot from El Camino Avenue to Main Avenue and 7,600 feet of the east NEMDC levee an average of 0.5 foot from Arcade Creek to Main Avenue. All work would be done either on top of the existing levee or on the waterside of the existing levee and would require replacement of the Main Avenue bridge crossing of the canal. About 7 acres of permanent levee easement and 24 acres of temporary easement would be needed.

- Construct a 700-cfs pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek. This structure would be 90 feet long, with a pumping capacity of 700 cfs and two low-level sluices, which would normally be open. The top of the pumping structure would be at elevation 44; the streambed elevation would be 24.

Natomas Cross Canal (NCC):

- Raise 18,000 lineal feet of the south levee of the NCC about 0.5 foot between the Sacramento River and Highway 99. All of this work would be accomplished on top of the levee within existing project right-of-way.

Pleasant Grove Creek Canal:

- Raise 500 lineal feet of the west Pleasant Grove Creek Canal levee about 1 foot near the Fifield Road bridge crossing and the Howsley Road bridge crossing. Work would also include modification of the containment levee across the canal at Sankey Road.

Sankey Road Area:

- Raise 3,000 lineal feet of East Levee Road along the NEMDC about 4 feet from Sankey Road to the south. This addition would have a top width of 30 feet and a base width of 60 feet. Modifications would also include the excavation of a channel along the Union Pacific Railroad from Sankey Road to Riego Road. A 3,000-cfs-capacity channel and culvert would be required to convey flow underneath the Union Pacific Railroad. This work would also require raising the Sankey Road approaches to East Levee Road. The Sankey Road modifications would require less than 2 acres of levee easement along with about 20 acres of channel easement.

- The selected plan would raise portions of the south levee of the Natomas Cross Canal and the east levee of the Pleasant Grove Creek Canal. These improvements would prevent floodwaters from entering the Natomas basin from the north, but under certain flooding circumstances they would also slightly increase the depth of flooding on lands in the Pleasant Grove area. To offset this impact, the selected plan has been refined to include a detention basin in the northeast corner of Natomas to store enough water to eliminate the increased flood elevation. (The draft report included lengthening the Fremont Weir to offset induced flooding in the Pleasant Grove Creek area. This plan feature was subsequently deleted due to a finding of operational ineffectiveness.) The detention basin area is currently used for rice farming and would be leveed to prevent the stored water from flooding Natomas. The levees would be approximately 11,600 feet long and have a top width of 20 feet, maximum height of 17 feet, and average base width of 100 feet. The detention basin has been sized to store 3,000 acre-feet at 10 feet of depth and therefore would cover approximately 300 acres.

Dry Creek:

- Construct about 4,600 lineal feet of new levee about 6 feet high along the north side of Dry Creek from the pumping station at the NEMDC to high ground near West 2nd Street and Ascot Avenue. This levee would have a 20-foot-wide top and a 50-foot-wide base.

- o Extend the existing south Dry Creek levee 2,400 feet east to high ground at Rio Linda Boulevard. The average height of this levee would be 4 feet; the top would be 20 feet wide and the base 40 feet wide. Land requirements for this work would include about 14 acres of permanent levee easement and 12 acres of temporary construction easement.

Arcade Creek:

- o Construct about 2,400 lineal feet of new levee about 3 feet high on the north side of Arcade Creek downstream from Marysville Boulevard. This levee would have a 20-foot top width and a 40-foot base width. It would also be necessary to raise 1,200 lineal feet of levee about 1 foot on the south side of Arcade Creek downstream from Marysville Boulevard. Land requirements would include about 2 acres of permanent levee easement and 14 acres of temporary construction easement.

The selected plan would require the acquisition of about 46 acres in fee or permanent easement to construct or modify the levees in Natomas exclusive of the detention basin and mitigation site. An additional 50 acres in temporary easement would also be required. The borrow area for the Natomas work would be a 125-acre site along the Sacramento River south of the Sacramento Metropolitan Airport.

RECREATION FEATURES

The following recreation features, as shown on Plate 27, are included in the selected plan:

- o Construct paved pedestrian/biking trails and parallel equestrian trails along portions of the NEMDC and Dry and Arcade Creeks, with necessary access and staging facilities. A total of 11.5 miles is proposed for development. The non-Federal sponsor would acquire fee title to 24 acres for the trails.

- o For safety reasons, reroute 1.1 miles of existing bike trail to avoid a surface crossing of Del Paso Boulevard.

CHAPTER 3

ALTERNATIVES

This chapter summarizes information on the flood control measures and alternatives discussed in Chapters IV through VI of the Main Report and in the Plan Formulation Appendix (Appendix B). It also describes potential sources of aggregate for the flood control dam proposed as part of the selected plan, including potential environmental impacts associated with each source.

PLANS CONSIDERED IN DETAIL

Twenty-seven alternatives were formulated using a variety of potential flood control measures. Of these 27, 6 action alternatives plus the no-action alternative were considered in detail. The action alternatives are:

- **400-Year Alternative**
  - NED plan
  - 894,000-acre-foot flood control detention dam near Auburn
  - Levee and related channel improvements in the Natomas area
  - No change to Folsom Reservoir flood storage (400,000 acre-feet) or objective release (115,000 cfs)

- **200-Year Alternative (Selected Plan)**
  - Locally preferred plan
  - 545,000-acre-foot flood control detention dam near Auburn
  - Levee and related channel improvements in the Natomas area
  - No change to Folsom Reservoir storage or objective release

- **150-Year Alternative**
  - Maximum level of protection without new flood detention storage upstream from Folsom Dam

- Levee and related channel modifications along lower American and Sacramento Rivers
- Increase Folsom flood storage to 650,000 acre-feet
- Lower Folsom Dam spillway 15 feet and install five new gates
- Increase Folsom Dam objective release to 180,000 cfs
- Levee and related channel improvements in the Natomas area

o **100-Year (FEMA) Levee Alternative**

- Minimum level of flood protection using levee modifications to permit most of Sacramento area to be removed from FEMA 100-year flood plain
- Levee and related channel modifications along lower American and Sacramento Rivers
- Increase objective release from Folsom to 145,000 cfs
- Levee and related channel improvements in the Natomas area
- No change in Folsom flood storage

o **100-Year (FEMA) Storage Alternative**

- Minimum level of flood protection using increased storage at Folsom Dam
- Increase Folsom flood storage to 590,000 acre-feet
- Levee and related channel improvements in the Natomas area
- No change to objective release from Folsom

o **100-Year (FEMA) Levee/Storage and Spillway Alternative**

- Minimum level of flood protection using a combination of Folsom and downstream modifications
- Levee and related channel modifications along lower American and Sacramento Rivers
- Increase flood storage in Folsom to 470,000 acre-feet
- Lower Folsom Dam spillway 15 feet and install five new gates
- Increase objective release from Folsom to 130,000 cfs
- Levee and related channel improvements in the Natomas area

Summaries of each of these alternatives and the no-action alternative follow. Table 3-1 shows the components of each action alternative. (See the Main Report for more detailed descriptions and maps of construction areas.) The environmental impacts of these alternatives are discussed in detail in the chapters that follow.

TABLE 3-1. Summary of Physical and Structural Components of the Flood Control Alternatives

Component	Alternative					
	400-Year	200-Year	150-Year	100-Year (FEMA) Levee	100-Year (FEMA) Storage	100-Year (FEMA) Levee/Storage and Spillway
Increase Folsom Storage from 400,000 acre-feet to:	N/A	N/A	650,000 AF	N/A	590,000 AF	470,000 AF
Lower Folsom Dam Spillway New Gates Required	N/A	N/A	15 ft YES	N/A	N/A	15 ft YES
Folsom Release and American River Capacity:	No Change (115,000 cfs)	No Change (115,000 cfs)	180,000 cfs	145,000 cfs	No Change (115,000 cfs)	130,000 cfs
Raise/replace Bridge at:	Ponderosa Way Main Avenue	Ponderosa Way Main Avenue	Numerous Bridges	Numerous Bridges	Main Avenue	Numerous Bridges
Raise Yolo Bypass Levees	NO	NO	YES	YES	NO	YES
Raise/New Levees: Natomas	YES	YES	YES	YES	YES	YES
Natomas Detention Basin	3,000 AF	3,000 AF	3,000 AF	3,000 AF	3,000 AF	3,000 AF
American River:	N/A	N/A			N/A	
Slurry Wall			4.1 mi	0.9 mi		0.7 mi
Toe Drain			7.8 mi	2.7 mi		0.6 mi
New Levee			1.0 mi	1.0 mi		0.9 mi
Levee Raising			11.4 mi	2.7 mi		0.0 mi
Riprap on Bank			1.5 mi	1.5 mi		1.5 mi
Riprap on Levee			5.3 mi	5.3 mi		5.3 mi
Riprap Bank and Levee			3.2 mi	3.2 mi		3.2 mi
Lengthen Sacramento Weir	NO	NO	3,600 ft	1,400 ft	NO	500 ft
Build Detention Dam at Auburn:	YES	YES	NO	NO	NO	NO
Storage Capacity	894,000 AF	545,000 AF				
Dam Height	495 ft	425 ft				
Replace Highway 49	YES	YES	NO	NO	NO	NO
Recreation Trails in Natomas	YES	YES	YES	YES	YES	YES

NO-ACTION ALTERNATIVE

This alternative constitutes the without-project future and is the basis for comparative economic, environmental, and engineering studies. With this alternative, no Federal agencies would participate in flood control efforts, and no additional flood protection along the American River would be achieved. The developed portions of the flood plain would remain exposed to flooding and flood-related impacts from storms greater than about a 63-year event. Given this level of protection, it is assumed that when the exemption from applicable FEMA base flood elevations expires in November 1992, all new development within the 100-year flood plain in Sacramento would require flood proofing to the 100-year level.

200-YEAR ALTERNATIVE - SELECTED PLAN

This alternative is the locally preferred plan, which has been selected for recommendation to Congress for authorization in 1992. The features of this plan are similar to those for the 400-year alternative and are fully described in Chapter 2 (Project Description).

400-YEAR ALTERNATIVE - NED PLAN

This alternative would produce the maximum NED benefits achievable by a flood control project on the American River. The primary features of this alternative are:

<u>Upper American River</u>

- Construct a concrete gravity dam 498 feet high on the North Fork American River at river mile 20.1 near Auburn.
- Create a detention basin to accommodate a peak storage of 894,000 acre-feet.
- Replace Highway 49 and Ponderosa Way at the North Fork American River crossings.

Natomas

- Construct levee improvements along the NEMDC, Arcade Creek, Dry Creek, Pleasant Grove Creek Canal, and NCC.
- Replace the Main Avenue bridge across the NEMDC.
- Construct a high-volume pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek.
- Construct a detention basin in the northeast corner of Natomas, adjacent to the Pleasant Grove Creek Canal.
- Construct bike and equestrian trails and other recreational amenities along portions of the NEMDC and Dry and Arcade Creeks.

150-YEAR ALTERNATIVE

This alternative represents the highest level of protection theoretically achievable without creating additional upstream storage. The components of this alternative consist of:

Lower American River

- Increase the seasonal flood control storage reservation in Folsom Reservoir from 400,000 acre-feet to 650,000 acre-feet.
- Lower the Folsom Dam spillway 15 feet and install five new gates to increase the design release into the lower American River from 115,000 cfs to 180,000 cfs.
- Raise, stabilize, and strengthen the lower American River levees to safely handle the increased design release (180,000 cfs) from Folsom Dam.
- Raise these bridges across the American River: Howe Avenue, H Street, Guy West, and Union Pacific Railroad trestle.
- Raise portions of the Yolo Bypass levees and acquire additional flowage easements.
- Lengthen the Sacramento Weir and widen the Sacramento Bypass approximately 3,600 feet.

Natomas

- Construct levee improvements along the NEMDC, Arcade Creek, Dry Creek, Pleasant Grove Creek Canal, and NCC.
- Replace the Main Avenue bridge across the NEMDC.
- Construct a high-volume pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek.
- Construct a detention basin in the northeast corner of Natomas, adjacent to the Pleasant Grove Creek Canal.
- Construct bike and equestrian trails and other recreational amenities along portions of the NEMDC and Dry and Arcade Creeks.

Increasing the flood control storage reservation in Folsom Reservoir would lower water levels in the reservoir seasonally, resulting in increased flows in the American River during the fall and decreased flows in the spring. This operational plan would reduce annual firm water yield to the Federal Central Valley Project (CVP) by about 33,000 acre-feet and cause an annual net loss in CVP hydropower production of about 411 gigawatthours.

The Folsom Dam spillway would be modified to allow earlier release of floodwaters as they begin to encroach into the flood control storage space. This modification would entail lowering the existing spillway 15 feet and installing five new gates. The design release into the lower American River would be increased from 115,000 cfs to 180,000 cfs to reduce the rate at which available storage space in the reservoir would be filled. Extensive levee work, installation of bank stabilization (riprap), and levee modifications (raising and strengthening) would be needed to allow the lower American River levees to accommodate the increased flows. All work required to accomplish these modifications would be conducted from the riverside of the levees since well-established residential neighborhoods and commercial developments are along the landside. The modifications would consist of (1) installation of 4.1 miles of slurry wall, (2) construction of 7.8 miles of new toe drain and 1 mile of new levee, (3) raising 11.4 miles of levee, and (4) placement of 10 miles of riprap on banks and levees. Plate 13 in the Main Report shows the extent and location of the work required.

Because flows from the American River into the Sacramento River would increase, the Sacramento Weir would have to be lengthened and the Sacramento Bypass widened by about 3,600 feet to divert the increased volume of water into the Yolo Bypass. These improvements would decrease Sacramento River water levels downstream from the confluence, reduce the extent of levee modification needed to offset hydraulic impacts, and decrease hydraulic stress to the riverbank opposite the confluence. To offset the impacts of the increased flow into the Yolo Bypass, several miles of levee would have to be raised.

The increased flows in the lower American River would raise flood stages in the NEMDC. As a result, the levee improvements required to protect the Natomas basin from flooding and to mitigate for the hydraulic effects of this protection would have to be larger than those indicated for the selected plan.

100-YEAR (FEMA) LEVEE ALTERNATIVE

This alternative would provide a 100-year (FEMA) level of protection by increasing the design release from Folsom from 115,000 cfs to 145,000 cfs. The elements of this alternative would be substantially the same as those of the 150-year alternative except that the current operation of Folsom Reservoir would be unchanged. The elements of this alternative include:

__Lower American River__

- Increase the design release from Folsom Dam into the lower American River from 115,000 cfs to 145,000 cfs.
- Raise, stabilize, and strengthen the lower American River levees to safely handle the increased design release (145,000 cfs) from Folsom Dam.
- Raise these bridges across the American River: Howe Avenue, H Street, Guy West, and Union Pacific Railroad trestle.
- Raise portions of the Yolo Bypass levees and acquire additional flowage easements.
- Lengthen the Sacramento Weir and widen the Sacramento Bypass approximately 1,400 feet.

Natomas

- Construct levee improvements along the NEMDC, Arcade Creek, Dry Creek, Pleasant Grove Creek Canal, and NCC.
- Replace the Main Avenue bridge across the NEMDC.
- Construct a high-volume pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek.
- Construct a detention basin in the northeast corner of Natomas, adjacent to the Pleasant Grove Creek Canal.
- Construct bike and equestrian trails and other recreational amenities along portions of the NEMDC and Dry and Arcade Creeks.

Accommodating a 145,000-cfs design release in the lower American River would require the following levee improvements: (1) installation of 0.9 mile of slurry wall, (2) construction of 2.7 miles of new toe drain and 1 mile of new levee, (3) raising 2.7 miles of existing levee, and (4) stabilizing 10 miles of levee and bank with riprap. Higher flows in the lower American River would raise the flood stage in the NEMDC and require a larger scale of levee improvements in and around the Natomas area than would be needed for the selected plan.

100-YEAR (FEMA) STORAGE ALTERNATIVE

This alternative would provide a 100-year (FEMA) level of protection by permanently increasing the space allocated to flood control in Folsom Reservoir from 400,000 acre-feet to 590,000 acre-feet. No improvements in the levees along the lower American River would be required. The elements of this alternative include:

Lower American River

- Increase the seasonal flood control storage reservation in Folsom Reservoir from 400,000 acre-feet to 590,000 acre-feet.

Natomas

- o Construct levee improvements along the NEMDC, Arcade Creek, Dry Creek, Pleasant Grove Creek Canal, and NCC.
- o Replace the Main Avenue bridge across the NEMDC.
- o Construct a high-volume pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek.
- o Construct a detention basin in the northeast corner of Natomas, adjacent to the Pleasant Grove Creek Canal.
- o Construct bike and equestrian trails and other recreational amenities along portions of the NEMDC and Dry and Arcade Creeks.

These modifications would result in a lower seasonal water level in Folsom Reservoir, higher flows in the lower American River in the fall and reduced flows in the spring, and reduced water and power yields for the CVP.

100-YEAR (FEMA) LEVEE/STORAGE and SPILLWAY ALTERNATIVE

This alternative would provide a 100-year (FEMA) level of flood protection by combining slightly increased flows in the lower American River with a small increase in the space allocated to flood control in Folsom Reservoir. The alternative has the same elements as the 150-year alternative but on a reduced scale. The elements include:

Lower American River

- o Increase the seasonal flood control storage reservation in Folsom Reservoir from 400,000 acre-feet to 470,000 acre-feet.
- o Lower the Folsom Dam spillway by 15 feet and install five new gates to increase the design release into the lower American River from 115,000 cfs to 130,000 cfs.
- o Raise, stabilize, and strengthen the lower American River levees to safely handle the increased design release (130,000 cfs) from Folsom Dam.

- o Raise these bridges across the American River: Howe Avenue, H Street, Guy West, and Union Pacific Railroad trestle.

- o Raise portions of the Yolo Bypass levees and acquire additional flowage easements.

- o Lengthen the Sacramento Weir and widen the Sacramento Bypass approximately 500 feet.

Natomas

- o Construct levee improvements along the NEMDC, Arcade Creek, Dry Creek, Pleasant Grove Creek Canal, and NCC.

- o Replace the Main Avenue bridge across the NEMDC.

- o Construct a high-volume pump station structure with low-flow sluices on the NEMDC just upstream from the mouth of Dry Creek.

- o Construct a detention basin in the northeast corner of Natomas, adjacent to the Pleasant Grove Creek Canal.

- o Construct bike and equestrian trails and other recreational amenities along portions of the NEMDC and Dry and Arcade Creeks.

Accommodating a 130,000-cfs design release in the lower American River would require these levee improvements: (1) installation of 0.7 mile of slurry wall, (2) construction of 0.6 mile of new toe drain and 0.9 mile of new levee, (3) and stabilizing approximately 10 miles of levee and bank with riprap. No levee raising would be required; however, higher flows in the lower American River would raise the flood stage in the NEMDC and require a slightly larger scale of levee improvements in and around Natomas than would be needed for the selected plan.

Permanent reoperation of Folsom would result in lower seasonal water levels in the reservoir, higher flows in the lower American River in the fall and reduced flows in the spring, and reduced water and power yields for the CVP. However, these changes would be relatively slight compared to the 150-year and 100-year (FEMA) storage alternatives.

FLOOD CONTROL MEASURES ELIMINATED

INDIVIDUAL MEASURES

The following flood control measures were evaluated but eliminated from formulation into specific alternatives.

Main Stem American River

- o Increase downstream channel capacity with setback levees
- o Raise Folsom Dam
- o Use storage space in upstream reservoirs for flood control
- o Improve flood forecasting and Folsom Reservoir operations
- o Construct small detention dams in the upper basin
- o Construct offstream storage facilities
- o Construct out-of-basin diversion facilities
- o Divert floodflows into Sacramento Deep Water Ship Channel
- o Use nonstructural measures, including flood proofing, flood plain evacuation, development restrictions, and flood warning

Natomas Area

- o Construct compartment levee in Natomas
- o Construct detention dams upstream from Natomas
- o Modify Fremont Weir and Yolo Bypass
- o Construct Sacramento River constriction
- o Construct new Natomas Cross Canal
- o Reduce objective release from Folsom Dam to lower stages in NEMDC
- o Use nonstructural measures, including flood proofing, flood plain evacuation, development restrictions, and flood warning

Chapter IV of the Main Report and the Plan Formulation Appendix (Appendix B) describe the reasons for dropping these measures from further consideration. In each case, the measure was infeasible, based primarily on one or more of the following criteria:

- o High cost
- o Adverse environmental impacts
- o Limited increase in flood protection

COMBINED MEASURES

The combinations of measures discussed in the following paragraphs and in the Main Report were also determined to be unacceptable on the basis of the above criteria.

Improved Forecasting/Storage/Levee

This combination of measures includes several of the main stem American River measures listed above with suggested revisions to the operations of both Folsom Dam and several water supply and hydropower dams in the upper American River basin. The combination was suggested as an alternative by a consortium of local and national environmental organizations as a way to obtain a 150-year level of flood protection along the American River without extensive construction, resulting in less environmental damage than the 150-year alternative described above.

As discussed in the following paragraphs, this alternative (1) is based on different assumptions for computing flood protection levels and (2) combines measures evaluated separately and eliminated during plan formulation. The alternative includes these measures:

- Secure flood control space in the upstream water and power reservoirs for additional temporary storage immediately before and during large storm events.
- Upgrade the flood control operation for Folsom Reservoir by making releases prior to large flood events, using inflow forecasts based on measured precipitation and flow data in the basin.
- Upgrade the flood control capability of Folsom Dam by temporarily storing floodwaters in the surcharge space available above the normal full-pool level during large floods.
- Ensure that Folsom Dam is operated according to the principles clearly described in its operating manual.
- Ensure that the American River levees are maintained to design specifications, thereby allowing higher release rates from Folsom Dam than the present design capacity.

Major assumptions made by the consortium include:

- **Erroneous Data.** The 1-day and 3-day discharges used (by the Corps) in developing the rainflood-frequency curve for the American River contain erroneous data points for the 1986 event which exaggerate flood risk along the American River by a few percentage points.

- **Estimating Flood Frequencies.** Flood frequencies should be analyzed using the "computed probability" methodology (used by FEMA) instead of the "expected probability" method (used by the Corps).

- **Upstream Storage.** At least 200,000 acre-feet of storage is available in the upstream water and power reservoirs at the start of a storm (such as the 1986 flood), suggesting that significant volumes of floodwater may be stored in these facilities during the initial days of a major storm.

- **Channel Capacity.** The American River levees were designed to carry and are capable of passing 152,000 cfs with 3 feet of freeboard. It is also assumed that minimal levee work would be required to restore the design capacity of the levees (adding a maximum of 1 foot of material) and reinforcing the levee core.

- **Folsom Operation.** With optimal operation of Folsom Reservoir, occurrence of coincident peaks on the Sacramento and American Rivers would be unlikely; the design backwater elevation affecting the NEMDC would be at least 1 foot lower than the elevation determined by the Corps; and nondamaging flows in American River could be significantly higher than the nondamaging flow assumed in the Corps' analysis.

- **Anticipatory Releases.** At least 20,000 acre-feet of equivalent flood storage benefit could be obtained by making anticipatory releases based on telemetered flow and precipitation data in the basin (releasing stored water based on predicted storm flows).

- **Surcharge Space.** Temporary use of up to 100,000 acre-feet of surcharge storage space in Folsom Reservoir during very large floods is feasible and should be accounted for in flood routings.

The following point-by-point discussion of the consortium's assumptions underlying this alternative clarifies the reasons for not including this alternative in the plan formulation process.

- **Erroneous Data.** This alternative assumes that the rainflood-frequency curve ignores the effect of the Auburn cofferdam collapse on the unregulated 1-day and 3-day volumes of the 1986 storm and thus contains exaggerated volume estimates. A reassessment by the Corps did result in modifying the annual maximum 1-day flow for 1986 from 204,000 cfs to 171,000 cfs. However, the effect of this modification was negligible on the routing results. The correction did not change the critical 3-day, 5-day, or longer durations, since the cofferdam filled and breached in less than 3 days.

- **Estimating Flood Frequencies.** This alternative assumes that the "computed probability" methodology, not "expected probability," should be used in estimating flood frequencies along the American River. As discussed in the Main Report, both methodologies are recognized by the U.S. Water Resources Council. Use of the expected probability methodology is treated as a policy question linked to the characteristics of the affected drainage basin and the purposes for which the methodology is used. In this instance, where a significant degree of uncertainty persists as to the magnitude and frequency of large floods along the American River, and where the estimate of such floods may provide the basis for sizing new flood control facilities for an urban area, the decision to use expected probability is consistent with Corps policy. Additional discussion on expected probability is contained in the Comments and Responses Appendix (T).

- **Upstream Storage.** This alternative assumes that significant flood storage could be obtained through proper use of water and power reservoirs in the upper American River basin. This storage is discounted because it is not reliable and bases its conclusion on three considerations:

    1. The upstream reservoirs are operated exclusively for water and power purposes by the Sacramento Municipal Utility District and Placer County Water Agency. The Corps has no control over the operation of these reservoirs, and the operators have not indicated a willingness to permit such control unless the owners would be compensated for any lost water and power opportunities. The cost of such an arrangement with the reservoir operators would not be justified given the flood reduction benefits achieved.

2. The upstream reservoirs are not equipped for flood control operations because they lack appropriate outlet works and spillway facilities to permit rapid evacuation of floodwaters. Thus, in the event a succession of small storms precedes a large event, the storage space provided by the reservoirs may be filled or partially filled. This problem could be overcome by retrofitting the reservoirs with appropriate outlet works. However, the cost of this undertaking would not be justified based on the flood reduction benefits achieved.

3. The upstream reservoirs are located so high in the basin that they capture on average only about 18 percent of the total basin runoff during major flood events. There is no assurance that even if the operational problems discussed above could be resolved, the reservoirs could be counted on to capture a sufficient portion of the runoff of all reasonably conceivable storms to make the investment in these facilities worthwhile. For example, the runoff of a large storm centered in the lower reaches of the watershed might be minimally affected by upstream reservoir storage.

- **Channel Capacity.** This alternative assumes that the levees in the lower American River are designed to handle sustained flows of 152,000 cfs with 3 feet of freeboard and that efforts to upgrade the levees would be minimal. The sustained safe floodflow capacity of the channel is 115,000 cfs with 5 feet of freeboard. The approach in this regard is based on three considerations:

  1. The last segment of the levee system completed in 1958 was designed, based on consultations with local flood control and planning officials, to convey a sustained design flow of 115,000 cfs with 5 feet of freeboard.

  2. The 3-foot freeboard with a flow of 152,000 cfs was initially (at the time of levee design in the late 1940's) considered appropriate for short (several hour) flow durations. However, levee performance and resulting studies since have demonstrated that a sustained flow of 152,000 cfs would be unsafe. In actual practice, flows of between 115,000 cfs and

130,000 cfs for less than 2 days during the 1986 storm caused serious erosion damage at several points along the channel levees.

3. Levee stability tests undertaken by the Corps in the aftermath of the 1986 storm showed that sustained flows in excess of 115,000 cfs, at some locations along the levee system, would cause serious problems.

o **Folsom Operation.** This alternative assumes that more efficient use of the existing flood storage available at Folsom Dam would avoid coincident peak flows at the confluence of the Sacramento and American Rivers and would thus reduce the backwater effects generated at the confluence during major storms. Folsom is operated for the American River channel capacity, not the conditions at the confluence with the Sacramento River. For purposes of this study, less than optimal use of Folsom Reservoir storage was considered to be an inescapable operational reality. However, even with a theoretically perfect operation of the reservoir, the coincident peaks in the Sacramento and American Rivers could be avoided.

Given the topography, hydrology, and use of the basin, optimum operation of Folsom Dam for flood control purposes is inherently difficult. The basin is relatively compact, and runoff from mountain storms reaches the reservoir relatively quickly. This condition reduces the reaction time available to dam operators, especially during the onset of a storm. Dam operators may legitimately delay raising releases to provide time to patrol the levees downstream, evacuate people from the parkway, and limit damage to facilitates in the parkway until it is certain that reservoir inflows dictate an increase in release. Finally, limited outlet works capacity at low reservoir elevations limit outflows, thereby increasing storage demands and compromising efficient use of this storage.

For these (and other) reasons, perfect use of the flood storage available at Folsom is not likely. This is especially the case when the established operation criteria in the flood control manual are based on certain assumptions about runoff and hydrologic conditions that are somewhat variable to begin with. On the other hand, it is not clear that such perfection would avoid coincident peaks at the Sacramento-American River confluence. High flows in these two river systems can be generated by a variety of storm patterns. Depending on the pattern, the timing of releases from Folsom Dam may indeed be a critical factor in avoiding coincident peaks at the confluence. However, to the extent that storms arrive in odd patterns or produce extended high volumes, coincident peaks may occur despite the best efforts of dam operators.

- **Anticipatory Releases.** This alternative assumes that some flood storage benefit could be achieved through anticipating releases based on improved weather forecasting. The Corps tends to discount the benefits claimed for weather forecasting. At best, it may be possible to anticipate inflows 6 to 8 hours before they reach Folsom Reservoir, but given the character of storms in the basin, it is impossible to determine whether these increased flows will dissipate during the succeeding 6- to 8-hour period or continue to build into a large flood storm. Release decisions in actual operations must therefore consider that, although it is desirable to empty the flood control space as fast as possible, it is not desirable to cause downstream flooding until it is certain that reservoir inflows dictate an increase in releases. Also, dam operations are legally constrained in that large releases should not exceed recent maximum inflow rates into the reservoir. Technology does not currently exist to reliably make anticipatory flood releases based on forecasted inflows.

- **Surcharge Space.** This alternative assumes that surcharge storage space is available for use during large storms and should therefore be accounted for in determining the capacity of the existing system and the level of protection it provides. The Corps does not disagree that storage above gross pool at Folsom may be available during large storms. However, 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 is utilized as prescribed in the water control manual for Folsom Dam and Reservoir.

For all the above reasons, this alternative was eliminated from the array of alternatives early in the plan formulation process.

Natomas Cross Levee

During the reconnaissance phase of the American River Watershed Investigation, the Corps considered two plans which would protect the developed southern portion of the Natomas basin, including the Sacramento Metropolitan Airport, while leaving the northern portion of the basin only partially protected and thus (theoretically) undevelopable. These partial protection alternatives are also described in the Main Report and in Appendix B. They would require constructing a levee extending across the basin from the east levee of the Sacramento River to the west levee of the NEMDC.

Two alignments were considered for the cross levee: one would extend parallel to Del Paso Road; the other parallel to Elverta Road. The Del Paso Road alignment would also require construction of a ring levee around the airport. These cross levee alternatives were eliminated during the plan formulation process because of the prohibitive cost of purchasing flood easements for all of the unprotected lands in the northern portion of the basin. Moreover, neither cross levee plan would serve as an effective barrier to urbanization. On completion of either of the two proposed alignments, the unprotected lands could be cheaply and effectively removed from the 100-year flood plain through the repair of several low spots along the Pleasant Grove Creek Canal and NCC. In that case, the increased construction costs and increased environmental impacts associated with the cross levee alternative would not be justified.

The accomplishments, features, and costs of each of the Natomas protection alternatives are shown in Table 3-2.

The "full Natomas" plan proposed in the selected plan and described in Chapter 2 would require raising 9 miles of levee around the perimeter of the basin to prevent floodwaters from overtopping the NCC, Pleasant Grove Creek Canal, and NEMDC. The Main Avenue bridge across the NEMDC would be raised to accommodate these improvements, and a gated pump structure would be constructed across the NEMDC above the mouth or Dry Creek. In the southern portion of Natomas, 2 miles of new levee along Dry and Arcade Creeks would be needed to control floodwaters prevented from entering the basin. In the northern portion of Natomas, a floodway channel adjacent to the Pleasant Grove Creek Canal and a detention basin (300 acres) requiring 2 miles of new levee would be needed to control backwaters created by the full Natomas plan.

TABLE 3-2. Natomas Protection Alternatives[1]

Alternatives	Full Protection	South Area Protection (Elverta Road Cross Levee)	Developed Area Protection (Del Paso Road Cross Levee)
Accomplishments			
Area protected (acres)	7,260	6,280	6,280
Agricultural/vacant acres	47,620	27,120	6,020
Highway protected (mi)	25	19	10
Area unprotected (acres)	0	21,480	42,580
Features			
Levees raised (mi)	9	5	5
New levees (mi)	4	8	14
Levee fill (million cu yds)	.6	2.8	7.0
Bridge relocation	Main Ave. at NEMDC	Main Ave. at NEMDC	Main Ave. at NEMDC
Gated pump structure	NEMDC at Dry Creek	NEMDC at Dry Creek	NEMDC at Dry Creek
Floodway channel	PGCC at Sankey Road	No	No
Flowage easements (acres)	300	21,480	42,580
First Cost (Millions)[2]			
Levee Improvements	$ 5.2	$ 3.0	$ 3.0
Gated pump structure	4.3	4.3	4.3
Bridge relocation	4.0	4.0	4.0
Floodway channel	1.0	0	0
Lands[3]	13.8	21.7	39.2
Environmental features	5.6	9.3	16.8
Cultural resources	.7	.7	.7
Flowage easements[4]	0	100.0	200.0
Engineering, design, supervision, and administration	5.6	6.0	6.0
TOTAL			
With easements	$40.2	$149.0	$274.0
Without easements	$40.2	$ 49.0	$ 74.0

TABLE 3-2. Natomas Protection Alternatives[1] (Continued)

Alternatives	Full Protection	South Area Protection (Elverta Road Cross Levee)	Developed Area Protection (Del Paso Road Cross Levee)
Annual Cost (Millions)[5]			
With easements	$ 3.8	$13.3	$24.3
Without easements	$ 3.8	$ 4.6	$ 6.8
Average Annual Benefits (Millions)[6]			
Benefits	$42.0	$34.0	$12.0
Net Annual Flood Control Benefits (Millions)			
With easements	$38.2	$20.7	$12.3
Without easements	$38.2	$29.4	$ 5.2
Advantages	• 100-year FEMA protection to all Natomas area. • Support by local government and area residents. • Lowest cost and highest net economic benefits.	• 100-year FEMA protection to area, two-thirds of Natomas. • Reduced chance of secondary adverse impacts.	• 100-year FEMA protection to developed area. • Likely supported by environmental groups.
Disadvantages	• Likely results in high adverse secondary impacts without adequate mitigation.	• Little support by local area governments and landowners. • Would not prevent future development in unprotected areas.	• Little or no economic feasibility. • Little support by local area governments and landowners. • Would not prevent future development in unprotected areas.

[1]Reconnaissance scope information for general comparison only.
[2]Based on October 1990 price levels.
[3]Assumes $6,000 per acre. A detailed estimate would show varying real estate costs from highest in the south to lowest in the North Natomas area, 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. Flood damage reduction benefits amount to about $9 million.

The cross levee alternatives would incorporate all of the features of the full Natomas plan except those related to raising the NCC and Pleasant Grove Creek Canal. Those alternatives would also avoid the need for a detention basin and floodway channel since the floodwaters produced by storms greater than about a 70-year event would be permitted to overtop the NCC and Pleasant Grove Creek Canal and flow into the basin.

The Del Paso Road cross levee would be approximately 6 miles long and require the placement of approximately 2.8 million cubic yards of fill material. Construction of a perimeter (ring) levee around the airport would require an additional 6 miles of levee and 3.8 million cubic yards of fill. Implementation of this alternative would require crossing 11 intermittent streams, 2 major drainage canals, 8 unimproved roads, 2 light-duty roads, 1 secondary road, and 1 interstate highway. Each stream crossing would require the placement of a culvert with flapgate. During nonflood periods, the flapgate would be raised to convey normal drainage. During flood periods, the flapgate would be closed to prevent flooding of the leveed area.

A cross levee along the Elverta Road alignment would be about 6 miles long and require about 2.7 million cubic yards of fill material. This alignment would affect 25 natural and manmade features and require the installation of gated culverts on 14 intermittent stream crossings. In addition, eight unimproved roads, one light-duty road, and one divided highway would need to be elevated.

Either cross levee alternative could be viewed as an attempt to convert reclaimed land in the northerly portion of the basin into a "natural overflow/retention basin." This conversion could be considered a form of inverse condemnation since the affected land was removed from the flood plain in the early 1900's. Recent revisions in the hydrograph for the American River basin indicate that Natomas now lacks 100-year flood protection. However, landowners could argue that these revisions merely indicate the inadequacy of the existing flood protection system for the area and the need for corrective action. From this perspective, any governmental effort to convert a portion of the basin into a "natural overflow/retention basin" through construction of a new cross levee could give rise to claims for compensation based on inverse condemnation. In that event, the State could be compelled to purchase flowage easements on the affected land. These easements would increase the cost of the project by up to $200 million for the Del Paso Road alignment

(42,500 acres x $6,000 per acre at fair market value times 75 percent of fee) and about half that amount for the Elverta Road alignment.

Alternatively, either cross levee plan could be treated as a flood control project with certain backwater effects. From this perspective, operation of the cross levee would create the same backwater effects as the full Natomas plan but would shift the location of these effects from the area east of the Pleasant Grove Creek Canal to the lands in the northerly portion of the basin. These effects would have to be mitigated through the purchase of flood easements covering the affected property. As indicated above, these flood easements would cost up to $200 million depending on the cross levee alignment.

Even if either cross levee plan could avoid the above costs, the plan would still not be viable because construction costs would be substantially higher than with the full Natomas plan and environmental impacts would be more severe. These burdens would not be offset because there would be no assurance that the northerly lands, having been excluded from the Federally cost-shared project, would not be protected by a local agency, such as Reclamation District 1000, acting on its own. A cross levee would leave several low spots unrepaired along the Pleasant Grove Creek Canal and the NCC. The cost of repairing these spots would be about $2 million, and Reclamation District 1000 could not be prevented from undertaking these minor improvements and thereby providing a minimum 100-year level of protection to the northern portion of the basin.

For all of the above reasons, the most practicable method of providing adequate flood protection to the people and property currently at risk in Natomas is to construct improvements along the existing levees around the perimeter of the basin.

AGGREGATE EXTRACTION

The selected plan includes construction of a flood control dam capable of containing a flood event with a 200-year recurrence interval. Construction of a dam this size would require 5.1 million cubic yards (9.8 million tons) of aggregate to produce the required 5.2 million cubic yards of concrete.

The draft EIS/EIR indicated that a portion of the aggregate would be obtained from the Middle Fork American River sand and gravel deposits. Public comments revealed substantial concerns regarding the environmental consequences of using those deposits.

In response to these comments, further evaluation was made of alternative aggregate sources not previously given decisive consideration by the agencies. The refinements were based on the criteria for aggregate sources that were expressed in the draft EIS/EIR. An aggregate source should have sufficient quantity and quality of material. Obviously, it is preferable if the source is close to the project area. The feasibility of alternative aggregate sources in the immediate and distant vicinity of the damsite were assessed to determined the most appropriate source of materials. The potential aggregate sources are listed below and shown in Figure 3-1.

- **Oregon Bar Pluton** - A quarriable body of granitic rock about 1.5 miles downstream from the damsite.
- **River Mile 22.4 Quarry** - A quarriable body of metamorphic rock about 2 miles upstream from the damsite.
- **North Fork American River Sand and Gravel Deposits** - Fluvial sand and gravel deposits in the backwaters of and beneath Lake Clementine.
- **Old Cool Quarry (Spreckles Limestone and Aggregate)** - A currently operating commercial quarry in the canyon of the Middle Fork about 5 miles upstream from the damsite.
- **Cool Quarry Amphibolite** - A quarriable body of metamorphic rock immediately west (downstream) of Old Cool Quarry.
- **Middle Fork American River Sand and Gravel Deposits** - A series of 10 sand and gravel bars along a 7-mile reach of the Middle Fork starting approximately 5 miles upstream from the damsite.
- **Bear River and Chevreaux Quarry** - Fluvial deposits of sand and gravel and quarriable rock on the Bear River, along Highway 49, approximately 11 miles north of the damsite.
- **Mississippi Bar on the Lower American River** - An extensive deposit of sand and gravel about 18 miles downstream from the damsite near Lake Natoma.
- **Yuba River Dredge Fields** - Extensive deposits of sand and gravel about 40 miles north of the damsite on the Yuba River north of Beale Air Force Base.

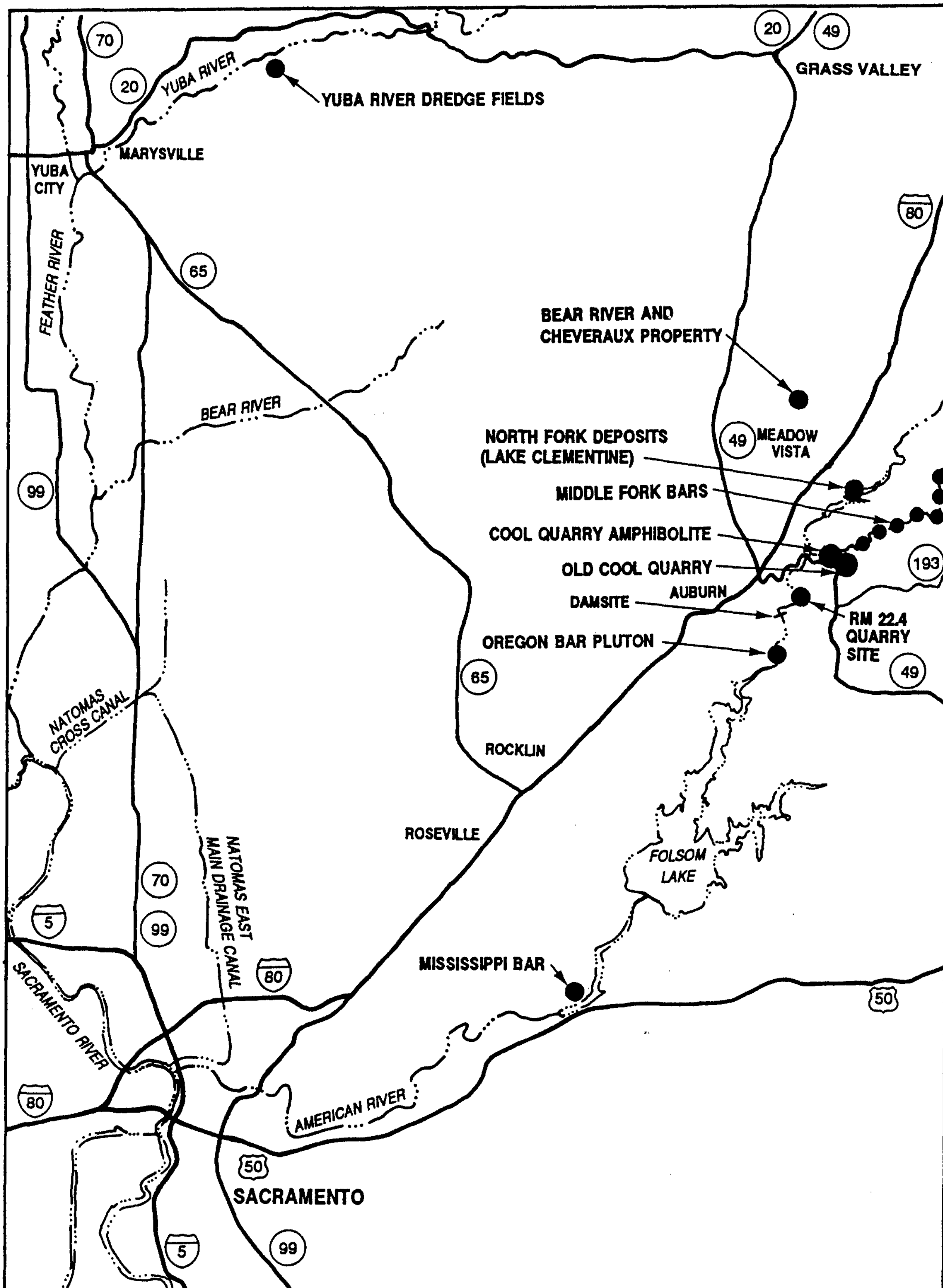

FIGURE 3-1. Alternative Aggregate Sources

Each site was evaluated to determine its feasibility as a source of construction material for the dam. An initial screening identified the most likely sources, which were also evaluated for potential environmental impacts. The results are detailed in an August 1991 report (included in the Geotechnical Investigations Appendix (Appendix M)) and summarized here.

AGGREGATE SOURCES - OBJECTIVES AND FEASIBILITY

Except perhaps for the North Fork American River sand and gravel deposits, all of the potential sources listed above contain sufficient reserves of material to construct the dam. However, other factors such as cost and environmental considerations also bear on the suitability of a potential source. Following are brief discussions of each source and their suitability based on preliminary engineering and environmental assessment.

Aggregate Sources Near the Damsite

Six of the nine potential sources evaluated are located in the American River basin within about 10 miles of the damsite. Of these six potential sources, four were dropped following initial screening because of either technical or environmental problems. The remaining two sites, Old Cool Quarry and the Middle Fork American River sand and gravel deposits, were found to be suitable and evaluated further.

Oregon Bar Pluton was discounted because of material and strength inadequacies.

The River Mile 22.4 site was dropped because of environmental problems associated with development and operation of a quarry at this location. Noise and visual impacts would be severe as the site is directly across the river from homes built around Robie Point at the edge of Auburn. Further, mitigation would be difficult for the extensive scarp created in the hillside following aggregate mining.

Several sand and gravel bars lie along the North Fork American River between the North Fork Dam (Lake Clementine) and the Ponderosa Way bridge (a distance of about 4 miles) approximately 10 miles upstream from the damsite. Additional detailed exploration would be needed to determine the quality and quantity of aggregate materials in the bars. Little information is available regarding aggregate in Lake Clementine. It is believed that about 390,000 cubic yards of aggregate was deposited upstream from North Fork Dam. Any additional deposits by flooding and mining since construction of North Fork Dam do not appear adequate for the flood control dam. Also, difficult vehicle access and environmental considerations make use of this site problematic.

The Old Cool Quarry is a familiar feature of the Auburn area. The quarry is currently leased from the Federal Government and operated by Spreckles Limestone and Aggregate, and has been operated as a commercial limestone source since early this century. The material produced has been used for concrete aggregate, riprap, and various industrial applications. The operator estimates reserves of 12 million tons of marble and 100 million tons of metavolcanic breccia. The currently permitted quarry has a processing capability of 600 tons per hour, which could be increased to 1,000 tons per hour, and enough available onsite storage space to stockpile several million cubic yards (Bartley, pers. comm., 1991). Wash water is obtained and discharged onsite, and private roads link the quarry to the damsite. Except for some residences near the quarry, minimal incompatible land uses exist in the surrounding area. For these reasons, this site is considered to be one of the least environmentally disruptive of the potential aggregate sources.

Just west of Old Cool Quarry is the potential aggregate source termed here the Cool Quarry Amphibolite. Development of a quarry at this site is environmentally problematic due to additional large areas that would be needed for aggregate processing or storage and topsoil and overburden storage. The site also lacks a reliable water source. For these reasons, this site is not considered a likely candidate for a new quarry operation.

The sand and gravel deposits along the Middle Fork American River contain about 9.6 million cubic yards of aggregate material. As a result of investigations made by the USBR in the 1960's and 1970's for its multipurpose Auburn Dam project, the Middle Fork bars are the best characterized of the aggregate sources near the damsite. However, mining of the deposits is logistically and environmentally problematic. Numerous roads would have to be developed, a conveyance system constructed, and water-quality criteria met. For these reasons, this site is considered to have the greatest potential for environmental impairments. Still, the adequacy of the materials and close proximity make this a candidate among sand and gravel sources in the damsite vicinity.

<u>Aggregate Sources Distant to the Damsite</u>

Of the three more distant sources considered, the Bear River and Chevreaux Quarry, near the town of Meadow Vista, is the closest source of large quantities of concrete-grade aggregate. Historically, several operations have extracted sand from the Bear River, the largest deposit of which is owned by the Joe Chevreaux Company. Available reserves are estimated to be as much as 80 million tons. The haul distance to the damsite is about 11 miles via public roads. The USBR considered the Chevreaux property a prime source of aggregate material for its multipurpose dam. However, the company owner and operator has emphatically stated that he does not want his operation considered as the prime source of aggregate material for the dam project.

Mississippi Bar is a large deposit below Folsom Dam consisting of sands and gravels dredged for their gold content from 1917 to 1949. In excess of 10 million cubic yards is available, although permitted reserves are estimated at 3-4 million cubic yards (Johnston, pers. comm., 1991). The Federally owned deposits are generally well suited for use as concrete aggregate. They were used for concrete aggregate for the construction of Folsom Dam, and were also considered by the USBR in 1967 for use as a source of concrete aggregate for the multipurpose Auburn Dam. Major revisions to land uses at the bar would be required to obtain the aggregate quantities needed for the flood control dam. Also, significant revisions would be necessary to mining, processing, transporting, and reclamation policies established in the environmental commitments attached to the mining project.

The aggregate reserves along the Yuba River near Marysville consist of extensive deposits of dredger tailings. These deposits are similar to those along the American River and at Mississippi Bar but are much larger in volume. Some of these deposits are government owned. The main obstacles to use of the Yuba River deposits are transportation related. Use would be feasible with rail transport and would make the Yuba deposits the least environmentally problematic of the aggregate sources distant to the damsite.

ENVIRONMENTAL IMPACTS

Based on preliminary engineering and environmental review, three potential aggregate sources were considered for more detailed environmental review:

- o Old Cool Quarry

- o Middle Fork American River Sand and Gravel Deposits

- o Yuba River Dredge Fields

The environmental review concluded that Old Cool Quarry is likely the best of the three final aggregate sources--it is technically adequate and appears to have the least potential for environmental impacts. Removing aggregate from the Middle Fork American River would result in significant environmental and recreational impacts. Both The Reclamation Board and Sacramento Area Flood Control Agency recommended in official resolutions of support for the project that use of these river bars be avoided. The Yuba River dredge fields were eliminated from consideration mainly because of the long haul distance.

The environmental review considered impacts to land use; public health and safety; water quality; air quality; fish, vegetation, and wildlife; transportation; noise; recreation; visual resources; and instream uses. The impacts associated with each source are summarized below and detailed in Appendix M.

Old Cool Quarry is considered to have the least potential for environmental impacts. The area has a long history of mining activity. The high level of existing disturbance at the site, its location out of the sensitive canyon bottom, and the use of an overland conveyor route to the damsite minimize the potential for environmental damage. Of the various impact categories, the additional noise generated by the expanded quarry operation is considered significant and unavoidable. However, the noise impacts associated with the mining of the Middle Fork American River sand and gravel deposits would be substantially similar. Indeed, both sites are located relatively close, about 5 miles upstream from the damsite. Impacts to land use, public health and safety, water quality, air quality, transportation, recreation, and visual resources were deemed potentially significant but mitigable. Potential impacts to biological resources at the quarry site were considered insignificant.

Use of the Middle Fork American River sand and gravel deposits would have the greatest potential for significant environmental impairment. This conclusion is based primarily on the large amounts of disturbance (several hundred acres) necessary to fully implement the alternative plus the close proximity to sensitive biological and recreational resources. Use of this source would result in significant unavoidable adverse impacts to biological resources, air quality, noise, recreation, visual resources, and stream channel morphology.

Significant but mitigable impacts would occur in the areas of public health and safety, water quality, biological resources, and transportation.

The existing operations, remote location, and disturbed nature of the area make the Yuba River dredge fields the least environmentally damaging of the sources distant from the damsite. Trucking the aggregate 40 miles to the damsite, however, would result in significant unavoidable impacts to transportation, air quality, noise, and public health and safety. Use of rail transport would mitigate some of these transportation-related impacts, but rail lines would have to be constructed. Impacts to other categories such as land use; biological, visual, and recreation resources; and water quality are considered potentially significant but mitigable. An environmental impact statement would be required for public disclosure of the environmental impacts that would result.

CHAPTER 4

LAND USE

This chapter describes the existing and projected future land use in the American River Watershed Investigation study area for both with- and without-project conditions.

EXISTING CONDITIONS

The study area comprises the lands in the American River flood plain, including the Natomas area of Sacramento and the American River Parkway, and the lands in the upper American River area in and around the damsite near Auburn.

NATOMAS

The 55,000-acre Natomas basin constitutes roughly one-half of the flood plain portion of the study area. These lands were reclaimed from the historic Sacramento and American River flood plain in 1914 by means of a system of canals and levees constructed around the perimeter of the basin. This system prevents stormwaters collected in the tributary streams east of Natomas from traversing the basin. Waters carried by Dry Creek, Arcade Creek, and other smaller streams south of Sankey Road near the Sacramento-Sutter County line are collected in the Natomas East Main Drainage Canal (NEMDC), conveyed southward around the southeast corner of the basin, and discharged into the Sacramento River. Waters carried by Curry Creek, Pleasant Grove Creek, Auburn Ravine, Coon Creek, and other smaller streams north of Sankey Road are collected in the Pleasant Grove Creek Canal and the Natomas Cross Canal (NCC), conveyed around the northeast corner of the basin, and discharged into the Sacramento River. The NCC and NEMDC also serve to contain backflows from the Sacramento and American Rivers during large flood events.

New hydrologic data prepared by the Corps in the aftermath of the 1986 flood indicate that this system provides less protection than previously believed. These data have caused the Federal Emergency Management Agency (FEMA) to include virtually all of Natomas within the bounds of the newly mapped 100-year flood plain in Sacramento. Only about 13 percent of the lands in the basin (7,140 acres) have been developed for urban use.

Although this development is concentrated in the southern portion of Natomas, the most feasible way to protect the people and property occupying the area is by improving the existing perimeter levee system along with the detention dam as proposed under the selected plan. However, as discussed in the Main Report, these levee improvements would increase the level of flooding in several areas east of Natomas by containing tributary streamflows which would otherwise reach the basin. Therefore, the selected plan includes hydraulic mitigation features at the mouths of Dry and Arcade Creeks and in the vicinity of Sankey Road. Although these areas are outside the perimeter levee system, they have been included as part of the Natomas area for purposes of evaluating the direct impacts of the project.

Moreover, since the selected plan would remove all of the areas inside the perimeter levees from the new 100-year flood plain (except minor local drainage areas), and would thus indirectly facilitate more intense urban development throughout the basin, the following Natomas subareas have been created in order to assess this growth-inducing potential and identify the impacts related to it:

- City Community Plan Areas. This portion of Natomas includes the South and North Natomas community plan areas. The South Natomas area is bounded by the NEMDC and the American River on the east and south and by I-80 on the west and north. The North Natomas area is bounded on the east by the city limit which runs parallel to Northgate Boulevard, on the north by Elkhorn Boulevard, on the west by the West Drainage Canal and El Centro Boulevard, and on the south by I-80.

- Unincorporated North Natomas (Sacramento County). This area includes all portions of the Natomas basin located south of the Sacramento-Sutter County line, north of I-80, and outside the City's North Natomas community plan area.

- South Sutter County. This area includes all portions of the Natomas basin located north of the Sacramento-Sutter County line.

These subareas are shown in Figure 4-1. Existing land uses for each subarea are shown in Table 4-1. These data are based on a flood plain inventory completed by the Corps' Sacramento District office.

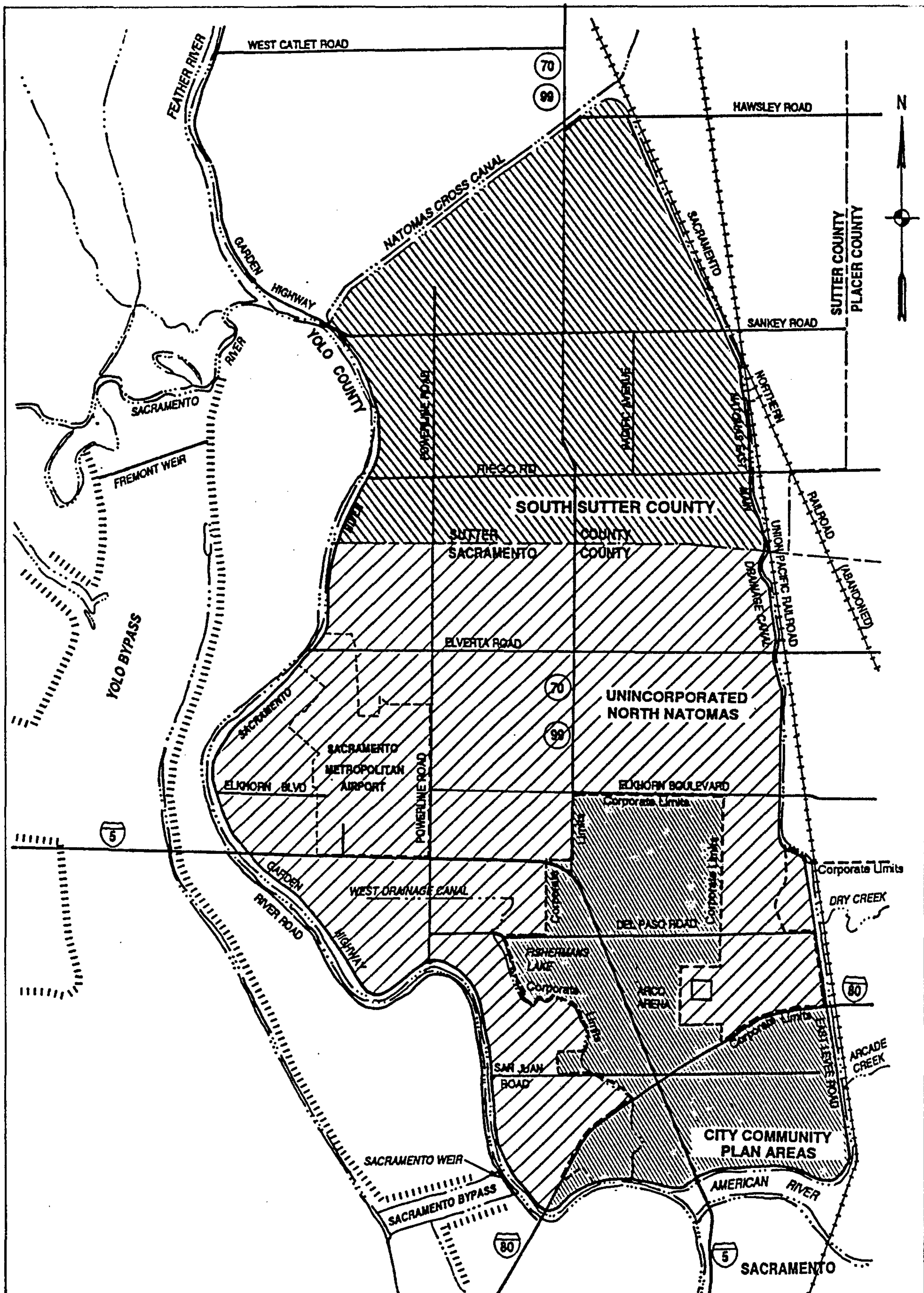

FIGURE 4-1. Natomas Subareas

TABLE 4-1. Natomas Area Existing Conditions, in Acres (1990)

Natomas Subarea	Residential[1]	Commercial[2]	Industrial[3]	Public[4]	Agricultural/ Vacant[5]	TOTAL
City Community Plan Areas	1,692	438	19	791	8,302	11,242
Unincorporated North Natomas	180	90	90	2,860	23,378	26,598
South Sutter County	390	195	195	200	16,062	17,042
TOTAL	2,262	723	304	3,851	47,742	54,882

1 "Residential" includes single-family homes, mobile homes, and multi-family structures such as apartment complexes and condominiums.
2 "Commercial" includes all retail outlets, hotels, and privately-owned offices.
3 "Industrial" includes all manufacturing plants, research and engineering facilities, warehouses, business parks, and construction yards.
4 "Public" includes actual public structures such as schools, hospitals, parks, public offices, police and fire stations, golf courses, utilities, military installations, churches, recreation clubs, and airports.
5 "Agriculture" includes agricultural lands, orchards, and farm buildings. "Vacant" includes all vacant lands and open space not in agricultural use.

The predominant land use in Natomas is agriculture/vacant (47,742 acres). Other uses include Sacramento Metropolitan Airport (2,800 acres), commercial/industrial development (807 acres), residential development (2,262 acres), a sports complex (220 acres), and public lands--excluding the airport--(1,051 acres). Residential development is concentrated in the southeastern portion of the basin east of I-5 and south of I-80. Other developed areas include Metro Airport, Natomas Air Park, the Natomas Sewage Treatment/Pumping Station, Arco Arena and Stadium, and Northgate industrial area, together with regional transportation corridors.

Existing local plans for the City community plan areas, comprising a total of 11,242 acres, anticipate substantial residential and commercial development by the year 2010. As discussed below, however, local regulations effectively preclude any residential development in these areas until November 1992. Development after that time will depend on Federal action to control floodflows in the American River.

Roughly 75 percent of the 26,598 acres comprising the unincorporated North Natomas area is currently designated for agricultural use under the existing Sacramento County General Plan. The County is currently updating this plan; however, the draft update contemplates only modest urban growth in this area from 1992 through the year 2030.

The south Sutter County portion of Natomas covers 17,042 acres, 95 percent of which is currently designated for agricultural use under the County's existing general plan. The County is contemplating a general plan amendment which would permit extensive residential, commercial, and other urban development covering 68 percent (11,954 acres) of the area.

LOWER AMERICAN RIVER

The largely urban lower American River area constitutes the other half of the flood plain portion of the study area. This area is protected from flooding by Folsom Dam and the levees running along both banks of the lower American River. As in Natomas, new hydrologic data have caused FEMA to downgrade the protective capability of this system and to place most of the lower American River area in the remapped flood plain. As shown in Figure 4-2, affected lands include the American River Parkway and the five urban subareas listed below:

- Dry Creek. The area bounded by Sankey Road to the north, the Sutter-Placer County line to the east, Dry Creek on the south, and the NEMDC on the west.

- North Sacramento. The area bounded by Arcade Creek on the north; Watt Avenue, Ethan Way, and Cal Expo race track on the east; the American River to the south; and the NEMDC to the west.

- South Sacramento. The area bounded by the American River to the north, Bradshaw Road to the east, the flood limit boundary to the south, and the Sacramento River to the west. This subarea includes the Pocket and Airport/Meadowview areas in the City of Sacramento. The Pocket area consists of a 4-1/2-square-mile area bounded to the north by 35th Avenue and the Sacramento River, to the east by Freeport Boulevard, and to the west and south by the Sacramento River. The Airport/Meadowview area is bounded on the north by a drainage canal north of the Executive Airport, on the east by the Union Pacific Railroad tracks, on the south by the city limit line, and on the west by Freeport Boulevard.

- Rancho Cordova. The area bounded by the American River to the north, Sunrise Boulevard to the east, Kiefer Boulevard to the south, and Bradshaw Road to the west.

Land Use

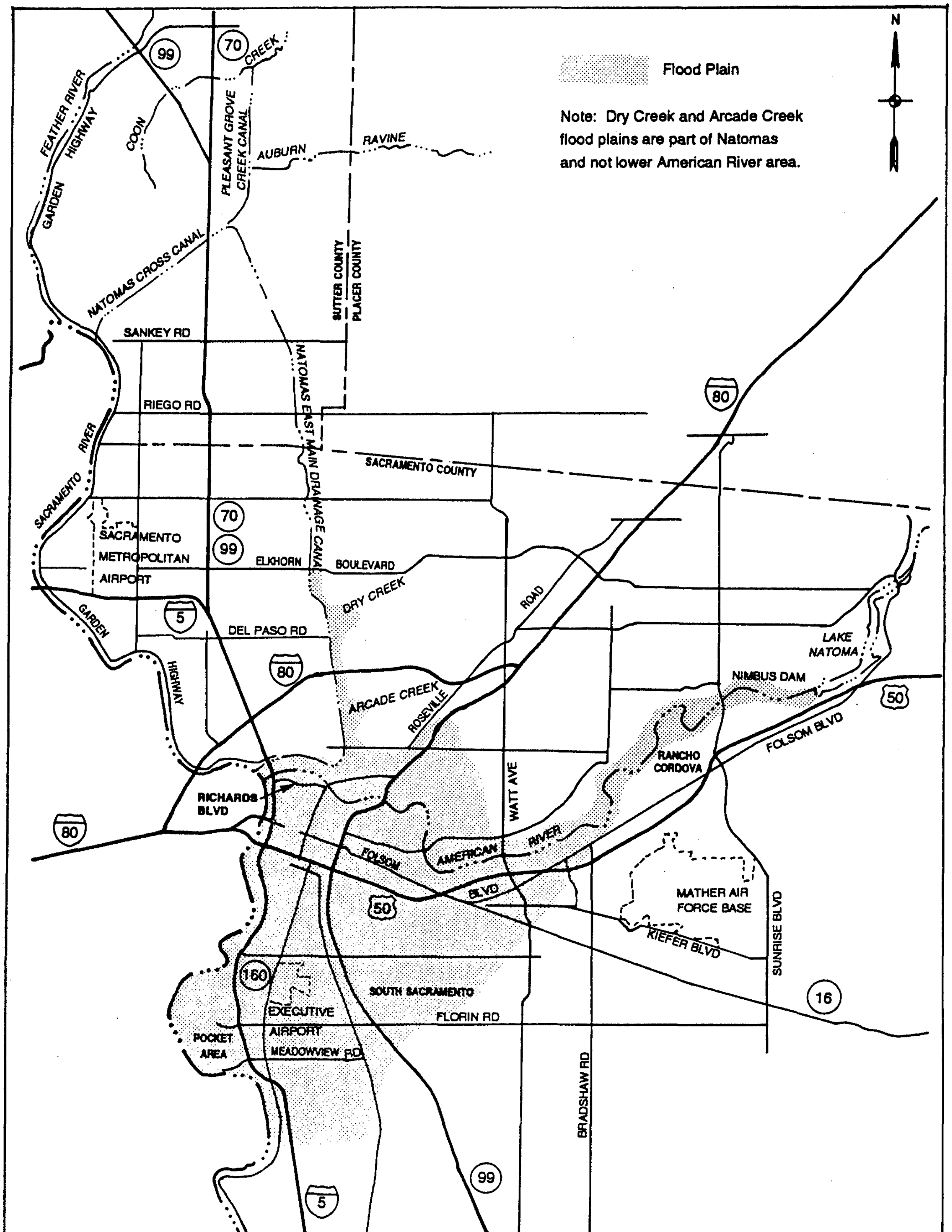

FIGURE 4-2. Lower American River Area

- 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 5,000-acre American River Parkway extends from the confluence of the Sacramento River to Nimbus Dam and is currently owned and managed by the Sacramento County Department of Parks and Recreation. Included in the 5,000 acres are about 350 acres which are considered part of the parkway located near Cal Expo. This property is currently owned by the State of California but managed by the County. An additional 600 acres of the parkway is located between Nimbus and Folsom in the upper 7 miles of the canyon and is being leased by the USBR from the California Department of Parks and Recreation.

While urban development predominates in the lower American River subareas surrounding the parkway, developable vacant land remains in each of the subareas except Richards Boulevard. Some of the vacant land in the south Sacramento subarea lies within the new 100-year flood plain, inside the city limit, and is subject to the City's land use policy discussed below. This policy permits development in these areas without regard to existing base flood elevations (the level likely to be reached by uncontrolled floodwaters in the event of a 100-year storm), provided the developers execute the City's legal notice and waiver documents. Unlike Natomas, base flood elevations are generally moderate throughout the lower American River area, with 1- to 3-foot elevations being common. High base flood elevations do exist in the Pocket area of the City, where they reach 11 feet, and in the Airport/Meadowview area south of Florin Road and west of the Union Pacific Railroad, where they reach 6 feet. It is believed that even if the lower American River area is not removed from the flood plain, new development could proceed on vacant lands in the areas of moderate flood depth by elevating new structures above or otherwise flood proofing them to the base flood level.

Existing land uses for the lower American River subareas are shown in Table 4-2.

UPPER AMERICAN RIVER

As shown in Figure 4-3, the upper American River area encompasses portions of Placer and El Dorado Counties and includes the lands within and immediately around the damsite near Auburn ("canyon area") and the lands occupied by the surrounding

TABLE 4-2. Lower American River Area Existing Conditions, In Acres (1990)

Lower American River Subareas	Residential	Commercial	Industrial	Public	Agricultural/ Vacant	TOTAL
North Sacramento	4,760	445	50	45	600	5,900
South Sacramento	28,530	2,870	400	6,595	5,905	44,000
Dry Creek	2,220	60	20	500	3,000	5,800
Rancho Cordova	1,483	104	20	60	2,533	4,200
Richards Boulevard	60	540	105	295	0	1,000
TOTAL	37,053	3,719	595	7,495	12,038	60,900

communities. The canyon area consists of about 42,000 acres of land ranging from gently sloping to extremely steep land in the canyons along the Middle and North Forks of the American River and includes the site of the USBR's authorized multipurpose Auburn Dam. Most of the property within the canyon area (26,100 acres) is owned by USBR. These lands are managed by the State Department of Parks and Recreation (DPR) as part of the Auburn State Recreation Area (ASRA) under a contract with USBR. Recreational use of these lands is restricted by terrain, lack of off-road parking, and road access to river facilities. Despite these limitations, the DPR estimates informal recreational use within the ASRA at 550,000 visitor days annually. Most activity occurs within the river and on the river bars. Limited portions of the canyon area (about 11,000 acres) are under the ownership of the Bureau of Land Management or U.S. Forest Service. The remainder of the area (about 5,000 acres) consists of isolated, privately owned parcels.

The communities surrounding the canyon area, including Auburn, Cool-Pilot Hill, Greenwood, Garden Valley, Georgetown, and Lotus-Coloma, have generally experienced growth significantly higher than statewide averages. The primary stimuli for this growth have been the attraction of rural and scenic settings, recreational and scenic attributes, mild climate, availability and price of homesites, and relative proximity to major employment centers. Major constraints to growth vary by subarea and include water supply and conveyance limitations, sewage service and septic tank suitability, lack of access and transportation capacity, slope and soil conditions, and zoning

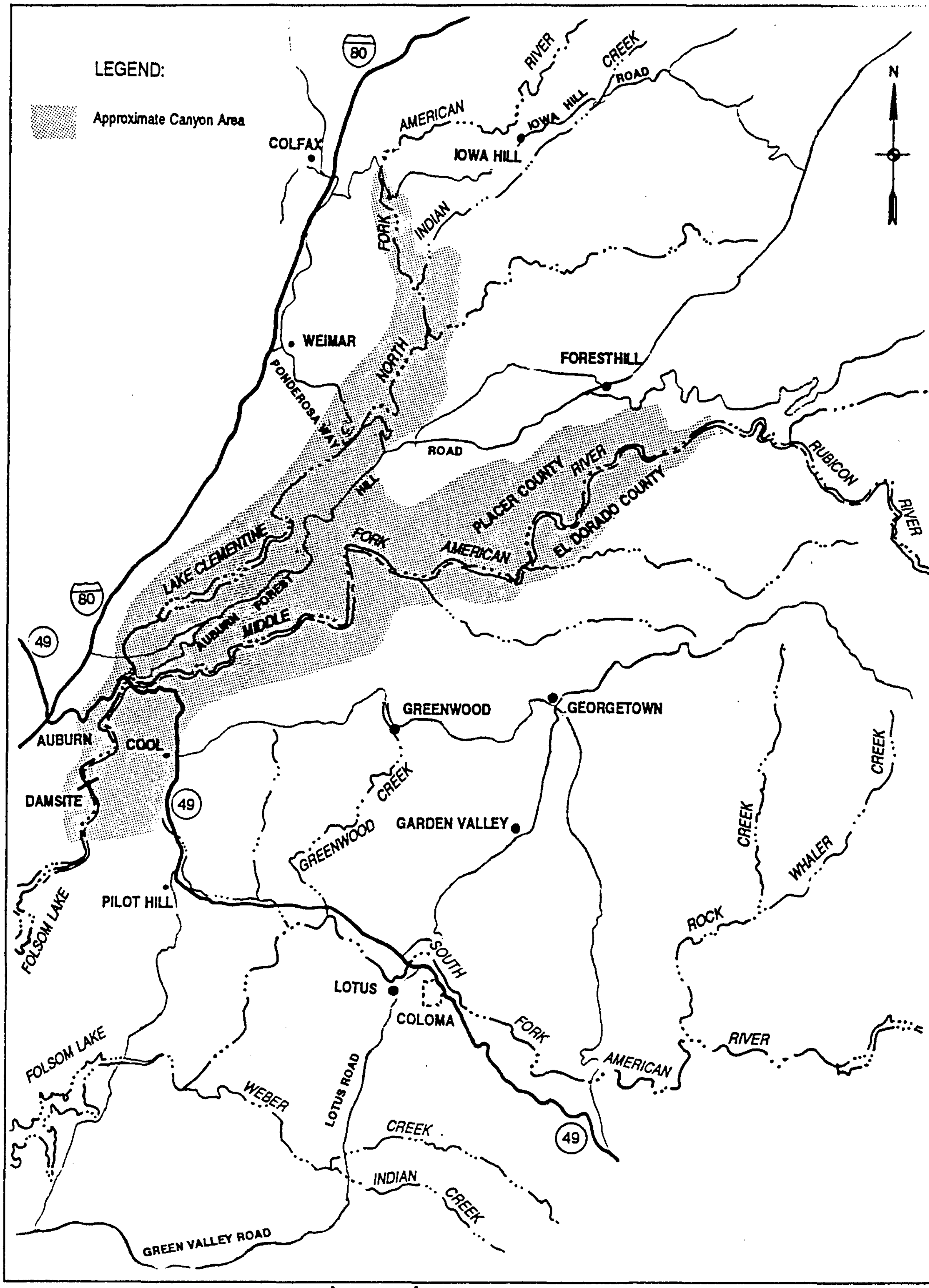

FIGURE 4-3. Upper American River Area

restrictions. Higher intensity urban uses are concentrated primarily in the Auburn Area. The predominant land uses within the remainder of the study area are low-density residential, rural residential parcels (improved and unimproved), forest and recreation, open space and conservation, and nonintensive agriculture and grazing land. Additional discussion is presented in the Land Use Appendix (Appendix E).

LEGISLATIVE AND REGULATORY BACKGROUND

Land use projections for the study area were significantly affected by the specific legislative and regulatory conditions governing development in the 100-year flood plain, ownership and use of the lands in the canyon area surrounding the Auburn Dam site, and the manner in which Highway 49 may be replaced. These specific conditions are discussed below.

NATOMAS/LOWER AMERICAN RIVER

Prior to 1986, the Sacramento area was generally thought to be protected from at least a 120-year flood by Folsom Dam, the Sacramento and American River levees, and the system of levees and canals extending around the perimeter of the Natomas basin. Following the flood of 1986, however, FEMA directed the Corps to evaluate the stability of the Sacramento River levees and reanalyze the area's general level of flood protection.

The Corps subsequently determined that portions of the Sacramento River levee were, in fact, unstable and might not withstand flows generated by a 40-year or greater storm in the Sacramento River watershed. The Corps further concluded that Folsom Dam and the levee system protecting lands within the American River flood plain, including Natomas, provided the area with no more than about a 70-year level of flood protection. Finally, it was determined that the levees and canals surrounding the Natomas basin provided less than a 100-year level of protection from uncontrolled flows in Dry and Arcade Creeks and from floodwaters in the Pleasant Grove Creek area.

This reevaluation of the flood plain resulted in changes to applicable base flood elevations and caused a larger portion of the Sacramento area to be mapped within the 100-year flood plain. However, special legislation enacted by Congress in 1988 restrained FEMA from using the new elevations for regulatory purposes and directed the agency during the ensuing 4-year period to administer the National Flood Insurance Program in Sacramento based on the elevations existing prior to the Corps' effort. In adopting this special legislation, Congress recognized that use of the new base flood elevations to manage development in the flood plain could cause severe economic disruption in the Sacramento region and potentially undermine the area's ability to carry out an effective flood protection effort.

In response to the special legislation, FEMA promulgated new Flood Insurance Rate Maps for the Sacramento area showing the new boundaries of the 100-year flood plain, but without indicating base flood elevations. The bounded area was designated as an "A-99" flood zone. This designation essentially means the area is subject to a 100-year flood event; however, measures are under way to remove the area from the 100-year flood plain. These rate maps became effective on November 15, 1989.

For their part, the City and County of Sacramento have given assurances to Congress that, during the 4-year period covered by the special legislation, areas lying within the new 100-year flood plain which are designated for agricultural use under existing general plans will not be redesignated for any urban use. In addition, the City has adopted a local land use planning policy applicable to all development in the flood plain. This policy permits development in the lower American River area subject to certain notice and waiver requirements. In Natomas, however, all residential structures must be elevated above FEMA's new base flood elevations. Since these elevations range from 15 to 23 feet in the South Natomas and North Natomas community plan areas, the City's policy effectively imposes a moratorium on residential construction in these areas. Commercial structures need not be elevated but must be designed either to keep floodwaters out below the base flood elevation or permit the water to enter the structure in such a manner as to avoid structural collapse. This land use planning policy will remain in effect until the levees along the east bank of the Sacramento River have been stabilized.

Since the necessary levee stabilization work will probably not be completed until the end of 1992, it is doubtful that any residential construction will proceed in Natomas prior to the expiration of the special legislation. Thus, the prospects for future growth in Natomas will be determined in October 1992, when it is anticipated that Congress will complete its deliberations on the American River Watershed Investigation. Assuming the project is authorized, Congress could extend the special legislation until construction of the flood control dam is completed. Alternatively, Congress could authorize the Corps to increase the space seasonally allocated to flood storage at Folsom Reservoir until replacement flood storage is available at

Auburn. This would permit FEMA to administratively formalize the A-99 zone designation in Natomas and remove the lower American River area from the 100-year flood plain. FEMA has indicated that it could take these steps if the following conditions are met:

- o Completion of stabilization work on the Sacramento River levee.
- o Authorization of a project providing permanent, comprehensive flood protection on the American River.
- o Reoperation of Folsom Reservoir to provide a 100-year (FEMA) level of flood protection until the comprehensive project is completed.
- o Initiation of the levee improvements needed in Natomas on an expedited basis.

Under all of the with-project scenarios discussed in this chapter, it is assumed that the selected plan will be authorized by November 1992 and that the remaining FEMA conditions will be fulfilled, or the special legislation extended, to permit development to proceed in all areas of the flood plain. Accordingly, even though construction of the flood control dam would not be completed until the year 2002, the baseline year for identifying growth attributable to the project is assumed to be 1992.

UPPER AMERICAN RIVER

The flood control dam is designed to occupy an area immediately adjacent to the site of the currently authorized multipurpose Auburn Dam project. The multipurpose project area covers about 42,000 acres around the damsite, most of which is owned by agencies of the Federal Government as part of, or in connection with, the multipurpose authorization. Construction and operation of the flood control dam would require that about 6,000 acres of the land in Federal ownership be acquired. Acquisition of these lands would be a State responsibility. This could be a complicated process, particularly if, as a consequence of authorizing the flood control dam, Congress deauthorized the existing multipurpose project and transferred the lands held under that project into private ownership. Such transfers could also make any future governmental development of the resources in the canyon area more difficult by permitting conflicting land uses to be established. Thus, for purposes of this analysis, it is assumed that authorization of the flood control project would not necessarily trigger deauthorization of the multipurpose project and that the lands in the canyon area currently held in public ownership would remain in that status.

The Corps has identified an in-kind, in-place replacement of Highway 49, along the existing alignment at river mile 23.0. It is recognized, however, that replacement of the highway will be a State responsibility. In this regard, Section 75 of the California Streets and Highways Code empowers the California Transportation Commission to "select, adopt, and determine the location for State highways on routes authorized by law." Highway 49 falls within this legislative provision, and the Transportation Commission, through Caltrans, has determined that a route adoption study, including environmental clearance and Transportation Commission approval, must be undertaken.

The route adoption study may result in a Highway 49 replacement constructed by the State of California which is significantly different in width and alignment from the replacement included in the selected plan. Engineering and environmental analyses separate from the Federal project will be required for the State's preferred replacement. A description of the alternative alignments which may be considered in this regard is contained in Chapter 17 (Cumulative Impacts) along with a discussion of the direct impacts which could result from each identified alignment. Chapter 18 (Growth-Inducing Impacts) contains a discussion of the indirect impacts which could result from adoption of one of these routes.

IMPACTS

SIGNIFICANCE CRITERIA

Project-induced land use impacts are considered significant if, under worst-case circumstances, the project would cause a substantial long-term disruption of an existing or reasonably foreseeable future land use.

METHODOLOGY

Federal regulations establish the period of analysis for Federal projects as the lesser of (1) the period of time over which any alternative plan would have significant beneficial or adverse effects, or (2) a period not to exceed 100 years. The economic and environmental analyses performed for the ARWI were generally based on a 100-year period extending to the year 2100. However, because the project would produce different land use impacts in each portion of the study area, and because these impacts could not be reliably projected over the assumed period of analysis, different scenarios were created to evaluate the land use changes which could occur as a result of the project.

Natomas

In the Natomas area, the project would protect about 55,000 acres, only 7,140 of which are currently in urban use. Local plans regarding the remaining acreage are in flux. Accordingly, three different land use scenarios were created for the with-project condition. Project cost/benefit calculations and indirect environmental impact assessments were based on a scenario which assumed that development would occur as anticipated under the adopted general plans of the City of Sacramento, Sacramento County, and Sutter County, each of which controls land use in a portion of Natomas. Development forecasts under these plans generally cover about a 20-year period through the year 2010. These forecasts anticipate that, between 1992 and 2010, 7,913 acres currently in agriculture or open space will be converted to urban use. Under the adopted general plan scenario, this threshold of development was assumed to remain constant for the remaining years of the period of analysis.

Given the limited timeframe of existing local plans and the likelihood that Sutter and Sacramento Counties will revise their general plans to permit a wider scope of urban development in Natomas, a modified local plan scenario was also created to provide an alternative assessment of the growth-inducing potential of the project. Under this scenario, the land use projections contained in adopted local plans were adjusted to include development proposed under general plan modifications now being considered by both the Sutter County and Sacramento County Boards of Supervisors. The resulting projections cover about a 40-year period and anticipate that, between 1992 and 2030, 23,829 acres currently in agriculture or other open space will be converted to urban use. Under the modified local plan scenario, this threshold of development was held constant for the remaining period of analysis. These projections were used to assess the indirect impacts that could occur as a result of the project in the south Sutter County portion of Natomas and in the unincorporated area of Sacramento County. This assessment appears in Chapter 18 (Growth-Inducing Impacts).

Finally, for comparison, a maximum-growth scenario was created for the with-project condition in Natomas based on projections of development far beyond the scope of any existing or contemplated local plans. Under this scenario, which covers about a 50-year period, it was assumed that, between 1992 and 2045, 39,426 acres currently in agriculture or other open space would be converted to urban use. This was considered "full buildout" of the area based on combining an asumed increment of population growth with current land uses and densities.

For the without-project condition in Natomas, the adopted general plan scenario assumed that control of floodflows in the American River would remain at present levels, leaving virtually the entire Natomas basin in the 100-year flood plain. High base flood elevations combined with stringent local and Federal flood plain management regulations would cause regional growth to shift to other parts of the Sacramento metropolitan area. As a result, virtually no growth would occur in Natomas beyond the base year 1992. These assumptions were also used in developing the modified local plan scenario.

Under the maximum growth scenario, on the other hand, it was assumed that even without the project, significant development would occur in Natomas based on local construction of cross and ring levees and approval of flood-proofed commercial projects. This growth would reduce the net development attributable to the project in Natomas to about 23,000 acres, roughly the same amount as the net development projected under the modified local plan scenario. This maximum-growth scenario was used by the U.S. Fish and Wildlife Service (FWS) to assess indirect impacts on fish and wildlife resources. This assessment is discussed in Chapter 7 (Fish, Vegetation, and Wildlife).

Lower American River

In the heavily developed lower American River area, the project would protect about 60,000 acres, 75 percent of which are currently in urban use. Existing local plans anticipate that over 90 percent of the area will be in some form of urban use by the year 2010. This projection was used for all assessments of land use changes in this portion of the project area under the with-project condition.

For the without-project condition, the adopted general plan scenario assumed that urban development would proceed generally as planned. However, high base flood elevations and stringent flood plain management regulations would preclude development in the Meadowview area south of Meadowview Road, accounting for about 20 percent of the lands in the lower American River area anticipated to develop under existing local plans. This assumption was also used in developing the modified local plan scenario. Under the maximum-growth scenario, however, it was assumed that development would proceed in all portions of the lower American River area at the same rate and magnitude as contemplated under existing plans.

Upper American River

In the upper American River area, it was assumed that authorization of the flood control project would not cause Congress to dispose of the lands which are currently held under USBR's multipurpose Auburn Dam authorization, but which would not be needed for the flood control project. These lands would remain in governmental ownership and would continue to be managed for recreational purposes pending a final determination of how the resources in the canyon area will be developed.

With respect to replacing Highway 49, the economic and environmental analyses prepared for the project were based on the in kind/in place replacement proposed under the selected plan. This alignment would have no significant effect on existing traffic patterns or related regional growth trends. Accordingly, the timing and magnitude of urban development in the upper American River area would be the same with or without the project.

NO-ACTION ALTERNATIVE

The no-action alternative constitutes the without-project condition.

Flood-Related Damages

Failure by the Federal Government to take action to control floodflows in the American River would expose the Natomas and lower American River areas to a substantial long-term risk of flooding. Present estimates are that Folsom Dam and the lower American River and Natomas levee systems can withstand no more than about a 70-year flood. Accordingly, under the no-action alternative, a rainstorm larger than a 70-year event could produce devastating short-term and long-term land use impacts throughout the flood plain. Immediate impacts would include damage to, and in some cases complete destruction of, existing residential/commercial and public property in the flood plain; contamination of flood plain lands resulting from flood-induced releases of hazardous and toxic wastes; and massive deposits of flood-borne debris on lands throughout the flood plain. These impacts would result in widespread disruption of existing land uses on both a short-term and long-term basis and would produce profound adverse effects on the economic, social, and political life of the community.

<u>**Growth and Development**</u>

With respect to growth and development, the following assumptions were made to develop land use projections for the Natomas and lower American River areas under the without-project condition.

- The Federal Government would take no action during the period of analysis to increase the existing level of flood protection along the American River.

- Without Federal action, the conditions necessary to proceed with development in all areas of the flood plain could not be fulfilled. Following expiration of existing special Federal legislation in November 1992, all new development in the 100-year flood plain would have to comply with applicable local and Federal flood plain management regulations using FEMA's new base flood elevations. Under these conditions, new development would be severely constrained in areas where the base flood elevation is 5 feet or greater. As shown in Figure 4-4, the affected areas would be virtually all of Natomas, the southern portion of the Meadowview area of the City, and small portions of the Pocket area of the City.

- In the remaining areas of the 100-year flood plain, where base flood elevations range from 1 to 3 feet, new development would continue in accordance with existing local plans.

- All other portions of the lower American River area (outside the 100-year flood plain but within the 400-year flood plain) would continue to develop as planned. These areas would absorb some of the development constrained in the 100-year flood plain, with the balance being absorbed elsewhere in the region.

<u>**Natomas**</u>. Based on the above assumptions, virtually no growth would occur in Natomas after 1992. This scenario recognizes that protecting the Natomas basin from flooding is integrally linked to controlling floodflows in the American River, a task requiring action by the Federal Government. Without such action, Natomas would remain in the 100-year flood plain, and high base flood elevations combined with stringent flood plain management regulations would effectively preclude

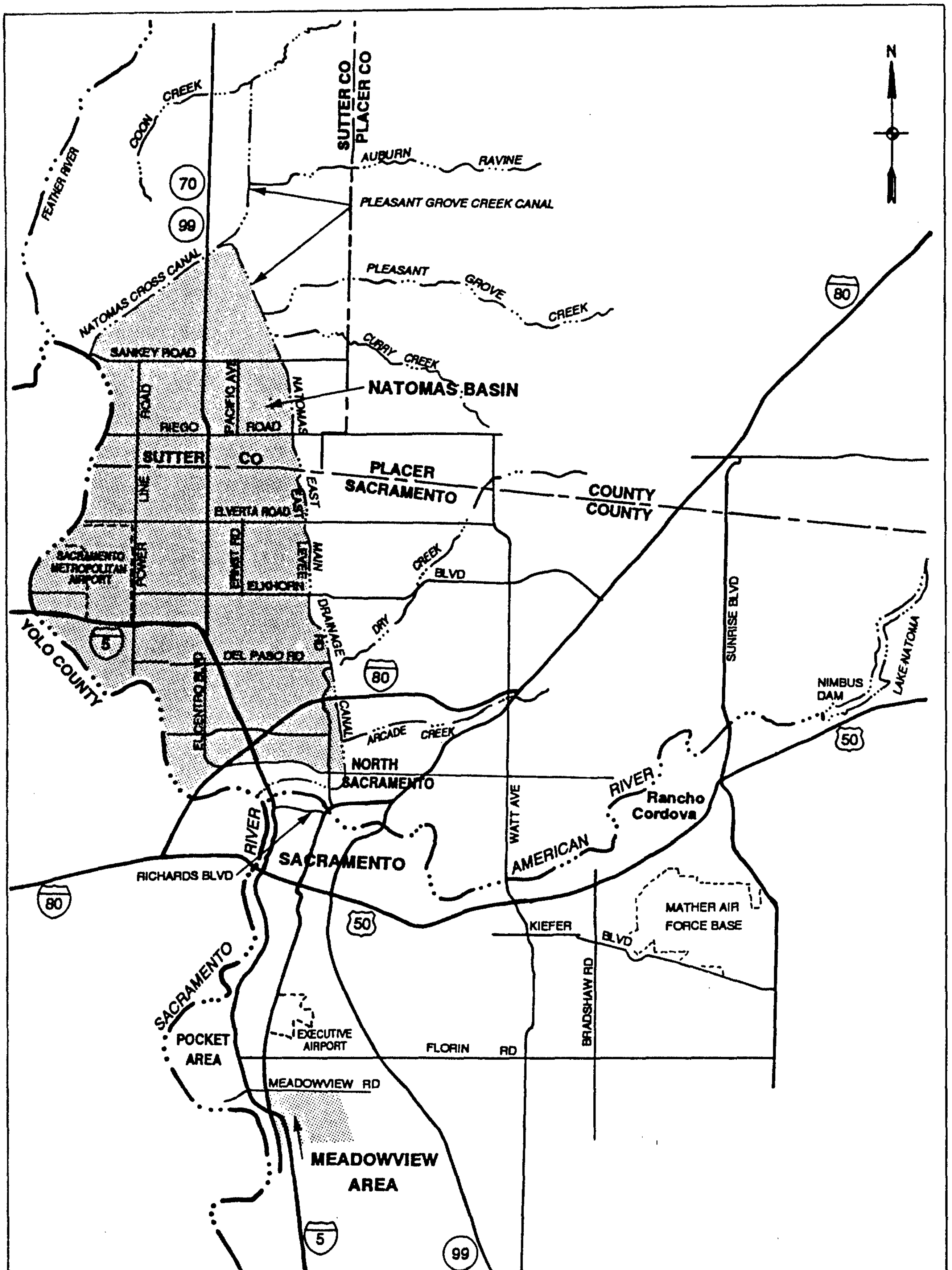

FIGURE 4-4. Areas Where Growth is Unlikely to Occur Without the Project

development. Undoubtedly, it would be possible to protect portions of the basin by means of cross or ring levees. However, there would be no shortage of land outside the flood plain to accommodate the regional growth projected for Natomas. Therefore, it was assumed that rather than seek local solutions to the flood problem, the affected local agencies would respond to the Federal Government's no-action policy by altering their general plans to focus on development outside the flood plain.

Without-project land uses for each Natomas subarea are presented in Table 4-3. These projections were used for both the adopted general plan and the modified local plan scenarios. A more detailed breakdown of these projections is presented at the conclusion of the Land Use Appendix (Appendix E).

TABLE 4-3. Natomas Area - Without Project, Adopted General Plan Scenario

TOTAL ACREAGE - 54,882						
Natomas Subareas	**All Urban Uses Combined**			**Agriculture/Vacant**		
	1992	**2100**	**Change**	**1992**	**2100**	**Change**
City Community Plan Areas	3,060	3,060	0	8,182	8,182	0
Unincorporated North Natomas	3,220	3,220	0	23,378	23,378	0
South Sutter County	980	980	0	16,062	16,062	0
TOTAL	7,260	7,260	0	47,622	47,622	0

Under the maximum growth scenario, it was assumed that even without Federal action to control flows in the American River, 16,512 acres in Natomas would be newly developed. This level of development would be achieved based on the following assumed local actions: First, Sutter County would construct a cross levee at the Sacramento-Sutter County line, thus protecting the south Sutter County portion of Natomas from American River floodflows entering the basin via the NEMDC. Spot improvements along the Pleasant Grove Creek and Natomas Cross Canals would further protect the area from Sacramento River floodflows and flows from the tributary streams east of Natomas. This would remove south Sutter County from the 100-year flood plain and permit the area to develop as contemplated in the County's proposed general plan amendment. Second, the City and County of Sacramento would permit flood-proofed commercial development in the eastern portion of the basin along the NEMDC where base flood elevations average about 10 feet. Third, Sacramento County would proceed with a ring levee around the Sacramento Metropolitan Airport, allowing for planned expansion of the airport and development for adjacent commercial and industrial uses. Table 4-4 presents the land use projections which flow from these assumptions.

TABLE 4-4. Natomas Area - Without Project, Maximum Growth Scenario

TOTAL ACREAGE - 54,882						
Natomas SubAreas	**All Urban Uses Combined**			**Agriculture/Vacant**		
	1992	**2100**	**CHANGE**	**1992**	**2100**	**CHANGE**
City Community Plan Areas	3,060	3,460	400	8,182	7,782	-400
Unincorporated North Natomas	3,220	8,358	5,138	23,378	18,240	-5,138
South Sutter County	980	11,954	10,974	16,062	5,088	-10,974
TOTAL	7,260	23,772	16,512	47,622	31,110	-16,512

__Lower American River__. Most of the lower American River area is already developed, and the remainder is anticipated to build out in accordance with the existing City and County general plans between 1992 and 2010. Much of the area to be developed during this period is located in portions of the flood plain where base flood elevations are minimal (1-3 feet). Accordingly, it was assumed that these areas would develop whether or not the project is authorized.

However, a small portion of the undeveloped land remaining in the lower American River area (about 1,400 acres) is located in the Meadowview area of the City south of Meadowview Road. This area comprises the southernmost reach of the flood plain and is currently open space. Base flood elevations in this area exceed 5 feet. It was assumed that without the project these elevations, combined with stringent local and Federal flood plain management regulations, would make development as contemplated under the City's existing general plan infeasible. Similarly, high base flood elevations would also make it infeasible to proceed with planned development in small portions of the Pocket area of the City (approximately 120 acres altogether).

As a result, under the without-project condition, between 1992 and 2010 urban uses in the lower American River area would grow by 6,045 acres from a base of 46,753 to a total of 52,798. This level of development would be about 1,500 acres less than the projected local plan buildout total of 54,353 acres, with the difference being attributable to the lands in the Meadowview and Pocket areas left vacant by inadequate flood protection.

The land use projections for the without-project condition in the lower American River area are presented in Table 4-5. These projections were used to create both the adopted general plan and the modified local plan scenarios. A more detailed breakdown is presented at the conclusion of Land Use Appendix (Appendix E).

TABLE 4-5. Lower American River Area - Without Project, Adopted General Plan Scenario

Lower American River Subarea	All Urban Uses Combined			Agriculture/Vacant		
	1992	2100	Change	1992	2100	Change
North Sacramento	5,342	5,527	187	558	371	-187
South Sacramento	37,944	43,478	5,534	7,056	1,522	-5,534
Dry Creek	2,800	2,800	0	3,000	3,000	0
Rancho Cordova	1,667	1,991	324	2,533	2,203	-330
TOTAL	47,753	53,798	6,045	13,147	7,102	-6,045

Under the maximum growth scenario, it was assumed that even without the project, growth would proceed in all portions of the lower American River generally in accordance with adopted local plans. High base flood elevations would make it impossible to proceed with some residential development. However, these residential projects would likely be replaced by flood-proofed commercial projects so that the total acreage developed under this scenario would be virtually the same as the 54,353 acres projected under existing local plans. As a result, there would be no net difference between the with- and without-project conditions.

<u>Upper American River</u>. Without a flood control project at Auburn, regional growth in the upper American River area would

continue in Placer and El Dorado Counties in accordance with each County's adopted general plan. The land previously acquired by the USBR for the authorized multipurpose Auburn Dam would remain in public ownership.

SELECTED PLAN

This alternative assumes that a 200-year peak flood control dam would be constructed in the upper American River area and that levee improvements would be constructed in Natomas to provide this area with the same level of protection as the rest of the American River flood plain.

Direct Impacts

Natomas. The selected plan would produce short-term land use compatibility impacts during construction of the proposed levee improvements in Natomas. These impacts would include:

- Transportation disruptions due to construction-related detours and temporary levee access, staging, and construction activities.
- Increased noise and general nuisance resulting from operation of heavy-duty construction equipment.

These impacts are more likely at improvement sites located near existing urbanized areas, including the southern portions of the NEMDC levees, the Dry Creek north and south levees, and the Arcade Creek levee sites. The extent and significance of these short-term impacts are assessed as part of the Natomas direct impact discussion in the appropriate succeeding chapters of this report (transportation, noise, etc.).

The selected plan would produce long-term land use impacts at the borrow site south of the airport, along the approaches to the Main Avenue Bridge, and in the Dry Creek area.

Excavation of the proposed borrow site for the levee improvement work would disrupt the existing agricultural land use and would significantly alter the agricultural productivity of the site if excessive amounts of topsoil are removed. Under a worst-case scenario, 125 acres of productive agricultural land would be lost. Assuming all of this land qualified as "prime" farmland, this would represent a loss of less than 1 percent of this category of land currently remaining in Natomas, but would contribute to the significant cumulative loss of prime farmland discussed in Chapter 10 (Agriculture/Prime and Unique Farmlands).

With respect to the Main Avenue Bridge relocation, approaches to the proposed new high-level single-span bridge over the NEMDC and railroad tracks would require retaining walls to reduce encroachment onto adjacent developed properties. These walls would eliminate several existing access points from Main Avenue and Del Paso Boulevard to adjacent businesses, thereby permanently disrupting existing land use patterns. This is considered a significant land use impact.

In the Dry Creek area, assuming that the north levee alignment would follow Ascot Avenue, this roadway would be relocated vertically to the top of the new levee, thereby eliminating access to existing residences from Ascot Avenue. Furthermore, the new levee would require some acquisition of lands along Ascot Road in the vicinity of West 2nd Street. These access and acquisition impacts would produce substantial long-term disruptions of existing land uses and would thus be significant.

In the northeast corner of Natomas, inclusion of a detention facility to mitigate hydraulic impacts to property and structures in the Pleasant Grove Creek area would conflict with land uses identified in the South Sutter County General Plan Amendment (GPA) released for consideration on July 31, 1991. This would be a potentially significant impact.

Lower American River. The selected plan would not cause any direct land use impacts in the lower American River

Upper American River. In the upper American River area, 6,023 acres would be required to construct, operate, and maintain the proposed flood control dam and related facilities. The vast majority of this land is owned by the Federal Government as part of the authorized multipurpose Auburn Dam project. Real estate acquisition, which is the responsibility of the State, is discussed in the Real Estate Appendix (Appendix O).

Construction of the dam would have unavoidable short-term impacts on existing recreational uses in the area between the confluence of the North and Middle Forks and the damsite. The completed structure would permanently obstruct movement between points along the Middle Fork of the American River above and below the damsite. Inundation of the canyon would occur only in connection with large rainstorms during the winter flood season when recreational use of the Middle and North Fork canyons would be minimal. Nevertheless, inundation-related erosion could damage existing roads and trails and thus adversely affect recreational access to the canyons. Damage sufficient to substantially reduce or eliminate use of any major road or trail would constitute a significant impact.

Replacement of Highway 49 and Ponderosa Way would cause short-term disruptions of through-canyon traffic, temporarily reducing recreational access to the upper American River. More importantly, abandonment of the existing Highway 49 alignment would substantially reduce access to the river on a long-term basis. This would be a significant impact.

Under the selected plan, the flood control dam would be designed to be neutral regarding any reasonably foreseeable long-term use of the canyon area, including recreation and water and power development. Construction and operation of the dam would thus have no significant impact on any of these uses. Mitigation requirements of the selected plan include acquisition of 5,385 acres of land on the South Fork American River. (See Section "Socioeconomic Impacts of Mitigation Land" in Chapter 15, Socioeconomics, for a discussion of impacts.)

Indirect Impacts

Natomas. As discussed above, three with-project scenarios were developed for the Natomas area: the adopted local plan scenario, the modified local plan scenario, and the maximum-growth scenario. Each scenario assumed that project authorization will occur during the 1992 legislative session and that flood-related constraints on development in Natomas would be removed in connection with this authorization. Accordingly, project-related growth under each scenario was measured using 1992 as the base year.

Under the adopted local plan scenario, between 1992 and 2010 the project would facilitate conversion of 7,913 acres of agriculture/open space to urban uses in accordance with the adopted general plans of the City of Sacramento and Sacramento and Sutter Counties. Thus, it was assumed that the area would grow from a 1992 baseline of approximately 7,260 urban acres to 15,173 acres by 2010. This level of development was held constant for the remaining period of analysis. As shown in Figure 4-5, new development under this scenario would occur in the City's South and North Natomas community plan areas, with a small portion occurring in the unincorporated area of Sacramento County. Existing agricultural uses in the remainder of Natomas would remain as currently designated in existing local plans.

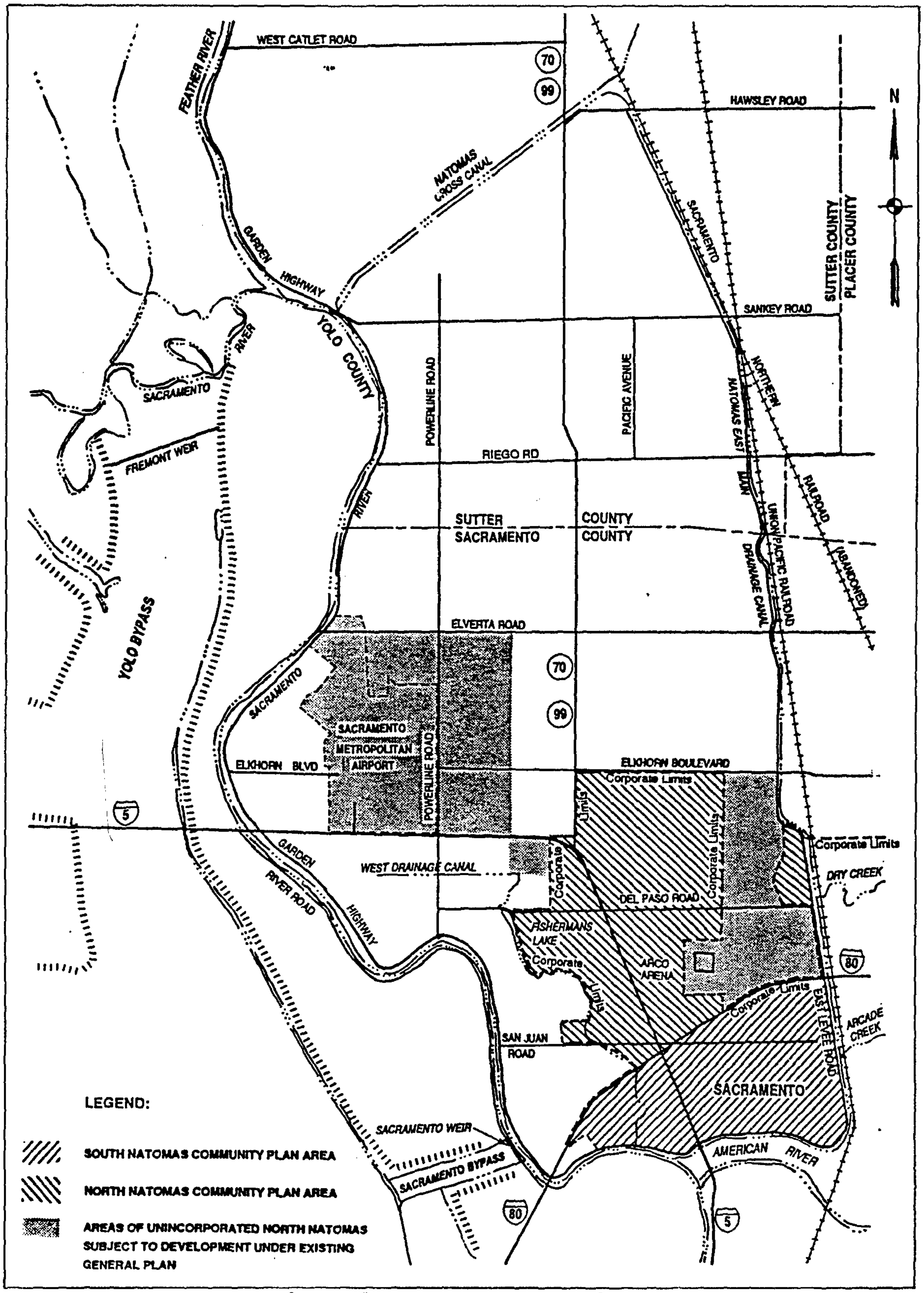

FIGURE 4-5. Areas in Which Development is Likely With the Project (Existing General Plans)

Table 4-6 presents the projections used for the adopted local plan scenario in each Natomas subarea. Since these projections have a relatively high probability of occurrence, they were used as the basis for calculating the flood damage reduction and location benefits attributable to the project in Natomas (see Economics Appendix, Appendix C) and for assessing indirect environmental impacts in the area. This approach avoids any unreasonable inflation of project benefits and is consistent with Federal planning principles and guidelines. A more detailed breakdown of the adopted general plan projections for the with-project condition is presented at the conclusion of the Land Use Appendix (Appendix E).

TABLE 4-6. Natomas Area - With Project, Adopted General Plan Scenario

TOTAL ACREAGE - 54,882						
Natomas Subareas	All Urban Uses Combined			Agriculture/Vacant		
	1992	2100	Change	1992	2100	Change
City Community Plan Areas	3,060	9,037	5,977	8,182	2,205	-5,977
Unincorporated North Natomas	3,220	4,436	1,216	23,378	22,162	-1,216
South Sutter County	980	1,700	720	16,062	15,342	-720
TOTAL	7,260	15,173	7,913	47,622	39,709	-7,913

The modified local plan scenario assumed that between 1992 and 2030 the project would facilitate conversion of 23,829 acres of agriculture/open space to urban uses in accordance with the City's adopted general plan, Sacramento County's proposed general plan update (concept alternative), and Sutter County's proposed general plan amendment. Table 4-7 presents the projections used for this scenario in each Natomas subarea. Because these projections rely to a great extent on unadopted planning documents, they are more speculative than the projections used under the adopted local plan scenario. Accordingly, the modified local plan scenario has been used only as the basis for the qualitative discussion of indirect impacts in unincorporated North Natomas and south Sutter County, which appears in Chapter 18 (Growth-Inducing Impacts).

TABLE 4-7. Natomas Area - With Project, Modified Local Plan Scenario

TOTAL ACREAGE - 54,882						
Natomas Subareas	**All Urban Uses Combined**			**Agriculture/Vacant**		
	1992	**2100**	**Change**	**1992**	**2100**	**Change**
City Community Plan Areas	3,060	9,037	5,977	8,182	2,205	-5,977
Unincorporated North Natomas	3,220	10,098	6,878	23,378	16,500	-6,878
South Sutter County	980	11,954	10,974	16,062	5,088	-10,974
TOTAL	7,260	31,089	23,829	47,622	23,793	-23,829

The maximum-growth scenario assumed that between 1992 and 2045, the project would facilitate conversion of 39,426 acres of agriculture/open space to urban uses. This was considered "full buildout" of the area based on combining an assumed increment of population growth with current land uses and densities. The difference between this scenario and the modified local plan scenario turns on the disposition of lands in the south Sutter County and unincorporated North Natomas subareas. Under both scenarios, substantial development is anticipated in the City's community plan areas. In south Sutter County, however, the maximum-growth scenario assumed more intense development than called for under the County's proposed general plan amendment. More importantly, in the unincorporated North Natomas subarea, the maximum-growth scenario assumed considerably more development than is anticipated under the general plan update being contemplated by Sacramento County. The most ambitious growth alternative proposed as part of the update process would accommodate only a relatively modest amount of growth (6,878 acres) in Natomas over the next 30 to 40 years. The County's approach is largely driven by an interest in preserving open space, buffering the airport, avoiding urban sprawl, and promoting transit-oriented development. Under the maximum-growth scenario, on the other hand, it was assumed that extensive development (19,405 acres) would occur in the unincorporated area during the next 50 years.

The land use projections for this scenario are set forth in Table 4-8. This approach was used by FWS for evaluating indirect fish, vegetation, and wildlife impacts in Natomas. This evaluation is discussed in Chapter 7 (Fish, Vegetation, and Wildlife).

TABLE 4-8. Natomas Area - With Project, Maximum-Growth Scenario

TOTAL ACREAGE - 54,882						
Natomas Subareas	**All Urban Uses Combined**			**Agriculture/Vacant**		
	1992	**2100**	**Change**	**1992**	**2100**	**Change**
City Community Plan Areas	3,060	9,037	5,977	8,182	2,205	-5,977
Unincorporated North Natomas	3,220	22,625	19,405	23,378	3,973	-19,405
South Sutter County	980	15,024	14,044	16,062	2,018	-14,044
TOTAL	7,260	46,686	39,426	47,622	8,196	-39,426

Net indirect impacts for the Natomas area are presented in Table 4-9. These impacts were measured by subtracting the changes projected under the without-project condition from those projected with the project. Table 4-9 thus quantifies the increment of growth attributable to the project under each land use scenario.

TABLE 4-9. Natomas Area Net Indirect Impacts

Land Use Scenario	TOTAL ACREAGE - 54,882					
	All Urban Uses Combined			Agriculture/Vacant		
	Without Project	With Project	Change	Without Project	With Project	Change
Adopted General Plan	7,260	15,173	7,913	47,622	39,709	-7,913
Modified Local Plan	7,260	31,089	23,829	47,622	23,793	-23,829
Maximum Growth	23,772	46,686	22,912	31,110	8,198	-22,912

<u>**Lower American River**</u>. In the lower American River area, only one scenario was created for the with-project condition. This area is largely developed already. It was assumed that with the project, buildout would be achieved between 1992 and 2010 in accordance with the existing City and County general plans. Under this scenario, the area would grow from a 1992 baseline of 46,413 developed acres to 54,353 developed acres by the year 2010. This projected development would be primarily residential. It would be located in the south Sacramento subarea and, to a lesser extent, in north Sacramento. Projections by individual subarea are contained in Table 4-10. A more detailed breakdown of these projections is presented at the conclusion of Land Use Appendix (Appendix E).

TABLE 4-10. Lower American River Area With Project, Adopted General Plan Scenario

Lower American River Subarea	All Urban Uses Combined			Agriculture/ Vacant		
	1992	2100	Change	1992	2100	Change
North Sacramento	5,331	5,527	198	569	371	-198
South Sacramento	37,615	45,033	7,418	7,385	0	-7,385
Dry Creek	2,800	2,800	0	3,000	3,000	0
Rancho Cordova	1,667	1,991	324	2,533	2,20	-330
TOTAL	47,413	55,351	7,938	13,487	5,574	-7,913

Net impacts for the lower American River under each land use scenario are presented in Table 4-11.

TABLE 4-11. Lower American River Area Net Indirect Impacts

Land Use Scenario	All Urban Uses Combined			Agriculture/Vacant		
	Without Project	With Project	Change	Without Project	With Project	Change
Adopted General Plan	53,798	55,351	1,555	7,096	5,574	-1,522
Modified Local Plan	53,798	55,351	1,555	7,096	5,574	-1,522
Maximum Growth	55,351	55,351	0	5,574	5,574	0

Upper American River. Operation of the flood control dam would periodically inundate a portion of the existing Highway 49 alignment and obstruct passage along this alignment during sizeable flood events. Under the selected plan, this obstruction would be avoided by moving the highway to a slightly higher elevation at river mile 23.0. This alignment would not significantly affect traffic patterns in the area and would, therefore, have no significant impact on growth in the area, or on land use changes related to growth.

400-YEAR ALTERNATIVE

In the Natomas and lower American River areas, the direct and indirect land use impacts of the 400-year alternative would be the same as those of the selected plan described above.

In the upper American River area, the 400-year alternative would involve a larger flood control dam and a correspondingly larger inundation area. Inundation caused by storms larger than a 200-year event could erode portions of trails and roads not reached by the 200-year design event. Damage sufficient to substantially reduce or eliminate use of any major road or trail would constitute a significant impact.

The indirect land use impacts associated with the 400-year alternative in the upper American River area would be the same as those of the selected plan described above.

150-YEAR ALTERNATIVE

In Natomas, the levee work required for the 150-year alternative would be essentially the same as that outlined under the selected plan. The levees along portions of the NEMDC would have to be higher and the levees along the north and south banks of Dry Creek and Arcade Creek would have to higher and longer. This additional work would incrementally increase short-term, construction-related impacts on existing residential and commercial uses in the area, but would not create any substantial long-term disruption of these uses. Indirect impacts in Natomas would be the same as those described for the selected plan.

In the lower American River area, under the 150-year alternative, flood control space in Folsom Reservoir would be increased by 250,000 acre-feet. The objective release from the reservoir would increase from the current 115,000 cfs to 180,000 cfs. To accommodate these higher releases, this alternative would require riprapping 1.5 miles of riverbank, 5.3 miles of levees, and 3.2 miles of both riverbank and levees.

In addition, 11.4 miles of levees on the lower American River within 1 mile of the new levee to be constructed would be raised 3 to 5 feet. These improvements would substantially alter the viewscape of the parkway, result in land being converted from natural vegetation to levee structure, and adversely affect the lower American River fishery. These effects would be substantial and enduring and would thus constitute significant impacts on recreational use of the American River Parkway.

Indirect impacts in the lower American River area would be the same as those described under the selected plan.

This alternative would not require flood control facilities in the upper American River or necessitate the replacement of Highway 49. Thus, there would be no direct or indirect land use impacts in the upper American River area.

100-YEAR (FEMA) LEVEE ALTERNATIVE

The direct and indirect impacts of this alternative on the Natomas and lower American River areas would be virtually the same as those described under the 150-year alternative. In the lower American River, flood control space in Folsom Reservoir would remain at 400,000 acre-feet. Objective releases from Folsom Reservoir would be increased from the current 115,000 cfs to 145,000 cfs. Direct construction and operational impacts would be those associated with increasing the channel capacity of the lower American River, as described above under the 150-year alternative.

This alternative would not include a dam in the upper American River canyon or require the replacement of Highway 49. Thus, there would be no direct or indirect impacts to land use in the upper American River area.

100-YEAR (FEMA) STORAGE ALTERNATIVE

The impacts of this alternative in the Natomas and lower American River areas would be virtually the same as those described under the selected plan since both alternatives would provide a minimum FEMA level of protection, require Natomas levee construction, and avoid any construction in the lower American River.

This alternative would not include a dam in the upper American River area or require the replacement of Highway 49. Therefore, there would be no direct or indirect impacts to land use in this area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The direct and indirect impacts of this alternative on the Natomas and lower American River areas would be substantially the same as those described under the 150-year alternative. In the lower American River, flood control space in Folsom Reservoir would be increased from the existing 400,000 acre-feet to 470,000 acre-feet. Objective releases from Folsom Reservoir would be increased from the current 115,000 cfs to 130,000 cfs. Direct impacts would be those associated with increasing the channel capacity of the lower American River, which would result in significant impacts on recreational use of the American River Parkway.

This alternative would not include a dam in the upper American River area or require the replacement of Highway 49. Thus, there would be no direct or indirect impacts to land use in the upper American River area.

MITIGATION

The following measures are recommended to mitigate the project's long-term land use impacts. Mitigation measures for short-term land use nuisance impacts are presented in the noise and transportation chapters of this report.

DIRECT IMPACTS

Natomas

Long-term disruptions of agricultural use of the levee improvement borrow site will be mitigated to a less than significant level by the following measure:

- o Develop and implement a reclamation/restoration plan for the borrow site prior to construction. The plan will include provisions to remove and replace topsoil so as not to preclude the future agricultural productivity of the site.

Long-term access impacts related to the relocation of the Main Avenue Bridge will be mitigated to a less than significant level by the following measures:

- o Construct frontage roads (with access off Northgate Boulevard and Pell Drive) on both the north side and south side of Main Avenue to service the affected land uses.

- o Reroute traffic using East Levee Road onto Sorento Road.

Long-term land use impacts associated with residential access along the north Dry Creek levee will be mitigated to a less than significant level by this measure:

- o Construct ramps in the area of existing driveways to allow homeowners along Ascot Avenue to access their property.

Potentially significant conflicts between the proposed detention facility in the northeast corner of Natomas and urban uses identified in the South Sutter County GPA will be reduced to less than significant by either of the following measures:

- o Reconfigure the land uses proposed under the GPA to accommodate the detention facility.

- o Locate the detention facility to accommodate new growth in the area.

Lower American River

Long-term impacts on recreational uses in the American River Parkway associated with the 150-year alternative, the 100-year (FEMA) levee alternative, and the 100-year (FEMA) levee/storage and spillway alternative could be reduced, but not to a less than significant level, by the following measures:

- o Establish a revegetation program for affected areas along the American River Parkway. (See discussion in Chapter 16, Visual Resources.)

- o Choose darker type rocks for riprap. Use a mix of minimum size and add larger rock to give the reinforced banks a somewhat more natural appearance.

- o Compensate for degradation of the existing fishery by intensifying hatchery operations.

Because there are no direct impacts to this area from the selected plan and 400-year alternative, no mitigation is required.

Upper American River

Recreational access impacts resulting from inundation-related erosion of major roads and trails in the canyon area will be mitigated to a less than significant level by the following measure:

- o Include provisions requiring repair of specified roads and trails in the inundation zone as part of the maintenance and operation program developed for the flood control dam.

INDIRECT IMPACTS

The cumulative impact of converting thousands of acres of agricultural and other open space areas to urban use in the Natomas and lower American River areas could be reduced, but not to a less than significant level, by the following measure:

- o Plan for higher density uses in more compact clusters of development capable of accommodating anticipated population increases with less overall loss of agriculture and open space.

CHAPTER 5

HAZARDOUS AND TOXIC WASTE

INTRODUCTION

The purpose of this chapter is to disclose information on known hazardous and toxic waste (HTW) sites located within the study area and to identify HTW impacts which may result from implementation of the selected plan or the alternatives to the selected plan (including No Action). Potential impacts due directly to construction of project facilities and indirect impacts as a result of the project are discussed in this chapter.

This chapter is based on reconnaissance-level studies involving limited research efforts, including a literature search of known contaminated sites in the study area, a preliminary field review conducted by the Corps, and a cursory reconnaissance conducted by the Sacramento Area Flood Control Agency in the Natomas area where project construction or construction-related activity would take place. ("Environmental Assessment of the American River Watershed Investigation 200-Year Alternative, Natomas Area Flood Improvements," Preliminary Draft, August 1991.) These studies are not intended to be a comprehensive evaluation of potential onsite environmental liabilities since a complete Phase I site assessment was not performed. A Phase I site assessment should be performed to further evaluate the risk of contamination for each improvement or borrow site prior to project construction. A Phase I site assessment which typically serves as a "due diligence" evaluation would generally include (1) an aerial photograph and historical literature review of the subject property and neighboring properties; (2) a site reconnaissance of the entire subject site; (3) a review of site maps, plot plans, geotechnical reports, and environmental reports when available; (4) interviews with site personnel and adjacent property owners; (5) interviews with appropriate regulatory personnel; and (6) a literature investigation of ground-water direction and flow rates.

The literature review conducted for this report to determine the extent of known sites within the project area included Federal, State, and local agency lists and data bases of HTW sites. Many of these lists overlap, creating occasional duplicate listings. Among the more comprehensive lists are the Comprehensive Environmental Response, Compensation, and Liability

Information System (CERCLIS) and the State Hazardous Waste and/or Substance Sites list. The U.S. Environmental Protection Agency (EPA) maintains and updates the CERCLIS data base. The State of California Office of Permit Assistance within the Office of Planning and Research maintains and updates the Hazardous Waste and/or Substance Sites list (pursuant to Government Code Sec. 265962.5). The State Water Resources Control Board, California Waste Management Board, and California Department of Health Services contribute data for this list. The list is updated as appropriate, but at least annually, and includes all hazardous waste facilities or property, underground storage tank leaks, all solid waste disposal facilities, and all public drinking water wells which contain detectable levels of organic contaminants and which are subject to water analysis.

Further field reconnaissance and review of aerial photos of the construction area will be made during the design phase of the project to determine whether there are any unlisted HTW sites in any project construction areas or rights-of-way. Results of this work and an updated literature survey will be formally coordinated with the non-Federal sponsors and the appropriate Federal, State, and local agencies. In addition, the Corps will develop a contingency plan identifying a responsible agency and outlining a course of action in the event that HTW sites are uncovered during construction.

REGULATORY BACKGROUND

The Corps recently developed agency policy in response to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), which holds certain categories of individuals strictly liable for all cleanup and response costs of any hazardous substances (HTW) regulated under CERCLA. This policy states that it would be the non-Federal sponsor's responsibility to ensure cleanup and pay all response costs of any HTW sites located on a civil works project. However, if HTW exists within the construction area, the Government would determine, as soon as possible, the extent and nature of the contaminated material prior to construction. If the project were under construction, the Government and non-Federal sponsor would decide whether to continue construction, terminate construction, or, if possible, redesign the project.

In any event, should the Government and non-Federal sponsor decide to proceed with construction, after considering any liability that may arise under CERCLA, the non-Federal sponsor would be responsible for any studies, investigations, and cleanup and response costs. In addition, the non-Federal sponsor would be obligated to operate, maintain, repair, replace, and rehabilitate the project in a manner so that liability to the Federal project would not arise under CERCLA.

EXISTING CONDITIONS

NATOMAS AND LOWER AMERICAN RIVER

Listed Sites

The literature review found in excess of 1,430 hazardous and toxic waste sites within the Natomas and lower American River 200-year flood plain (Fugro-McClelland, October 1991). These sites are only those listed in the databases of State and Federal agencies involved in HTW control. They do not include some sites most vulnerable to flooding, such as small-scale above-ground chemical and petroleum storage tanks.

The majority of the listed sites are tank leaks, storage pits, and similar storage or disposal facilities. Of the approximately 1,430 HTW sites, about 334 sites could result in significant contamination if they were inundated. However, 175 of these 334 sites are considered a serious threat, irrespective of potential inundation, and have been identified by Federal or State regulatory agencies for either cleanup or further monitoring. These sites are listed below by category. The number of sites in each category is given; however, because some sites are listed in more than one category, the totals appearing below do not sum to 175. Ten of these are Federal Superfund sites in the Natomas or lower American River areas. No existing HTW sites are in the proposed levee construction areas.

- The National Priority List (NPL). Sites in this category present a significant risk to human health and the environment and receive remedial funding under CERCLA. The following three sites in this category are in the Sacramento area flood plain:

  The Sacramento Army Depot
  8530 Fruitridge
  Sacramento, CA

Jibboom Junkyard
240 Jibboom Street
Sacramento, CA

Aerojet General Corporation
Highway 50 and Aerojet Road
Rancho Cordova, CA

- The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). Sites listed under this program may have a potential for releasing hazardous substances into the environment. Fifteen sites in this category are in the Sacramento area flood plain.

- Federal facilities with known or suspected environmental problems included in the CERCLA database. One site (the previously listed Sacramento Army Depot) is in the Sacramento area flood plain.

- California State Superfund sites as designated under the California Abandoned Sites Program Information System (ASPIS). This database is kept by the California Department of Health Services. Fifty-six sites in this category are in the Sacramento area flood plain.

- California's Cortese Act, which requires the California State Office of Planning and Research to list several categories of potential and confirmed hazardous waste or substance sites. The categories on the Sacramento area flood plain are (a) leaking tanks, (b) abandoned hazardous waste sites, and (c) sites slated for cleanup over the next 5 years by the California Bond Expenditure Plan. One hundred and seventeen sites are in this category.

Landfills and solid waste transfer station sites could also cause contamination if inundated by major flooding. Six such sites in the Sacramento area flood plain are listed below.

- The Fruitridge Transfer Station, located at 8550 Fruitridge Road.

- The L & D Landfill Company, located at 8635 Fruitridge Road. This site is currently being monitored by the California Solid Waste Assessment Test Program. Sites monitored under this program contain hazardous wastes capable of escaping into either the water, the air, or both. Assessment tests must be submitted to either the

Regional Water Quality Control Board or the local Air Quality Management District (or Air Pollution Control District). In some instances, reports must be submitted to both agencies.

- o The B & C Disposal Site, located at 8597 Jackson Road (Highway 16).
- o The Ramona Avenue Landfill, located at Ramona Avenue and Power Inn Road. This site has been closed.
- o Sacramento Waste Disposal, located at 360 North Street.
- o The 23rd and A Street Disposal Site, located at 23rd and A Streets.

Potential Contamination Sites

The following potential contamination sites were identified during the reconnaissance of locations where construction and construction-related activities will take place in the Natomas area. This list does not constitute a comprehensive study of contamination sites; a Phase I site assessment will be necessary as part of the design phase of the project.

Natomas East Main Drainage Canal. A pile of gravel (approximately 200 cubic yards) that emitted a hydrocarbon odor was located on the levee road on the east side of the canal just north of the Main Street bridge. The gravel appeared to be roadbed, railroad bed, or tank backfill material.

Three abandoned automobiles were in or near the canal. Two automobiles are located on the east side of the canal below the Interstate 80 bridge. One of these vehicles is in the water. During site reconnaissance, a sheen was observed from the vehicle in the water. Most likely this sheen is the result of a combination of fuel, motor oil, hydraulic fluids, and other petroleum-based fluids from the vehicle. The quantity observed was less than 10 gallons. The third automobile was on the west side of the canal between the El Camino Avenue and Silver Eagle Road bridges.

A Union Pacific rail line parallels the east levee in the improvement zone. In several areas, staining was evident below the tracks. In addition to the hydrocarbon contamination associated with railroads, herbicide and pesticide contamination is also common. Arsenic and heavy metals could be present in the railroad right-of-way. Don Johnson of Union Pacific Railroad indicated that several brands of pesticides have recently been used onsite: Oust, Hybar, Kermax, Garlon 3A, Roundup, Spike, Atrazine, and Simizine. He noted that annual spraying is the common practice in California. This year, six different chemicals were used: Sulfometuron-methyl, Bromacil, Diuron, Triclopyr, Glyphosate, and Tebuthiuron. The half-life for most of these chemicals is less than a year; however, longer lasting chemicals could have been used in the past. Johnson said that the soil below the tracks could be considered a threat to agriculture, but not to human health (Johnson, personal communication, July 18, 1991).

Several areas of stained soil were discovered during site reconnaissance. The largest area was approximately 10 feet square. The majority of the stains appeared to be hydrocarbon contamination, possibly from waste motor oil. Many empty 1-quart motor oil containers were strewn across the site.

Remnants of several 55-gallon drums were in the canal. The drums had no markings to show which chemicals had been stored inside. Dumping by local residents is common (Jim Clifton, Reclamation District 1000, personal communication). In addition to the 55-gallon drums, several 5- and 1-gallon containers were in the levee improvement area. Most of these containers were unmarked; however, a few had markings indicating that they had contained acetone. Also, several aerosol paint and finish containers were near the canal.

Local dumping was evident throughout most of the site. Trash and other household debris were scattered over much of the site. Trash included items such as clothing, paper, shotgun shells, shopping carts, and plastics. Jim Clifton of Reclamation District 1000 stated that dumping by local residents is common. Furthermore, there is evidence that hazardous materials from methamphetamine laboratories have been dumped in the canal area. Also, thousands of tires are in the canals (Clifton, personal communication, July 18, 1991).

Several powerlines are on and around the site. Some of the poles have transformers attached which could possibly contain polychlorinated biphenyls (PCB's).

A section of asphalt road north of El Camino Avenue, extending from East Levee Road across the creek to the east side of the canal, has several oil stains. North of the Main Street bridge on the west side of the canal is a pile of asphalt rubble. The soil beneath the asphalt appears to be stained.

Automobile parts were discovered in and around the canal. These parts included items such as shock absorbers, springs, axles, tires, and fenders.

Several areas of scorched earth are along the levees and in the canal.

Dry Creek North Levee. Since access to the site was restricted by a barbed wire fence, field reconnaissance of the property was not possible. However, a perimeter site reconnaissance did not disclose any obvious sources of contamination; that is, storage tanks, abandoned vehicles, or machinery.

The site is an open field apparently used for grazing. East of 2nd Street on Ascot Avenue, adjacent to the improvement site, was a 2-square-foot section of soil stained with what appeared to be hydrocarbon.

The area surrounding the improvement site is primarily used for agriculture. Adjacent to the property along Ascot Avenue are several residences. Several 55-gallon drums were at one residence. Abandoned vehicles, refrigerators, and trash were scattered at another residence across from the improvement site.

Dry Creek South Levee. The site is located in an agricultural area. Cattle were observed on or near the improvement site. A pile of asphalt and masonry rubble was observed in the improvement zone.

The site, located in an agricultural and residential area, has a potential for residual pesticides. Several 55-gallon drums were observed at one of the adjacent residences.

Arcade Creek. Dense vegetation prevented adequate field reconnaissance of much of the site. However, scattered trash and debris were observed.

The site is located in a residential area. Scattered trash was present in the vicinity of the levee. Abandoned vehicles, several 55-gallon drums, paint cans, and containers of acetone were observed at the adjacent residences.

Sankey Road. Staining was evident in several places below a Union Pacific spur line which traverses the improvement area. In addition to the hydrocarbon contamination associated with railroads, herbicide and pesticide contamination is also common. Arsenic and heavy metals could be present in the railroad right-of-way. Don Johnson of Union Pacific Railroad indicated that several brands of pesticides have recently been used onsite: Oust, Hybar, Kermax, Garlon 3A, Roundup, Spike, Atrazine, and Simizine. He noted that annual spraying is the common practice in California. This year, six different chemicals were used: Sulfometuron-methyl, Bromacil, Diuron, Triclopyr, Glyphosate, and Tebuthiuron. The half-life for most of these chemicals is less than a year; however, longer lasting chemicals could have been used in the past. Johnson said that the soil below the tracks could be considered a threat to agriculture but not to human health (Johnson, personal communication, July 18, 1991).

Part of an abandoned vehicle was observed in the improvement zone. The vehicle did not appear to be leaking fluids. An abandoned tractor was located near the spur line. No soil stains were visible near the tractor.

The site is located in a rural area with few residences. Many agricultural fields are in the vicinity. A row of residences parallels the site between the spur line and Natomas Road. Numerous 55-gallon drums were observed at a residence/ boat-repair yard. Most appeared to be unmarked; however, a few indicated that they contained solvents, fuel, and waste oil. Several above-ground storage tanks had no indication of the contents. An above-ground storage tank is located at a separate site near the improvement area. However, no obvious staining was noted.

Pleasant Grove Creek Canal. No evidence of contamination was observed in the improvement area. An agricultural machine yard near the site appeared to contain used parts for agricultural equipment. Above-ground storage tanks were present onsite.

Natomas Cross Canal. Some trash was scattered about the site. The surrounding lands are vacant. Interstate 99 crosses the site.

UPPER AMERICAN RIVER

Historically, the upper American River area was affected primarily by gold-mining activities. The gold mines in this area had their origin at or very near the beginning of the California gold rush, when miners moved from Coloma on the South Fork of the American River into the canyon of the Middle Fork.

The earliest miners worked the surface and near-surface placers along the principal streams. However, before long most of the important mining activities focused on hydraulic mining of the older gravel formations, and by the late 19th century, dredges were operating in several of the principal drainages.

The Sliger Mine, located on the El Dorado side of the Middle Fork above what is believed to be Spanish Bar, was hydraulically mined from 1922 (when it was reopened) to 1937. More than 80,000 tons of ore was produced during the 4 years from 1932 through 1935. The concern with such mining and dredging activities is that when pyrite in the rocks is exposed to air and water, sulfuric acid is created. Deep gravel deposits were mined at the Sliger Mine. However, because mineralization has occurred, there is no exposed pyrite or resulting sulfuric acid formation. This may be attributable to the fact that there is very little pyrite in the rocks of the upper American River canyon. In any case, the Sliger Mine is not considered an HTW site.

No HTW sites are listed at the damsite. However, two sites near the project area--the Auburn Sanitary Landfill and the Auburn State Recreation Area tank leak--are classified as hazardous waste sites on the California Regional Water Quality Control Board and California Hazardous Waste and Substances Sites lists. It is unlikely that other hazardous waste sites are in the area. Because of steep terrain and heavy recreational use, illegal hazardous waste sites are unlikely in the upper American River.

IMPACTS

Little is known about the impacts of flooding on stored toxic and hazardous waste substances. However, some important research is currently under way on the effects of natural disasters on sites where hazardous substances are present. Preliminary information shows that flooding causes significant releases of such substances into the environment (Showalter, 1991).

SIGNIFICANCE CRITERIA

The significance of impacts related to hazardous and toxic wastes is based on both institutional and public recognition of potential public health risks if contaminants are introduced into the environment. For the purposes of this analysis, any action which substantially increases the risk of an uncontrolled release of hazardous or toxic materials into the environment is considered significant.

NO-ACTION ALTERNATIVE

Natomas and Lower American River

Under the no-action alternative, no Federal action would be taken to modify the existing flood control system. Therefore, during a 100-year storm, virtually all of Natomas and parts of the lower American River areas within the 100-year flood plain would be flooded. Flooding from 200- and 400-year storms would be more extensive.

Floodwaters could seep into the soils surrounding the existing HTW sites within the flood plain. Most of these sites would not present a serious threat if flooded. However, inundation of 334 of the sites could result in significant contamination; of these, 175 could pose a potential public health threat. The predominant types of HTW sites in the area are tank leaks or pits containing hazardous substances. If floodwaters were to seep into the areas around such sites, the water could transport the leaking contaminants offsite. However, it is not expected that floodwaters would increase or exacerbate the amount of leakage. In any case, floodwaters could cover existing HTW sites in the 100- and 400-year flood plains, resulting in possible significant water-quality and public health impacts.

These risks can be reduced by continued cleanup of identified sites and steps to reduce flood risk for specific sites; however, flood proofing of storage and disposal facilities in the flood plain is not considered an adequate solution (Showalter, 1991). Flood-proofing standards would have to be extremely high to be effective.

SELECTED PLAN

Direct Impacts

Natomas and Lower American River. Hazardous waste spills or leaks during construction could have significant impacts on water quality. As part of the job specification, the contractor will be required to have a plan for proper disposal of any construction wastes, with water-quality protection of the American and Sacramento Rivers as the primary objective.

Additionally, contaminants currently at the construction sites could be disturbed and released. The following describes the incidences of contamination which are present at the construction sites and possible risks associated with construction at these sites.

NEMDC East and West Levees. The site reconnaissance revealed several areas of potential hazardous waste contamination. Of particular concern is the pile of gravel north of the Main Street bridge on the east side of the canal. This gravel potentially could be contaminated with hydrocarbons which contain benzene and other hazardous chemicals. Construction activities could subject workers to these hazardous chemicals. The abandoned vehicles are also a concern. The railroad is an additional area of concern since there is evidence that pesticides have been and are being used along the railroad right-of-way. Furthermore, there is evidence of hydrocarbon staining below the tracks. Excavation of the roadbed material or surrounding soil could result in a release of potentially harmful chemicals. Also, 55-gallon drums at the site could indicate that hazardous chemicals are present onsite. Since the type of chemical stored inside the drums is unknown, the potential contaminants are unknown. The other containers suggest that there could be limited pockets of contaminated soil.

Since the levee improvement right-of-way is in an industrial area, there is the potential for contamination in the area surrounding the levee improvement area. An accidental release of hazardous materials from an industrial site could potentially affect the subject site. Hazardous chemicals could migrate via air or ground water to the property. Collection of ground-water flow information is beyond the scope of this report. Thus, the potential for offsite contamination to affect the property is unknown.

The underground cables could pose a risk if they are damaged during levee construction.

The literature review revealed the presence of numerous contaminated sites within 1 mile of the property. With many contaminated sites in the immediate vicinity of the site, migration of hazardous materials is possible. Excavation of levee material could result in a release of hazardous materials.

__Dry Creek North Levee__. Complete field reconnaissance was not possible because of restricted access to the property. Perimeter reconnaissance did not identify any obvious contamination. One minor concern is the possible presence of pesticide residue from past applications. It is unknown what types of pesticides, if any, were used at the site; however, expected levels of pesticide residue should be similar to surrounding areas. The stained soil observed during site reconnaissance appeared to be limited and was most likely the result of dripping fluids from a motor vehicle.

Since the surrounding area is used primarily for agriculture, it is unlikely that industrial pollution could affect the site. One concern could be pesticide residue from past applications. However, the concentrations of residual pesticides should be similar to surrounding property.

The adjacent properties could potentially affect the subject site. The 55-gallon drums in the adjacent yard could contain hazardous materials. The drums also could indicate that hazardous materials were stored at the property in the past. Illegal dumping of hazardous materials is also possible. The abandoned vehicles and refrigerator could indicate that antifreeze, freon, and other hazardous materials are present.

The literature review revealed four sites of environmental concern within 1 mile of the site. All are listed as "no further action," indicating that the California Department of Health Services does not consider the sites to be a major concern. A few operating permits were noted in the report. The operating permits indicate that underground storage tanks are present near the subject site.

__Dry Creek South Levee__. Residue may be present due to past applications of pesticides. The pile of rubble could indicate that a road or a building had been on the site. There was no staining or other feature to indicate subsurface contamination.

The 55-gallon drums at the adjacent residence could indicate that hazardous materials are or were present. Since there is access to the site from the residence, materials could possibly have been dumped in the improvement zone. However, no obvious staining was observed.

The literature review did not reveal any major environmental concerns in the immediate vicinity of the improvement zone.

Based on this limited review, there do not appear to be any impacts to the site.

Arcade Creek. The presence of trash and debris could indicate that household hazardous waste has been dumped onsite. Hazardous waste could pose a threat to workers during construction or to the adjacent residences. The environment could also be affected if hazardous waste were released during construction activities.

The presence of 55-gallon drums could indicate that hazardous materials are or were stored near the levee. Paint and solvent containers also could indicate that hazardous materials were stored near the levee. The improvement site is easily accessible from these residences; consequently, these materials could have been dumped.

Since the levee improvement right-of-way is near an industrial area, there is the potential for contamination in the area surrounding the levee improvement area. An accidental release of hazardous materials from an industrial site could potentially affect the subject site. Hazardous chemicals could migrate via air or ground water to the subject property. Collection of ground-water flow information is beyond the scope of this report. Thus, the potential for offsite contamination to affect the subject property is unknown.

The literature review revealed numerous environmental concerns within 1 mile of the site. The presence of contaminated sites nearby indicates that migration of hazardous substances to the site is possible.

Sankey Road. The railroad is an area of concern since there is evidence that pesticides have been and are being used along the railroad right-of-way. Furthermore, there is evidence of hydrocarbon staining below the tracks. Excavation of the roadbed material or surrounding soil could result in a release of potentially harmful chemicals.

If the site has been used for agriculture in the past, the possibility exists for residual pesticide contamination. However, there is no indication that the levels at this site are greater than at surrounding lands.

The presence of many 55-gallon drums could indicate that the residence/boatyard illegally stored and used hazardous materials. No secondary containment was visible to prevent contamination of the soil if a spill occurred. The proximity of the boatyard and the quantity of drums indicate that contamination is possible. Furthermore, contamination from the yard could have migrated to the improvement area.

The literature review revealed that some operating permits have been issued to businesses near the improvement zone. If the underground storage tanks permitted in the area have leaked, it is possible that the site could be contaminated.

Pleasant Grove Creek Canal. There was no evidence of onsite contamination; however, hazardous materials may be used or stored at the machine yard. The above-ground storage tanks may contain hazardous materials. If contamination exists at the site, contaminants could have migrated to the improvement zone. However, the literature review did not identify a listing of these sites as contaminated.

The literature review did not identify any listed environmental concerns.

Natomas Cross Canal. No stained soil or other indications of hazardous materials were observed during site reconnaissance. However, hazardous materials could have been released from the Interstate 99 bridge, although no staining was observed to indicate recent dumping of hazardous materials.

There is low potential for offsite contamination. Residual pesticides from past applications could be present. However, there is no indication that residual pesticides are present at higher than background levels.

The literature review did not identify any environmental concerns.

Upper American River. There is a potential for release of hazardous or toxic substances in the upper American River area due to construction activities related to the flood control project.

Hazardous or toxic materials, such as gasoline, diesel, and oil needed to run construction equipment, will be controlled at the construction site. Contractors will be required to submit a plan for the proper handling and management of these hazardous materials to prevent accidents that threaten the safety of workers as well as the water quality of the American River.

Aggregate for the dam will come from the Old Cool Quarry site. The borrow materials, comprised of limestone and amphibolite, contain no contaminants.

The upper American River canyon has been extensively mined for gold. At the present time, the few remaining operations are small ones, and none are regulated by the Central Valley Regional Water Quality Control Board. In the past, the bigger mines employed hydraulic methods to mine the gold. Hydraulic mining had been banned for years because it was the source of significant sedimentation problems downstream.

A review of the Regional Water Quality Control Board's Listing of Dischargers and conversation with board staff revealed no problem active mine, abandoned mine, or tailings within the project area. No acid mine drainage problem had been documented in the past. (Dan Fua, Department of Water Resources, personal communication, November 14, 1991.)

Review of the geology of the project area revealed no significant deposit of acid-forming rocks such as pyrite in the upper American River. These deposits have been known to occur in the lower elevation of the Sierra foothills. The small pyrite deposits that may have been exposed by hydraulic mining in the upper American River have since been mineralized, such as at the Sliger Mine in the Middle Fork American River, and prevented from producing acid drainage. Since there will be no excavation of gravel bars and deposits in the project area, except for keying dam foundation, there is no likelihood that any acid-forming rocks will be reexposed during the construction and operation of the project. (Dan Fua, Department of Water Resources, November 14, 1991.)

Mine tailings along the upper American River will likely contain mercury. There is no known operation, past or present, that used cyanide to extract gold in the upper American River. Infrequent inundation of these mine tailings may cause erosion and transport of the sediment-containing mercury downstream. However, it has been known that the mercury in these tailings is in a form insoluble in water and that water-quality impairment is not expected. (Dan Fua, Department of Water Resources, personal communication, November 14, 1991.)

Indirect Impacts

Natomas and Lower American River. Implementation of the selected plan would result in the removal of significant portions of Natomas and the lower American River from the 100-year flood plain. With respect to HTW, this would have the beneficial effect of removing existing HTW sites from the 100-year flood plain, thereby eliminating the risk associated with flooding of these sites by a 100-year event.

On the other hand, provision of flood protection would allow for continued development of Natomas and the lower American River area currently lying within the 100-year flood plain. The proposed industrial, commercial, and residential growth would increase the amount of HTW in the form of substances used in industrial processes, commercial applications, and household products. The risk of spills, leaks, and improper disposal, along with associated possible public health impacts, will be increased in Natomas and the lower American River. In spite of the removal of flood risk from the area, the potential for significant impacts associated with HTW will remain due to the risks presented by the increased presence of hazardous substances.

The management of hazardous waste is addressed under the Sacramento County Hazardous Waste Management Plan (Tanner Plan), which was adopted by the County Board of Supervisors on January 24, 1989. The County and Cities of Sacramento, Folsom, Isleton and Galt within the County are in the process of incorporating this plan into their respective general plans and are updating their zoning ordinances to be consistent with this plan (Steve Tracy, Sacramento County Planning Department, personal communication, November 8, 1991).

400-YEAR ALTERNATIVE

The direct and indirect impacts associated with the 400-year alternative would be the same as those described for the selected plan.

150-YEAR ALTERNATIVE

The 150-year alternative would require substantially higher and wider levees in the Natomas and lower American River areas than would any other flood control alternative. Additional HTW sites may be affected by expanded construction and borrow sites. Indirect impacts would be the same as those described for the selected plan.

There would be no indirect impacts relating to toxic or hazardous material in the upper American River area.

100-YEAR (FEMA) LEVEE ALTERNATIVE

The impacts would be the same as for the 150-year alternative.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Direct impacts would be the same as those for the selected plan in Natomas. There would be no direct impacts associated with the 100-year (FEMA) storage alternative in the upper American River.

The indirect impacts would be the same as impacts of the selected plan in Natomas and the lower American River. There would be no indirect impacts in the upper American River area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The impacts would be the same as for the 150-year alternative.

MITIGATION

SELECTED PLAN

The Phase 1 site assessment and associated studies described above will be accomplished during project engineering and design. This information will determine likelihood of measures needed to avoid or remediate HTW hazards for construction. Costs for remediation are solely a non-Federal responsibility.

Direct Impacts

Impacts are similar for Natomas and the lower and upper American River. Control of hazardous or toxic materials, such as gasoline, diesel, and oil needed to run construction equipment, will be necessary at each construction site. Contractors will be required to submit a plan for the proper handling and management of these hazardous materials to prevent accidents that threaten the safety of workers as well as the water quality of the adjacent waterways. The following describes mitigation measures needed to prevent substantial release or spill of toxic materials at construction sites and reduce potential impacts to a less than significant level.

Access. Restrict public access to construction sites in order to prevent access for dumping and vandalism which could result in release of toxic materials.

Potential Onsite Contamination. An assessment to further evaluate the potential for existing onsite contamination at each construction site will be accomplished prior to construction if necessary. Subsurface sampling will be conducted to evaluate the magnitude of contamination. A review of existing environmental records with the Department of Health Services will be conducted. Such a review will help identify where hazardous materials may have been dumped in the levee improvement area in Natomas and in upper American River.

If stained soil or other indications of hazardous materials are revealed during construction, operations should be stopped. The suspect soil or liquids should be analyzed and disposed of appropriately.

Any hazardous materials encountered during construction should be appropriately tested and sent to a disposal facility. Any debris, trash, and automobile parts present onsite should be collected and disposed of appropriately.

Potential Offsite Contamination. Files should be reviewed for the adjacent properties. This review is necessary to ensure that hazardous materials are not being released near the subject property.

Construction Practices. Implement precautionary measures during construction to minimize spills and soil and water-quality contamination. The following measures may be modified somewhat as a result of conditions imposed by various regulatory agencies and should not be regarded as all the possible measures that could be implemented.

- Enforce strict onsite handling rules to minimize spills and to keep construction and maintenance materials out of receiving waters.

- o Collect and remove from the job site all pollutants such as sanitary wastes and petroleum products.

- o Prepare and implement a spill prevention and countermeasure plan for each construction site.

- o Identify locations of all underground cables and pipes prior to any construction activities.

<u>**Indirect Impacts**</u>

<u>Natomas and Lower American River</u>. The management of hazardous waste is addressed under the "Sacramento County Hazardous Waste Management Plan" (Tanner Plan), which was adopted by the Sacramento County Board of Supervisors on January 24, 1989. Specific policies, programs, and siting criteria contained in the plan will mitigate significant indirect HTW impacts in the Natomas and lower American River.

The purpose of the plan is to:

- o Identify current hazardous waste streams, estimate future waste streams, and then determine future needs for facilities to manage hazardous waste generated in the County.

- o Develop and implement a process, including siting criteria, for local review of proposed offsite hazardous waste facilities.

- o Create a consistent hazardous waste management system which applies to Sacramento County and the Cities of Folsom, Galt, Isleton, and Sacramento.

- o Require efforts to reduce the amount and toxicity of hazardous waste to the maximum extent technically and economically feasible.

- o Provide the public, industry, and local government with the information needed to take steps to minimize hazardous waste generation, and recycle, treat, and otherwise manage hazardous waste generated in the County.

- o Set waste reduction goals that can be used to monitor the success of this plan.

The plan contains specific policies which provide for siting of facilities; implementation, including general plan consistency and incorporation into the local zoning ordinance; local review process; and program recommendations, including disposal of household hazardous waste. The plan provides for further studies and reassessment of the plan every 4 years.

Implementation of the County Hazardous Waste Management Plan will reduce potential impacts to a less than significant level.

Upper American River. No indirect impacts were identified for the upper American River.

400-YEAR ALTERNATIVE

Measures required to mitigate the direct and indirect impacts associated with the 400-year alternative would be the same as those described for the selected plan.

150-YEAR ALTERNATIVE

The 150-year alternative would require substantially higher and wider levees in the Natomas and lower American River areas than would any other flood control alternative. Additional HTW sites may be affected by expanded construction and borrow sites. Indirect impacts would be the same as those described for the selected plan.

Measures required to mitigate the direct impacts would be the same as those required for the selected plan. Phase I site assessments will be necessary for all construction sites.

There would be no indirect impacts relating to toxic or hazardous material in the upper American River area.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Measures required to mitigate impacts of this alternative would be the same as for the 150-year alternative.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Measures required to mitigate direct impacts of this alternative would be the same as those required to mitigate impacts of the selected plan in Natomas. There would be no direct impacts associated with the 100-year (FEMA) storage alternative in the upper American River.

The indirect impacts would be the same as impacts of the selected plan in Natomas and the lower American River. There would be no indirect impacts in the upper American River area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The measures required to mitigate the impacts of this alternative would be the same as the measures required for the 150-year alternative.

CHAPTER 6

DRAINAGE AND WATER QUALITY

This chapter addresses the impacts of the flood control alternatives on drainage patterns in the project area and on the quality of surface water and ground water in the study area.

EXISTING CONDITIONS

NATOMAS

The Natomas area is located at the confluence of the American and Sacramento Rivers in the lower portion of the Sacramento Valley. As described in the main report, drainage from areas east of the Natomas basin is conveyed around the perimeter of Natomas by a canal system which includes the Natomas Cross Canal, Pleasant Grove Creek Canal, and Natomas East Main Drainage Canal.

The Natomas basin itself is drained by a system of canals and pumping stations maintained and operated by Reclamation District 1000. These facilities collect, convey, and discharge water into the Sacramento River, NCC, and NEMDC. The principal branches of the interior drainage system are the North, East, and West Drainage Canals and the Natomas Main Drainage Canal. These canals are shown in Figure 6-1.

Reclamation District 1000 has a policy whereby the district does not undertake disposal of stormwater runoff originating on nonagricultural lands (Spink). Accordingly, local property owners who develop their lands for nonagricultural uses must establish separate drainage districts to pay for construction, operation, and maintenance of drainage improvements.

Storm drainage facilities serving existing development in the South Natomas Community Plan (SNCP) area are provided by the City of Sacramento. These facilities have been financed through assessment districts, the latest of which, the Natomas West Assessment District (NWAD), is being formed to provide urban drainage facilities for anticipated development in the area west of I-5 and south of I-80.

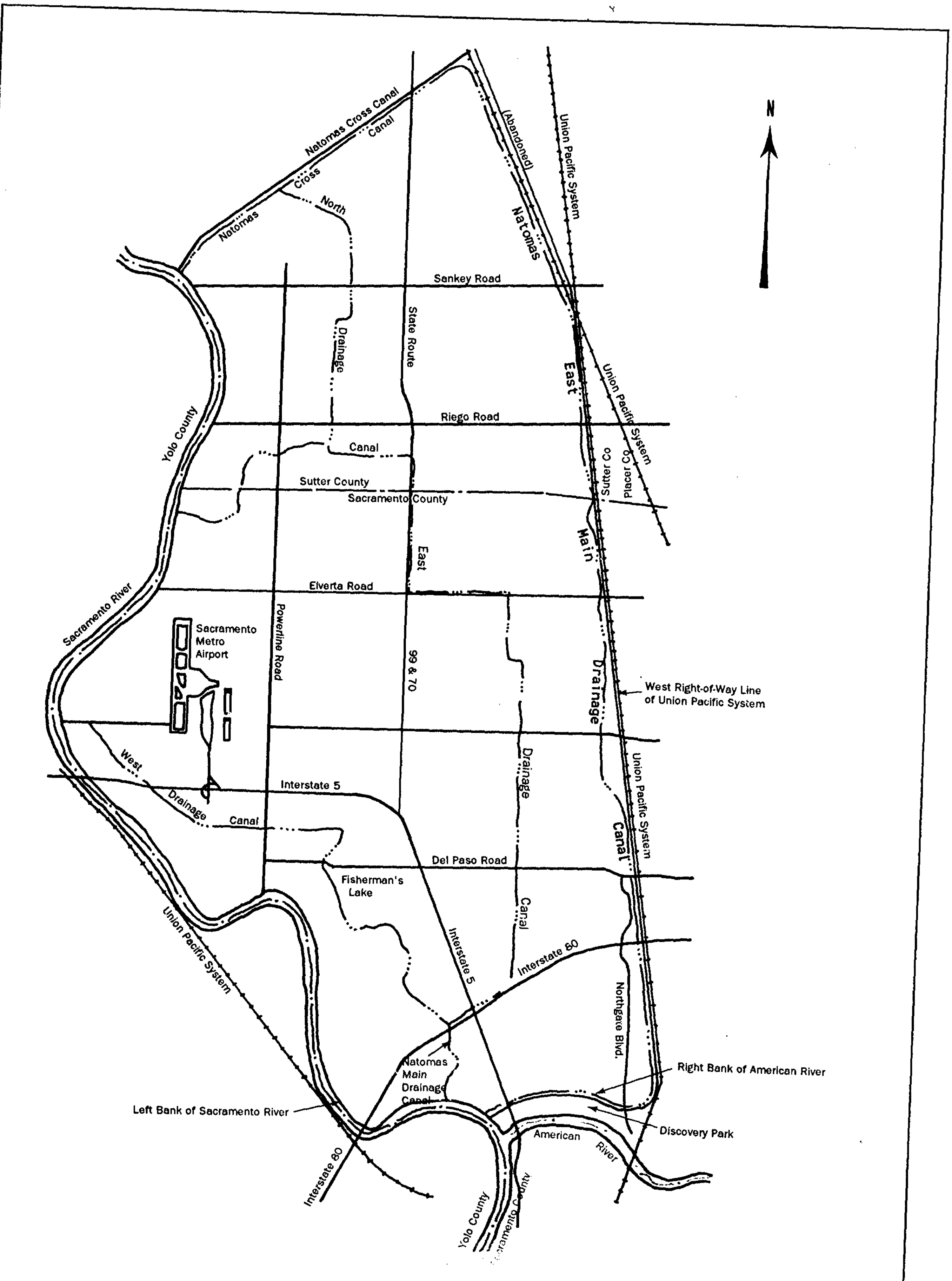

FIGURE 6-1. Natomas Interior Drainage System

The water quality of the Sacramento River near Natomas is good to fair for numerous beneficial uses recognized by the Central Valley Regional Water Quality Control Board (CVRWQCB). Primary beneficial uses include municipal and industrial water supply, recreation, irrigation for agriculture, and warmwater and coldwater fisheries habitat.

Near-saturated dissolved oxygen concentrations, low suspended and dissolved organic loads, and moderate-soft to moderate-hardness conditions result in water of good quality for municipal and industrial water supplies. Two municipal drinking water treatment plants are in the vicinity of the Natomas area--the West Sacramento plant, on the south bank of the Sacramento River slightly upstream from the I-80 bridge, and the City of Sacramento plant, on the east bank at the confluence with the American River. Table 6-1 compares water quality of the Sacramento and American Rivers.

The principal water-quality problems in the Sacramento River near Natomas result from increased summer water temperatures; discharges of urban runoff; and seasonal discharges of pesticides, herbicides, sediments, and fertilizers from farming. Farmers in the Natomas basin currently pump irrigation waters into the basin. These waters are subsequently recirculated and reused. As these waters recirculate, they receive increasing pollutant loads until the first rains occur in the fall, at which point these loads are discharged into the Sacramento River.

In addition to seasonal discharges of agricultural pollutants, the Sacramento River receives a growing quantity of nonagricultural pollutants related to discharges from wastewater treatment plants, untreated urban runoff, and acid mine discharges. Urban runoff in particular is considered a significant source of pollutant concentrations at discharge points into the river. Accumulated pollutants may include pesticide residues, oil and grease, and heavy metals from roadways, parking lots, rooftops, and other surfaces (Montoya, et al., 1988; Silverman, et al., 1988; Oltmann and Shulters, 1987; and Stenstrom, et al., 1984). Rainstorms collect these elements and deposit them in adjacent waterways for ultimate discharge into the river.

Pollutant concentrations depend on storm intensity, land use, and the elapsed time between storms. Montoya (1987) reported urban runoff and sediment discharges into the Sacramento and American Rivers containing copper, lead, zinc, cadmium, and chromium at concentrations exceeding EPA water-quality criteria

TABLE 6-1. Comparison of Water Quality of the American and Sacramento Rivers, 1970-85[1]

Parameter[2]	Sacramento River at Sacramento		American River at Sacramento	
	Range	Average	Range	Average
Hydrogen Ion (Ph)	6.8 - 8.3	7.5	7.1 - 7.8	7.5
Conductance (uhmos/cm)	110 - 270	150	45 - 85	60
Temperature (°C)	5 - 24	-	0 - 26	-
Dissolved Oxygen	6.5 - 13.5	-	6 - 13.5	-
Calcium	2 - 20	12	4 - 8	6
Manganese	2 - 12	7	0.3 - 2.6	1
Sodium	2 - 30	12	1 - 5	2
Potassium	0 - 2	1.5	0.5 - 1.0	0.7
Bicarbonate	35 - 120	85	18 - 30	22
Sulfate	4 - 18	10	0 - 8	4
Chloride	1 - 20	10	<1 - 4	2
Nitrate	0 - 1	0.5	0 - 1	0.3
Silica dioxide	5 - 23	20	1 - 16	10
Hardness (as $CaCO_3$)	25 - 100	70	12 - 30	20
Turbidity (NTU)	8 - 100	13	1 - 50	50
Total Dissolved Solids	40 - 200	110	30 - 70	45

[1] Source: Metcalf and Eddy, 1985 (in City of Sacramento, 1987a).
[2] All parameters in milligrams per liter unless otherwise indicated.

(EPA, 1986). Urban runoff is likely to produce its most damaging effects during the first major rainfall after the dry season. At this time, high concentrations of pollutants in the runoff may combine with low flows in the river to diminish the potential for dilution, resulting in elevated pollution levels.

Water-quality objectives for all waters in the State are established by the State under applicable provisions of Section 303 of the Federal Clean Water Act (FCWA) and the State's Porter-Cologne Water Quality Control Act. For the Sacramento River, these objectives are set forth in the water-quality control, or basin, plan prepared by the CVRWQCB and are described in Table 6-2.

In cases where the basin plan does not contain standards for a particular pollutant, such as lead, other criteria may be used to establish a standard. These criteria may be applied from State Water Resources Control Board (SWRCB) documents such as the Inland Surface Waters Plan, the Pollutant Policy Document, or from EPA water-quality criteria developed under Section 304(a) of the FCWA. A major element of the future SWRCB water-quality control plans will be the adoption of water-quality objectives for toxic substances mandated by the FCWA. Most of the

TABLE 6-2. Water-Quality Objectives for American River and Sacramento River[1]

Water Quality Objective	Applicable Water Body[2]
Turbidity (Jackson Units) and Color	
- No increase beyond natural background levels	30,44,45,50,51
- Less than or equal to 10 JTU	50,51
Bottom Deposits	
- None, other than of natural causes	30,44,45,50,51
Floatables, Oil and Grease	
- No visible effects other than of natural causes	30,44,45,50,51
Odors	
- None, other than of natural causes	30,44,45,50,51
Pesticides	
- No individual pesticides or combination of pesticides shall reach concentrations found to be deleterious to fish and wildlife; no increase in pesticide concentrations over background levels in indigenous aquatic life	30,44,45
- Less than 0.1 ug/l, as summation of individual concentrations	50,51
Hydrogen ion concentration (pH)	
- No significant change in normal ambient value; shall not be depressed below 6.5 units or raised above 8.5 units as a result of waste discharge, except Goose Lake	30,44,45,50,51
Biostimulants	
- No substance will be added which produces aquatic growths in the receiving waters to the extent that such growths cause nuisance or damage to any of the beneficial water uses	30,44,45
- Total nitrogen content shall be maintained below 1.0 mg/l	50,51
Bacteria	
- As recommended by the California State Department of Health	30,44,45
- Fecal and standard coliform per 100 ml shall be maintained at levels not exceeding historical values	51
- Not to exceed a median (MPN) of 100 fecal coliform per 1,000 ml	50
Temperature	
- Waters shall remain free from adverse temperature changes resulting from waste discharge or other activities of man	30,44,45,50,51
Dissolved Oxygen (DO)	
- Median shall not fall below 85 percent of saturation in main water mass, and the 95 percentile concentration shall not fall below 75 percent of saturation; dissolved oxygen at any location shall not fall below 5 mg/l (7 mg/l in waters above 1,000 feet in elevation) at any time due to waste discharges; when natural factors cause lesser concentrations, then controllable factors shall not cause further reduction	30,44,45,50
- Below Nimbus Dam shall be greater than or equal to 7.0 mg/l above Watt Avenue Bridge and 5.0 mg/l below Watt Avenue Bridge all year	51

TABLE 6-2. Water-Quality Objectives for American River and Sacramento River[1] (Continued)

Water-Quality Objective				Applicable Water Body[2]
Total Dissolved Solids (TDS)				
- Shall not exceed 125 mg/l				44,45,51
- Shall not exceed 100 mg/l				50
Trace Constituents or Toxicity				
- No substance which will produce deleterious effects upon beneficial uses shall be discharged to receiving waters				30,44,45,50,51
- Shall be maintained below the following levels (in mg/l):				50,51
• Arsenic	0.01	Cyanide	0.01	
Barium	0.1	Fluoride	0.5	
Boron	0.5	Iron	0.3	
Cadmium	0.01	Lead	0.05	
Chromium		Manganese	0.05	
(hexavalent)	0.05	Silver	0.01	
Copper	0.01	Zinc	0.01	
Cobalt	0.2	CCE (3)	0.15	
Chloride	0.05	MBAS	0.5	

[1]Source: Regional Water Quality Control Board. 1978. Water Quality Control Report: Sacramento River Basin (5A), Sacramento-San Joaquin Delta Basin (5B), and San Joaquin Basin (5C). Volume One. Central Valley Region. Sacramento, CA.

[2]Applicable Water Bodies: North Fork, Source to Folsom Lake (44)
Middle Fork, Source to Folsom Lake (45)
Folsom Lake (50)
Lower American River, Folsom Dam to Sacramento River (51)
Sacramento River, Colusa Basin Drain to I Street Bridge (30)

pollutants known to be present in urban runoff are included in this list of toxic substances, including trihalomethanes (THM), heavy metals, and selected pesticides (City of Sacramento, Draft EIR for NWAD, 1991).

The basin plan standards will apply to most discharges into the Sacramento River, with the CVRWQCB being able to apply other criteria with SWRCB approval (De Vlaming, pers. comm., 1991). Currently, no clear method exists for adopting new standards for pollutants such as lead. The evaluation of cumulative effects and mass loading limits is also likely to apply to urban stormwater discharges into the Sacramento River (City of Sacramento, Draft EIR for NWAD, 1990).

The specific application of water-quality limits to new projects will be addressed as part of the National Pollutant Discharge Elimination System (NPDES) permitting process for urban stormwater discharge established under Section 402 of the FCWA. Recent amendments of the FCWA require large municipalities with populations of 100,000 to 250,000 to obtain NPDES permits from the CVRWQCB to ensure compliance with adopted basin plan standards. There is some uncertainty as to how compliance with the adopted standards will be enforced. However, it is believed that permittees will be required to monitor discharges of standard pollutants found in urban runoff, including copper, lead, and zinc (City of Sacramento, Draft EIR for NWAD, 1990).

The City of Sacramento, under a joint agreement with the County of Sacramento, City of Folsom, and the City of Galt, obtained an NPDES permit from the CVRWQCB in June 1990. The permit requires the City and the other permittees to evaluate and implement control programs to improve water quality and protect beneficial uses. The permit includes requirements to implement both construction site and stormwater management programs for new development using best management practices (BMP's) that control pollutant discharges to the maximum extent practicable. These activities could include structural controls, sampling and monitoring stations, and nonstructural controls such as educational programs (City of Sacramento, Draft EIR for NWAD, 1990).

In addition, a monitoring program is required which outlines annual Sacramento River sampling at two locations during two storm events. The City and County have jointly undertaken a study of the impacts of urban runoff on water quality in the lower American River as part of the NPDES permit process (City of Sacramento, Draft EIR for NWAD, 1990).

LOWER AMERICAN RIVER

The project area in the lower American River includes the American River Parkway and the portions of the City and County of Sacramento which lie within the 400-year flood plain of the American River. The adequacy of drainage in developed portions of the lower American River area varies. A number of areas having drainage problems were identified by the city in 1986, and the needed improvements are expected to be completed by 1995. Additional areas served by small-sized storm drains and pump stations experience nuisance flooding nearly every winter.

As noted in Chapter 17 (Cumulative Impacts), the most serious drainage problems in the lower American River area are in the Dry Creek drainage basin in North Sacramento and in the Morrison Creek drainage area in South Sacramento. Local projects to improve existing drainage systems are planned for both these areas.

Runoff from the portions of the lower American River area north of the river is collected and discharged into the American

River. Runoff from areas south of the river is collected and discharged into the Sacramento River. In both cases, the discharges are subject to the same regulatory requirements as described for Natomas, including the application of BMP's to new development as required under the local agencies' joint NPDES permit.

Water quality along the lower American River is generally good to excellent for all beneficial uses. However, dissolved oxygen and temperature do not meet some beneficial objectives during low water years when flows in the river are reduced. For example, between 1960 and 1980, the lower American River experienced 89 violations of pH and dissolved oxygen standards. (See Table 6-3.) Furthermore, low flows periodically experience high water temperatures that have jeopardized juvenile fish.

UPPER AMERICAN RIVER

The Middle Fork is one of three major forks within the 2,631-square-mile drainage basin of the American River. The American River includes natural areas and those that have been modified by human activity to meet recreational and water-supply needs. The Middle Fork drainage basin is approximately 616 square miles.

Water-quality management by the CVRWQCB includes establishment of beneficial uses and water-quality objectives. Protection and enhancement goals for identified beneficial uses determine the overall water-quality objectives. The beneficial uses of the American River include:

Municipal and domestic supply	Warm freshwater habitat
Irrigation	Cold freshwater habitat
Stock watering	Spawning (warm water)
Water contact recreation	Spawning (cold water)
Canoeing and rafting	Migration
Noncontact water recreation	Wildlife habitat
Hydroelectric power generation	Riparian habitat

The primary beneficial uses in the vicinity of the project area include domestic water supply, contact and noncontact recreation, cold water spawning, cold freshwater habitat, and wildlife habitat.

Long-term water-quality monitoring programs have been conducted in the upper American River. However, since 1981, most efforts have been curtailed. The STORET Water Quality Database

TABLE 6-3. Violations of Water-Quality Goals at American River, 1960-80

Station Name	Station No.	Parameter	No. of Violations	No. of Observations	Percent In
North Fork American River upstream of Middle Fork	052557	pH	5	84	6
Middle Fork American River upstream of North Fork	052558	pH	6	98	6
South Fork American River (Kyburz)	A7455000	Arsenic Selenium	2 1	18 9	11 11
South Fork American River (Kyburz)	11439500	pH	1		
American River at Folsom Bridge	052552	pH	11	98	11
American River at Nimbus Dam	11446400	pH	1	113	<1
Lower American River below Nimbus Dam	WB05A0718000	pH DO	1	191	<1
American River below Nimbus Dam	A0718000	DO	2	192	1
American River at Nimbus Dam Fish Screen	052551	pH	13	112	12
American River at Fair Oaks	11446500	pH	1	43	2
American River Cordova Sewage Treatment Plant R2	WSB050079871R1	pH DO	1 1	125 127	<1 <1
American River Northeast Sewage Treatment Plant R1	WB050079871R1	pH DO	8 1	129 126	6 <1
American River at Sacramento	11447000	pH	2		
American River at Sacramento	A0714000	DO	2	217	<1
American River Arden Sewage Treatment Plant R2	WB050079847R2	DO	1	125	<1
American River Arden Sewage Treatment Plant R1	WB050079847R1	pH DO	27 5	109 111	25 5
American River at 16th Street	052549	pH	10		

Source: Shulters, M.V., 1982.

(U.S. Environmental Protection Agency, 1989) was queried to determine present baseline conditions and identify long-term water-quality trends.

The USBR performed a 1-year study in the Middle Fork near Auburn to compare water-quality parameters between high- and low-flow conditions. All parameters were within CVRWQCB established objectives. (See Table 6-4.)

USBR also did comprehensive sampling between 1980 and 1981 to compare water quality between the North and Middle Forks. (See Table 6-5.) The North Fork was found to have higher

TABLE 6-4. Average High- and Low-Flow Monthly Water-Quality Data at Middle Fork American River Near Auburn, 1972[1]

Parameter[2]	May (high flow)	September (low flow)
GENERAL		
Discharge (cfs)	4,120	43
Dissolved Oxygen	11.7	9.1
Hardness ($CaCO_3$)	10	34
Temperature (°C)	11.8	24.1
Total Dissolved Solids	24	58
Specific Conductance (uhmos)	28	87
Turbidity (JTU)	8	0.5
CHEMICAL		
Bicarbonate (HCO_3)	12	37
Boron (B)	0	0
Calcium (Ca)	3.2	9.9
Carbonate (CO_3)	0	0
Chloride (Cl)	2.5	4.4
Fluoride (F)	0	0.1
Magnesium (Mg)	0.5	2.3
Nitrate (NO_3)	0	0
Potassium (K)	0.3	0.7
Silica (SiO_2)	9	13
Sodium (Na)	1.4	3.2
Sulfate (SO_4)	1	6
BACTERIOLOGICAL		
Coliform (MPN/100 ml)	Median (yr)	6.2
	Maximum	620
	Minimum	0.2

[1] Bureau of Reclamation. 1972. Auburn Folsom South Unit, Station No. USBR 11433500.
[2] All parameters in mg/l unless otherwise indicated.

concentrations of dissolved minerals, which resulted in higher conductivities, hardness, and pH. The U.S. Geological Survey (1975-87) also recorded higher levels of dissolved solids and higher pH levels on the North Fork; however, dissolved oxygen concentrations were similar for both forks. (See Table 6-6.)

Historically, water-quality parameters for the American River have been generally within acceptable limits to meet CVRWQCB objectives and beneficial uses. However, several transient water-quality violations occurred at several sampling sites between 1960-80. (See Table 6-3.) During this period, the North and Middle Forks recorded five and six pH violations, respectively.

TABLE 6-5. Average Annual Surface-Water Quality on the American River, 1980-81

Parameter	Average	Number of Observations	Average	Number of Observations
PHYSICAL				
Air Temperature (^{o}C)	15	4	15	4
Conductivity Field (umhos/cm)	97.2	10	52.2	10
Depth (ft)	2.4	5	2.6	5
Residue Dissolved (180^{o} C)	69.6	5	41.2	5
Secchi Visibility (inches)	30	4	30	4
Temperature (^{o}C)	13.2	10	12.1	10
Turbidity (JTU)	2.9	10	1.3	10
CHEMICAL				
Hardness (Ca)	42.1	5	19.2	5
Dissolved Oxygen	10.1	10	10.4	10
Dissolved Oxygen (% Saturation)	96.7	10	96.5	10
HCO_3 Ion	51.2	5	26.4	5
pH	7.3	10	7.2	10
pH Laboratory	7.3	5	7	5
NITROGEN				
NH_3 + NH_4 (Total)	0.01	7	0.02	6
NH_3 & Organic (Total)	0.21	7	0.02	8
NO_2 & NO_3 (Total)	0.02	8	0.02	8
Organic	0.16	10	0.14	9
Total	0.19	10	0.17	10
Total (Inorganic)	0.03	9	0.03	9
Un-Ionized (NH_3-N)	0	10	0	10
OTHER CHEMICAL				
DISSOLVED				
Calcium (Ca)	11.6	5	5.4	5
Magnesium (Mg)	3.2	5	1.4	5
Phosphate (Ortho)	0.01	6	0.02	6
Potassium (K)	1.0	3	1.3	4
Sodium (Na)	2.6	5	1.8	5
TOTAL				
Chloride (Cl)	2.6	5	2.0	5
Hardness ($CaCO_3$)	42.1	5	19.3	5
Phosphate (PO_4)	0.01	6	0.02	6
Sulfate (SO_4)	8.0	5	3.3	4
Sodium	11.8	5	16.2	5
BIOLOGICAL				
Chlorophyll A (ug/l)	0.33	9	0.6	9
Pheophtn A (ug/l)	0.24	9	0.36	9
METALS				
Cadmium (Cd)	0.01	1	0.01	1
Chromium (Cr)	0.02	1	0.02	1
Copper (Cu)	0.02	1	0.02	1
Iron (Fe)	0.06	1	0.05	1
Lead (Pb)	0.01	1	0.01	1
Manganese (Mn)	0.02	1	0.05	1
Mercury	0.001	1	0.001	1
Nickel (Ni)	0.03	1	0.03	1

TABLE 6-5. Average Annual Surface-Water Quality on the American River, 1980-81 (Continued)

Parameter	Average	Number of Observations	Average	Number of Observations
Silver (Ag)	0.01	1	0.01	1
Zinc (Zn)	0.01	1	0.01	1

[1] U.S. Bureau of Reclamation sampling station (No. USBR052557) located on the North Fork of the American River above confluence with Middle Fork.
[2] U.S. Bureau of Reclamation sampling station (No. USBR052558) located on the Middle Fork of the American River above confluence with North Fork.
[3] All parameters in mg/l unless otherwise indicated.
Source: U.S. Environmental Protection Agency. 1988. STORET Water Quality Database.

TABLE 6-6. Comparison of Average Annual General Water-Quality Parameters Between the North and Middle Forks American River, California (1975-1981)

Parameter	North Fork			Middle Fork		
	Below Auburn Dam Site	North Fork Dam	Slaughter Ravine	Near Auburn	Foresthill	French Meadows
Water Temperature (^{o}C)	9.9	14.7	-	-	-	-
pH	7.7	8.0	7.8	7.5	7.4	7.3
Dissolved Oxygen (mg/l)	10.9	9.7	10.2	10.4	10.9	10.3
Solid Residue (Dissolved at 180^{o}C)	46.9	67.2	67.9	36	32.6	26

[1]U.S. Geological Survey. 1975-1987. Water Resource Data - California. Volume 4. Sacramento, CA.

Recreational overuse and improper land use are considered potential sources of water-quality problems for the upper American River basin. Poorly managed mining operations can also generate water-quality impacts. Such activity may include recreational gold panning or commercial mineral mining. The project would not affect current activities within the canyon.

Mining operations have a history of various water-quality problems in the upper basin. A major concern associated with any mining activity is increased sedimentation. Incidents of increased sedimentation from mining activities near the river have resulted in significant impacts on aquatic organisms near and downstream from the activity. A separate water-quality concern related to mining is the potential for trace minerals or heavy-metal contamination of floodwaters due to seepage from mine tailings. (See the impact discussion in Chapter 5, Hazardous and Toxic Waste, for further discussion.)

The Old Cool Quarry is located in the Middle Fork American River canyon, approximately 5 miles upstream from the proposed damsite. The site is approximately 500 yards south of the river channel. Wash water is obtained from onsite wells and discharged onsite into settling ponds that have been developed from areas of previous excavation. Two ponds are presently being used. The primary site, the "south pit," is located in the southern area of the quarry, roughly 1/2 mile from the river channel. The northern pond is near the northern boundary and lies roughly 500 yards south of the river channel. Water use and disposal within the operation are contained within the quarry site (Bartley, pers. comm., 1991). Surface drainages are also contained onsite.

IMPACTS

SIGNIFICANCE CRITERIA

Several methods of determining the level of significance of drainage and water-quality impacts are available. The following describes three criteria which have been used in this study:

For purposes of this analysis, any degradation in water quality below standards established by the SWRCB, CVRWQCB, or EPA would constitute a significant impact. The potential for such significant impacts would depend on the volume and concentration of the pollutants in the discharge and the volume and background pollutant concentrations of the river.

More specific to the American and Sacramento Rivers, non-degradation is the operational policy of the RWQCB. The non-degradation policy calls for the protection and maintenance of high-quality water resources at background levels of quality, which means that pollutant concentrations in the American River must not increase to the extent that beneficial uses are affected. The following water-quality objectives for the American River are part of the nondegradation policy:

- No increase beyond natural background levels for turbidity.
- No bottom deposits other than natural causes.
- No floatables, oil and grease, other than natural causes.

- o No significant change in normal ambient pH value; pH shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges.

- o No added substances which produce aquatic growths in the receiving waters to the extent that such growths cause nuisance or damage to any of the beneficial water uses.

- o Bacteria levels will be those recommended by the California State Department of Public Health.

- o Water shall remain free from adverse temperature changes resulting from waste discharge or other activities of man.

- o No added substances which produce deleterious effects upon beneficial uses to receiving waters.

- o No significant increase in color beyond natural background levels.

Finally, the California Environmental Quality Act, Appendix G, indicates that:

> "A project will normally have a significant effect on the environment if it will (f) substantially degrade water quality; (g) contaminate a public water supply; (h) substantially degrade or deplete ground-water resources; and (i) cause substantial flooding, erosion, or siltation."

It should be noted that construction activities associated with implementation of the selected plan have the potential to result in significant impacts to water quality. Definitive determination of significance is impossible at this time. However, where the potential exists for significant impacts, such impacts have been identified as significant, and appropriate mitigation has been recommended to reduce them to less than significant.

Drainage impacts have been evaluated on the ability of existing drainage facilities to convey runoff. In general, the project is intended to improve the capacity of the existing flood protection network to convey storm runoff in the Sacramento region. This is considered a beneficial impact of the project.

NO-ACTION ALTERNATIVE

Flood-Related Impacts

Under the no-action alternative, no Federal or State action would be undertaken to modify the existing flood control system. Therefore, no direct construction impacts to water quality would occur.

The Sacramento area would remain exposed to significant flooding risk within the American River flood plain. Inundation of some areas or facilities within the flood plain could result in significant water-quality impacts. Landfills, sewage conveyance and treatment structures, and areas used to store hazardous materials pose a potential threat to water quality in the event of severe flooding.

Landfills can be a source of hazardous material contamination and of flood debris. There are five open waste disposal sites and one closed facility within the flood plain. Contamination of water by hazardous materials and/or debris would affect drinking water quality. Aquatic habitat and organisms would also be affected; depending on the severity of contamination, the impacts may be short term or long term.

Inundation of sewage conveyance and treatment facilities could potentially result in contamination of surface waters (namely, the American and Sacramento Rivers) by untreated or infectious wastes. No wastewater treatment plants are located within the 200-year flood plain of the American River.

The release of hazardous or toxic substances caused by a flood would threaten the water quality of local drainages and the American and Sacramento Rivers. Drinking water supplies could become contaminated. Effects on aquatic habitat and organisms would likely result in the vicinity of a spill and downstream. The potential for contamination would depend on the location of a storage facility and the level of flood proofing employed at the facility. Tanks or other containers within the flood zone that are not tied down and/or anchored pose the greatest threat. Approximately 1,430 sites have been identified where toxic and hazardous materials are present within the flood plain. Roughly 334 of the sites are considered potentially dangerous and would pose a significant threat of contamination if inundated. (See Chapter 5, Hazardous and Toxic Waste.)

Commercially available hazardous products also pose a threat to water quality. Products such as pesticides, cleaning compounds, and solvents may be found in homes or retail stores or at landfills or illegal dump sites. These chemicals may be released to floodwaters due to inundation of such buildings or locations.

Growth and Development

Regional growth in all of the project areas would proceed under the no-action alternative essentially as anticipated under the existing City and County General Plans, consistent with current California State Department of Finance population projections. The absence of a comprehensive flood control program along the American River would constrain development in the Natomas basin and in certain portions of the Pocket and Meadowview areas of the City. (See Chapter 4, Land Use.) However, most, if not all, of this development would be absorbed elsewhere in the region (that is, generally outside the flood plain affected by the American River), thus creating a slightly different urban drainage pattern than anticipated under the with-project condition. Since all discharges into regional waters would remain subject to existing regulatory requirements, water-quality impacts on a regional scale would be minimally affected.

SELECTED PLAN

This section describes the direct impacts to water quality which will result from construction and maintenance-related activities associated with the selected plan. This section also describes the indirect water-quality impacts in the project area over the life of the project as a result of development pressures.

Direct Impacts

Natomas. Improvement of the levees surrounding the Natomas basin could result in increased turbidity and sediment loading in the adjoining channels due to erosion of the levee banks caused by removal of vegetation and operation of heavy equipment. Pollution of the water channels could also be caused by spills of construction materials such as gravel, cement, oil, grease, fuel, or even the hydromulching mixture proposed for use during revegetation. The potential for contamination of stormwater runoff would also increase during construction and immediately following construction due to the exposure of "unprotected" soil surfaces. The most likely contaminants would include sediments and petroleum residues from construction equipment parking areas.

The degree to which construction activities affect water quality is partially determined by the timing of construction activities and local climate. In general, construction during the dry season when flows in the drainage channels and creek are low would serve to avoid impacts influenced by rainfall runoff.

Construction of the improvements could result in short-term changes in sediment loads in existing agricultural drainage channels and future drainage from construction activity. The exact amount of sediment load and other construction impacts is uncertain. Most levee work along the Pleasant Grove Creek Canal, NEMDC, and NCC would be on top of existing levees, although the levees would be widened in selected locations, limiting the potential for significant impacts. However, impacts to all the drainages are considered potentially significant. These impacts are expected to be reduced to a less than significant level by implementation of a mitigation program for construction. The mitigation program will include preparation and implementation of an erosion and sediment control plan and implementation of other precautionary measures as part of construction practices to minimize water-quality degradation. The erosion and sediment control plan will be consistent with best management practices as contained in the NPDES permit for Sacramento County/City. These measures are described in greater detail in the mitigation section.

Maintenance of the project features constructed under the selected plan would not generate any long-term drainage or water-quality impacts in Natomas.

Implementation of the selected plan would result in improved drainage conveyance and increased flood protection in the Natomas basin. This would be considered a beneficial drainage impact.

Lower American River. The selected plan will not involve any construction or cause any direct construction-related impacts in the lower American River area.

Upper American River. Water-quality impacts within the upper American River canyon would potentially be generated by quarry operations, construction activities, and floodwater impoundment behind the dam.

Quarry Operations. Implementation of the selected plan would involve expansion of the Old Cool Quarry operation to a production rate of 1,000 tons per hour. The increased rate of production would require a greater amount of water for washing processes. In turn, a higher amount of waste material would be generated and require disposal in the settling ponds. The RWQCB would review the proposed operating plans to determine the need for waste discharge requirements and/or a monitoring program.

As this site is already disturbed, it is likely to have fewer significant environmental effects than undisturbed source locations. Measures are available to divert surface runoff away from drainage courses and to control the discharge of waste materials. (See Mitigation.) Potentially significant water-quality impacts of this operation could be mitigated.

Aggregate from Old Cool Quarry would be transported to the damsite via a conveyor system along the south side of the river. Vegetation removal and soil disturbance resulting from construction of the conveyor system could lead to accelerated erosion of topsoil. Loose soil may be transported by wind or by overland flow to the river channel, potentially increasing the sediment load in the vicinity of construction activity. The operation of heavy equipment required to construct the conveyor would also cause soil disturbance. There is also the potential for spillage of petroleum products, oil, or grease. These constituents could degrade surface-water quality and could be harmful to aquatic habitat.

The impacts associated with conveyor construction are considered potentially significant. The installation and removal of the conveyor would be a short-term function. As identified in the mitigation section, several measures could be implemented to reduce the potential for these impacts to less than significant.

<u>Construction Impacts</u>. Constructing a roller-compacted concrete (RCC) dam would entail many operations potentially affecting water quality near the damsite. These include foundation excavation, butching operations, placement of embankment fill, and haul road construction. Primary impacts from these activities are sedimentation and erosion from operating heavy equipment along bank slopes, potential resuspension of river sediments caused by heavy equipment operations near the river, and erosion of exposed sites during storms. Other potential impacts include spillage of petroleum products and incidental spillage of construction materials such as cement and gravel. Sediment eroded from the construction site is transported to local surface watercourses and then dispersed downstream. It should be noted that the damsite has already been highly disturbed by previous foundation work completed for the multipurpose dam. The U.S. Soil Conservation Service (SCS) (1982) sampled construction sites in Sutter and Placer Counties and found erosion rates varied from 1 to 128 tons/acre/year.

Based on the most severe annual erosion rate for construction activities reported by SCS, and assuming a 3-year construction period and 200-acre construction site on the American River, it is expected that up to 8,000 tons of sediment would be generated. This would be considered a potentially significant impact on water quality. The existing diversion in the damsite area in conjunction with standard erosion control measures would reduce this impact to less than significant.

Besides sedimentation, other water-quality parameters resulting from construction could be changed significantly. For instance, channel construction activities often result in increased concentrations of dissolved calcium, sulfate, and chloride; increased concentrations of total iron and manganese; and increased levels of turbidity, suspended sediments, and dissolved solids (Shields and Sanders 1986; Thackston and Snead 1982; and Canter 1977). Asbestos could be released from the crushing of any serpentine rock.

The spoils operations in the vicinity of the American River pose a potential turbidity threat to the waterway. However, because the river has been diverted in the vicinity of the damsite, little potential exists for turbid discharges during excavation and removal of spoils in the immediate vicinity of the damsite. Also, because of the routing of the river through the diversion tunnel, banking of spoils in the existing keyways minimizes water-quality impacts posed by this operation.

On the other hand, because of the proximity to the river, banking of spoils in the Salt Creek area could result in a significant water-quality impact. Plans call for placement of spoils on top of existing fill imported during previous operations. Initial placement would begin at the base of the existing embankment near the river and proceed upward as additional spoils are placed. Overland flow could wash material directly into the river. Also, the proximity of Salt Creek increases the potential for impact. Excessive or untimely discharges from the creek during spoil placement could wash unprotected material into the river. Due to the potential for untimely Salt Creek flows, water-quality impacts associated with spoils disposal are considered potentially significant. Current plans call for ultimately directing discharges from the creek through a concrete channel. Standard construction erosion control practices during spoils placement, as well as containment of Salt Creek within a conveyance structure, should serve to reduce potential water-quality impacts to insignificant levels.

Construction activities required to implement an in-kind replacement of Highway 49 at river mile 23 and replacement of Ponderosa Way as proposed under the selected plan would generate similar water-quality concerns as identified under dam construction. Roadway excavation would expose soils to increased erosion potential, and construction activities in the vicinity of the American River would increase the potential for spillage of petroleum products or construction materials. These impacts are considered potentially significant and can be reduced to less than significant through implementation of an appropriate mitigation plan. It should be noted that these impacts would be short term and occur only during construction of the facilities.

Impoundment Impacts. Temporary impoundment of high flows in the canyons of the North and Middle Forks of the American River would increase water contact with terrestrial soils and vegetation, introducing additional nutrients, minerals, and sediments into the river. This would happen to some extent naturally during flooding when flows escape their channels, but during impoundment, water levels would remain higher for longer periods than under the no-action alternative, leading to more materials entering the stream. Impoundments caused by the flood control dam would be periodic and temporary, with the frequency and duration of inundation depending on storm patterns in the watershed. Excessive nutrient loading, resulting in algal blooms, increased biochemical oxygen demand, and reduced concentrations of dissolved oxygen, is a common occurrence in newly impounded permanent reservoirs (Gunnison, et al. 1986). However, these impacts would be minimal or nonexistent because of the temporary duration of inundation and therefore are considered not significant.

During flood and/or high-flow events, channel and slope erosion would occur, causing nutrients and sediments to partially settle in the flood control reservoir. Suspended materials would be transported downstream into Folsom Reservoir where increased retention times would permit further settling. Because of the relative infrequency of flooding in the upper canyons and the volume of materials likely to enter the stream in connection with a flood, the sedimentation associated with the flood control dam would not significantly affect water quality in the American River.

Another concern associated with flooding in the upper American River canyon is the potential inundation of abandoned mine operations. As discussed in Chapter 5, Hazardous and Toxic Waste, a review of the Regional Board's Listing of Dischargers and conversations with the board's engineering and planning staff revealed no problems with active or abandoned mines or mine tailings.

Review of the geology of the project area revealed no significant deposit of acid-forming rocks such as pyrite in the upper American River. These deposits have been known to occur in the lower elevation of the Sierra foothills. The small pyrite deposits that may have been exposed by hydraulic mining in the upper American River have since been mineralized, such as at the Sliger Mine in the Middle Fork American River, and prevented from producing acid drainage. Since there will be no excavation of gravel bars and deposits in the project area, except for keying dam foundation, there is no likelihood that any acid-forming rocks will be reexposed during the construction and operation of the project.

Mine tailings along the upper American River will likely contain mercury. There is no known operation, past or present, that used cyanide to extract gold in the upper American River. Infrequent inundation of these mine tailings may cause erosion and downstream transport of the sediment containing mercury. However, the mercury in these tailings is insoluble to water; therefore, water-quality impairment is not expected.

<u>Indirect Impacts</u>

<u>Natomas</u>. The flood protection improvements proposed in the selected plan would provide flood protection for existing development in Natomas and would allow the development of portions of the basin presently in agricultural use, thus resulting in significant drainage and water-quality impacts.

<u>Drainage</u>. The conversion of existing agricultural lands to urban uses in the South and North Natomas Community Plan areas would alter existing watershed drainage and result in an increase in impervious surfaces and peak stormwater flow rates. If these increased flows are discharged into the Sacramento River when the river is at flood stage, the increase in water levels in the channel would increase the risk of levee failure and consequential flooding of the Natomas area, as well as areas bordering on the Yolo Bypass downstream of the Sacramento Bypass (North Natomas Community Drainage System Revised Supplemental Draft EIR, November 1989).

The significance of this flood risk impact would depend on the water levels at critical levee locations. Whenever water levels in the Yolo Bypass, American River, or NEMDC are at or near the limit of allowable freeboard levels, discharge from the basin would cause encroachment into design freeboard. Such encroachment would constitute a significant impact (North Natomas Community Drainage System Revised Supplemental Draft EIR, November 1989).

The drainage systems being planned for the North and South Natomas Community Plan areas would accommodate flows generated by a 100-year storm event in the basin. The resulting estimated discharges of up to 5,700 cfs from North Natomas Community Plan area and 390 cfs from the NWAD would increase water levels in the Sacramento and American Rivers, NEMDC, Sacramento Bypass, and Yolo Bypass and could create a significant risk of flooding depending upon conditions at the time of discharge (North Natomas Community Drainage System Revised Supplemental Draft EIR, November 1989, and City of Sacramento, Draft EIR for NWAD, 1990).

Drainage improvements proposed for South Natomas are needed for the City of Sacramento to permit development in western South Natomas in accordance with the adopted SNCP. The affected area lies in the northwestern portion of the City and in the unincorporated area of Sacramento County, on the east side of the Sacramento River approximately 1.5 miles upstream of its confluence with the American River. Surface water from this area now collects in a network of agricultural ditches that eventually discharge into the Natomas Main Drainage Canal and the Sacramento River.

The improvements proposed would consist of new underground storm drains along West El Camino Avenue, River Plaza Drive/Orchard Lane and Road B and an easement leading to a new pump station on the north side of the El Centro Road/Garden Highway intersection. A small portion of the drainage would continue to discharge into the Natomas Main Drainage Canal. The remainder would drain into underground stormwater lines that would collect into a 90-inch-diameter pipe and then would terminate at the new drainage pump station. The pumping plant design will be coordinated with the Corps of Engineers, The Reclamation Board, DFG, CVRWQCB, State Lands Commission, and SMAQMD.

Temporary handling of summer irrigation flows from agricultural lands would be provided by interconnecting underground pipes to the remaining stormwater drainage system. When the proposed project is completed, existing roadside drainage ditches would be eliminated by filling existing wet areas (determined to be nonjurisdictional wetlands).

The City is proposing the financing of this and other water, sewer, and road improvements through a communitywide assessment district. Reclamation District 1000 does not accept responsibility for disposing of stormwater runoff originating on nonagricultural lands. If landowners wish to develop their property for nonagricultural uses, a separate drainage district must be established to fund needed improvements.

The objectives of the North Natomas Community Drainage System are to allow development of the North Natomas Community Plan area, provide facilities for storm events up to and including the 100-year event for runoff originating within the areas served by the facilities, and provide drainage for existing agricultural lands outside of the North Natomas Community Plan area that are tributary to the proposed drainage systems. The project would include two interrelated but separate systems--the San Juan Canal system and the Del Paso Canal system--with one pump station at the terminus of each canal to lift storm runoff into the Sacramento River.

Design of the pump stations would be coordinated with the same entities described for the South Natomas systems. These pump stations would increase the stage and flows in the Sacramento River. As previously stated, the Corps of Engineers and the State of California presently have no allowance within the river's floodway to receive additional pumped water. The Corps of Engineers, in cooperation with the State of California Flood Control Center, could order the pumps shut off if inflow posed a risk to river levees protecting Natomas, Sacramento, or West Sacramento.

City flood control officials indicate that if the American River is not controlled, urbanization will not be feasible in Natomas, and the pump stations will not be constructed. If flood control protection is provided, the San Juan station would probably be constructed first and the Del Paso station in the latter phases of Natomas buildout.

Water quality. While new development in Natomas would reduce the volume of agricultural pollutants currently discharged into the Sacramento River, this development would result in increased discharges of pollutants normally associated with urban uses, including elevated levels of metals, hydrocarbons, oil, grease, and sediment. The uncontrolled discharge of urban stormwater runoff from developed areas would degrade the quality of the receiving waters. For purposes of this analysis, any degradation in water quality below standards established by the SWRCB, CVRWQCB, or EPA would constitute a significant impact.

The potential for such significant impacts would depend on the volume and concentration of the pollutants in the discharge and the volume and background pollutant concentrations of the river. A 2-year storm, coupled with a low fall riverflow, is expected to represent the worst case because of the flushing of accumulated pollutants into the river. Adverse effects on aquatic resources such as fish and invertebrates could occur as a result of toxicity or alterations in food sources. (City of Sacramento, Draft EIR for NWAD, 1990.)

The NPDES permit issued to the City of Sacramento, County of Sacramento, and other parties does not contain specific water-quality objectives, but refers to RWQCB Basin Plan standards and nondegradation policies for water-quality criteria reference points. The permit relies on a monitoring and evaluation period to note any degradation of water quality and aquatic resources from urban runoff (CVRWQCB, 1990). The City and County are obligated under the permit to use best management practices to improve stormwater quality. Under applicable provisions of the FCWA, plan development in south Sutter County will be subject to these same requirements. Notwithstanding these requirements, however, it appears that periodic exceedences of established standards would be unavoidable. As discussed above, this impact is considered significant (City of Sacramento, Draft EIR for Natomas West Assessment District, 1990).

The scope of the indirect impacts associated with the selected plan would broaden if the general plan modifications currently being considered by Sacramento and Sutter Counties are implemented. A discussion of these proposed modifications and their effect on the environment appears in Chapter 18.

Lower American River. Implementation of the selected plan would permit development to proceed in accordance with the City's adopted General Plan on vacant lands in the Pocket and Airport/Meadowview areas of the City. The affected lands are located near the Sacramento River in an area served by a new urban drainage system which conveys stormwater runoff to pump stations along the Sacramento River for ultimate discharge into the river. As in Natomas, notwithstanding implementation of BMP's, runoff attributable to project-induced growth in the lower American River area would increase the amount of oil, grease, and heavy metals discharged into the Sacramento River and could occasionally violate established standards for lead and copper, thereby adversely affecting established resources in the river. This is considered a potentially significant impact.

Upper American River. Implementation of the replacement of Highway 49 at river mile 23.0, as proposed under the selected plan, would not significantly alter traffic patterns in the area and would not, therefore, result in any indirect drainage and water-quality impacts. However, the State-required route adoption process which must be undertaken prior to any replacement of the highway could result in a high bridge alignment. Such an alignment would shorten commute times between residences in western El Dorado County and job centers along the I-80 corridor and would thus contribute to regional growth pressures and associated growth-related impacts, including drainage and water-quality impacts. The State route adoption process and potential high bridge alignments are discussed in Chapter 17. The effect on regional growth of adopting one of these alignments is discussed in Chapter 18.

400-YEAR ALTERNATIVE

The 400-year alternative would produce substantially the same drainage and water-quality impacts as the selected plan in the Natomas and lower American River areas. Direct construction impacts and growth-inducing impacts would be the same. However, the 400-year alternative would expose these areas to a slightly lower risk of flooding and flood-related water-quality impacts. (See discussion under no-action alternative above.)

In the upper American River area, the larger 400-year dam would require more time to construct and would result in slightly increased construction-related impacts on water quality than the dam proposed under the selected plan. Operation of the larger 400-year structure would generate a slightly greater inundation pool and correspondingly more sedimentation impacts.

150-YEAR ALTERNATIVE

The drainage and water-quality impacts associated with the 150-year alternative in Natomas would be similar to the selected plan. This alternative would involve significant bank protection and levee construction along the lower 23 miles of the American River, causing potentially significant amounts of sediment to enter the river. Assuming proper construction procedures were implemented (e.g., construction during low-flow periods, use of clean materials, revegetation of disturbed sites, etc.) the effects of construction on water quality would be minimized. No long-term significant impairment of water quality is expected.

The 150-year alternative would increase the space allocated to flood control at Folsom Reservoir by 250,000 acre-feet, lower the Folsom Dam spillway by 15 feet, and result in higher storm-related releases from the reservoir. These measures would result in the following impacts on water quality:

- o Lowering the level of Folsom Reservoir to accommodate additional flood storage would reduce cold water releases from the reservoir during the fall and spring. As a result, water temperatures in Folsom Reservoir and the lower American River would rise. These higher temperatures would adversely affect aquatic resources, particularly the cold water fisheries in the reservoir and the river channel. (See discussion in Chapter 8.)

- o Lowering the dam spillway and increasing the objective releases from Folsom Reservoir would result in more severe sedimentation impacts in the lower American River than would be experienced under the selected plan.

The 150-year alternative will avoid all direct and indirect impacts in the upper American River area.

100-YEAR (FEMA) LEVEE ALTERNATIVE

The direct and indirect impacts in Natomas associated with this alternative would be substantially the same as for the selected plan. However, this alternative would leave the basin and other areas of the flood plain exposed to a higher risk of flooding and flood-related water-quality impacts than the selected plan.

This alternative would entail substantially the same construction impacts as the 150-year alternative in the lower American River. However, because additional flood control reservation would not be required in Folsom Reservoir, the long-term water-quality impacts associated with the 150-year and 100-year (FEMA) storage alternatives would be avoided.

The 100-year (FEMA) alternative will avoid all direct and indirect impacts in the upper American River area.

100-YEAR (FEMA) STORAGE ALTERNATIVE

The direct and indirect impacts associated with this alternative in Natomas would be substantially the same as for the selected plan. However, this alternative will leave the basin and other areas of the flood plain exposed to a higher risk of flooding and flood-related water-quality impacts than the selected plan.

This alternative would not require construction in the lower American River area, but would increase the space allocated to flood control in Folsom Reservoir by 190,000 acre-feet. This operational measure would result in temperature increases in the reservoir and the lower American River, causing fisheries impacts comparable to those described for the 150-year alternative.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The direct and indirect impacts associated with this alternative in Natomas would be substantially the same as for the selected plan. However, this alternative would leave the basin and other areas of the flood plain exposed to a higher risk of flooding and flood-related water-quality impacts than the selected plan.

This alternative would result in construction impacts similar to those of the 150-year alternative in the lower American River. However, long-term impacts would be reduced due to the need for a smaller increase in the flood control reservation in Folsom Reservoir.

MITIGATION

DIRECT IMPACTS

Implementation of the selected plan has the potential to significantly affect water quality at all of the construction sites, material storage sites, and access routes required to complete project improvements. Potential water-quality impacts would be most likely where construction activities would occur near surface-water features (that is, NEMDC, Arcade Creek, and American River).

In general, to minimize direct impacts from sedimentation and incidental spillage, temporary measures will be implemented to divert natural streamflows from the active construction and storage sites. This would make construction easier in the dewatered channel and would minimize contact of potentially harmful materials with active streamflow. This could be accomplished at the proposed damsite by utilizing the existing diversion tunnel that USBR had constructed at river mile 20.1.

Installing a network of temporary interceptor dikes and ditches at other construction sites would convey sediment-laden flows into temporary settling basins. These basins would retain the waters, allowing sediments to settle. Finally, certain construction activities should be limited to annual low-flow periods. Selected water-quality parameters (pH, dissolved oxygen, and turbidity) should be regularly monitored during construction.

The above mitigation strategies will be implemented through preparation of an erosion and sediment control plan for each distinct project feature. Implementation of the above measures would reduce potential water-quality impacts to less than significant. However, the potential would still exist for inadvertent spills or releases into receiving water. Preparation of a spill prevention and counter measure plan would partially mitigate these impacts in the event of an accidental spill.

Infrequent temporary impoundment behind the flood control dam would result in increased sediment loads being transported downstream to Folsom Reservoir. Although no mitigation has been identified for this impact, these increases were considered to be adverse, but not significant, due to the infrequent occurrence and minimal increase over existing conditions during flood events.

Drainage impacts would involve disruption of existing drainage patterns during construction. This impact would be short term and is considered adverse, but not significant. Overall, implementation of the selected plan would have a beneficial impact on drainage by improving flood protection for existing urban development in the Sacramento metropolitan area.

A more specific discussion of mitigation appropriate to distinct components or areas affected by the selected plan and alternatives is provided below.

Natomas

Development and implementation of an erosion and sediment control plan could effectively reduce the potential for turbidity problems created when the levee banks become susceptible to erosion due to soil disturbance caused by vegetation removal and operation of heavy equipment. The following features will be included in such a plan:

- o Revegetation and stabilization of disturbed soils. Reseeding and mulching work shall be completed by October 1 of any year following grading. If erosion control improvements are not installed by October 1 of any year following grading, exposed soil may require additional treatment following seasonal rains and subsequent erosion.

- o The use of small sediment catchment basins or traps to prevent sediment from being transported over construction sites should be considered. The location and size of these basins would be designed to minimize any impacts on riparian areas or wet areas. Types of sediment traps to be considered include filter berms, straw base barriers, filter inlets, vegetative filter strips, and culvert risers.

- o The plan will include details regarding seed material, fertilizer, and mulching. The seed material will include native plant species and be approved by a revegetation specialist or erosion control specialist.

Precautionary measures will be implemented during construction to minimize water-quality degradation. Minimizing water-quality degradation is greatly dependent on precautions taken during the design and construction period. The following measures may be modified somewhat as a result of conditions imposed by various regulatory agencies. The following is a partial list of measures that will be implemented.

- o Cover any graded areas with protective mulch as soon as possible, but no later than October 1 of any year, and reseed with adaptive plant species of value to wildlife.

- o Enforce strict onsite handling rules to keep construction and maintenance materials out of receiving waters.

- o Collect and remove from the job site all pollutants such as sanitary wastes and petroleum products.

- o Prepare a spill prevention and counter measure plan.

- o Minimize surface disturbances to soil and vegetation as much as possible.

- o Revegetate graded or disturbed areas.

- o Dispose of excavated material away from water sources.

These mitigation measures would be appropriate to all the alternatives discussed in this report.

Lower American River

Levee improvements required under the 150-year alternative would be subject to the same mitigation identified under Natomas.

Upper American River

Mitigation identified for the Natomas features are also applicable to project features in the upper American River. Other appropriate mitigation will include:

- Equipment and vehicles used during site preparation should be properly maintained and clean. Daily observation of all pieces should determine the potential for leaks or other problems. Maintenance, refueling, etc., shall be conducted in a specified area beyond the high waterflow level (10-year flood plain).

- The presence of fuel, grease, and similar products on the site in conjunction with the operation and maintenance of machinery is unavoidable, but would not occur to a degree that would pose a substantial risk to the surface or ground-water resources. A fuel tank spill containment structure should be used and designed to contain the fuel, grease, and similar products required at construction sites plus the precipitation associated with a 100-year, 24-hour storm. Equipment and vehicles used should be properly maintained. This storage shall be located in a designated area beyond the high-water level (10-year flood plain). Drainage structures would be in place at this location to divert flows away from the harvesting area and river channel.

- To minimize erosion potential, Salt Creek should be contained within a conveyance structure in the vicinity of spoils disposal sites.

Processing plant impacts will be generally limited to the disposal of wash water which includes fines such as clays and silts washed out of the crushing and screening units. The RWQCB states that ponds are typically not a problem as long as flows are not directly discharged to surface waters.

A monitoring program will be required at any North or Middle Fork construction sites. Baseline conditions for the river would have to be established prior to preparing any site for excavation. Sampling locations would likely be required upstream and downstream of each excavation site.

Monitoring will be required monthly throughout the construction and reclamation stages. Daily observation of the settling ponds would be required by the RWQCB. These reports would include a description of monthly river sampling results and any observations related to floating or suspended matter, discoloration, bottom deposits, and aquatic life.

The RWQCB area engineer would also periodically inspect the area. The results of the monitoring program and/or of the inspections may lead to changes in the Waste Discharge Requirements issued by RWQCB. Any suggestions for changes will be considered for implementation within contract scope and existing waste discharge requirements.

The activities of the Old Cool Quarry are expected to be contained within the quarry boundaries. The RWQCB should be involved in the review of wash water disposal operations. It may be possible that no permit would be required even with the increased activity.

Maintenance of equipment and vehicles will be as discussed previously. Stormwater runoff shall be diverted away from sources of potential contamination.

INDIRECT IMPACTS

Significant flooding impacts resulting from discharges of interior drainage into the Sacramento River and/or the canal system surrounding Natomas could be avoided by providing facilities to safely retain stormwater runoff when the receiving waters are at flood stage.

Periodic exceedences of established water-quality standards resulting from increased discharges of urban stormwater into the Sacramento River could be reduced in magnitude and frequency, but not eliminated, through the implementation of'best management practices to improve stormwater quality and reduce the volume of stormwater runoff. These practices include:

- o Retain stormwater runoff onsite by means of detention storage.

- o Design storm drainage to slow water flows and depress peak flow volumes.

- o Minimize impervious surfaces.

- o Maximize percolation, evaporation, and evapotranspiration of stormwaters.

Table 6-7 lists all of the BMP's contained in the Sacramento NPDES permit. Since some exceedences of established standards would be expected despite the implementation of these BMP's, under the criteria used in this chapter, the project would produce significant and unavoidable indirect impacts on water quality.

TABLE 6-7. List of Potential Best Management Practices

"Educational" Control Measures
o Educate re: The impacts that result when oil, antifreeze, pesticides, herbicides, paints, solvents, or other potentially harmful chemicals are dumped into storm sewers or drainage channels.
o Educate re: The proper use (e.g., application methods, frequencies, and precautions) and proper management of fertilizers, pesticides, herbicides, and other potentially harmful chemicals.
o Educate re: The effective use of "housekeeping" practices, including the use of adsorbents, cleaning compounds, and oil/grease traps for controlling oil and grease in gas stations, automotive repair shops, parking areas, commercial/industrial facilities, and food service facilities.
o Educate re: The nonpoint source pollution impacts that result from littering and improper solid waste practices.
o Educate re: The need to keep rainfall land runoff from contacting potential contaminants. Describe typical examples of the problem and practical solutions.
o Educate re: The need to minimize both the total volume of runoff and the peak rate of runoff from a given area. Describe basic principles and suggest alternative practical means to enhance surface retention and infiltration.
o Educate re: The relationship between air pollution and nonpoint source water-quality problems.
o Educate re: The need to intensify vehicle inspection and maintenance efforts to reduce leakage of oil, antifreeze, hydraulic fluid, and other potentially harmful chemicals.
o Educate re: The environmental impacts that result from leaks and spills from gasoline, fuel oil, and chemical tanks (above and below ground).
o Educate architects, engineers, contractors, and public works personnel about the need for and practical methods for erosion control, sediment control, ground-water disposal, and site waste disposal.

TABLE 6-7. List of Potential Best Management Practices (Continued)

"Educational" Control Measures (Continued)
o Educate farmers, ranchers, and other managers of agricultural and/or open space lands re: the need for and practical methods for erosion control and sediment control.
o Educate managers and users of parklands and open space lands re: the need to restrict off-trail activities. Establish and enforce practical, site-specific regulations to control off-trail activities.
o Educate re: The need to clean up and properly dispose of pet wastes.
o Educate re: The need to cooperate with programs (by others) that seek to reduce particulate atmospheric emissions of pollutants from individual, public, commercial, and industrial sources.
o Educate re: The need to cooperate with programs (by others) that seek to reduce automobile use by various means (e.g., ridesharing, carpooling, public transportation).
o Educate re: The need to intensify vehicle inspection and maintenance efforts to reduce automobile emissions.
o Educate re: The need to minimize the total runoff volume that roof drains contribute directly to storm sewers and drainage channels. Describe basic principles and suggest practical alternatives to minimize their peak rate of discharge.
"Regulatory" Control Measures
o Research, strengthen (if necessary), and enforce regulations that give local jurisdictions the legal authority to control littering and the improper disposal of potentially harmful wastes.
o Research, strengthen (if necessary), and enforce regulations that give local jurisdictions the legal authority to prevent the improper disposal of silt, debris, refuse, or other pollutants into storm sewers and drainage channels.

TABLE 6-7. List of Potential Best Management Practices (Continued)

"Regulatory" Control Measures (Continued)
o Research, strengthen (if necessary), and enforce regulations that give local jurisdictions the legal authority to eliminate cross-connections, which allow sanitary sewage and/or commercial/industrial wastewater to enter storm sewers or drainage channels.
o Develop and implement effective erosion and sediment control regulations and requirements for corresponding construction inspection programs. These should apply to public sector as well as private sector construction programs.
o Research, strengthen (if necessary), and enforce regulations that give local jurisdictions the legal authority to require site drainage designs and systems that minimize the total volume of runoff and the peak rate of runoff from new construction, where local conditions permit.
o Research, strengthen (if necessary), and enforce regulations that give local jurisdictions the legal authority to require oil and grease controls in areas that are significant sources of oil and grease (e.g., gas stations, automotive shops, wrecking yards, machine shops, commercial/industrial facilities, parking areas, and food service establishments).
o Require new commercial, industrial, institutional, and major multifamily residential building complexes to have drainage facilities that incorporate onsite retention and/or infiltration to ensure that neither the total volume of runoff nor the peak rate of runoff exceeds pre-project conditions.
o Require new public and private sector developments to make significant use of permeable surfaces in new landscaping, recreation areas, walkways, and parking areas to maximize infiltrations (e.g., bark, gravel, and other ground cover, brick, cobblestones, and porous pavement). Use planted areas and/or grassy swales, where appropriate, to maximize retention and infiltration.

TABLE 6-7. List of Potential Best management Practices (Continued)

"Regulatory" Control Measures (Continued)
o Coordinate with the RWQCB to ensure that potential water quality impacts are adequately considered at the time NPDES permits are issued for any discharges to storm sewers or drainage channels. Include monitoring of all pertinent constituents as a permit stipulation.
o Develop and implement improved erosion and sediment control policies in the environmental elements of all general plans (develop and adopt general plan amendments, where needed).
o Adopt policies that require all CEQA compliance documents and site drainage design to explicitly address erosion potential, proposed erosion and sediment control plans, proposed inspection programs, related environmental impacts, and enforceable mitigation measures to minimize environmental impacts.
o Develop and implement regulations that require landowners and/or tenants to provide covers (e.g., roofs, tarps) to keep rain off areas that contain contaminants (e.g., chemical storage areas, waste storage areas, contaminated industrial areas) and to keep runoff from draining through areas that contain contaminants.
o Coordinate efforts (by others) to intensify the implementation of existing regulations that call for improved designs of new tanks (e.g., double walls, monitoring facilities); an aggressive self-monitoring program to be conducted by landowners and tenants; and a strategically focused spot-check program to search for, identify, test, and control leaking storage tanks.
"Public Agency" Control Measures
o Label storm drain inlets and provide signs along the banks of drainage channel sand creeks explaining the environmental impacts of dumping wastes.
o Develop and implement programs that provide convenient means for people to properly dispose of oil, antifreeze, pesticides, herbicides, paints, solvents, and other potentially harmful chemicals (recycle, if possible).

TABLE 6-7. List of Potential Best Management Practices (Continued)

"Public Agency" Control Measures (Continued)
o Develop and implement an aggressive field program to search for, detect, and prevent dumping or routinely discharging pollutants into storm sewers and drainage channels. This may involve reevaluating previous decisions that allowed relatively clean waters to be discharged to the stormwater systems.
o Develop and implement an aggressive field program to search for, detect, and control illicit connections of sewers that carry sanitary and/or commercial/industrial wastewater.
o Determine the effectiveness of increasing the frequency of cleaning out storm sewer inlets, catch basins, storm sewers, and drainage channels in areas where sediments and/or debris tend to accumulate. Develop and implement improved programs where appropriate.
o Develop and implement an aggressive field program to search for, test, remove, and properly dispose of sediment deposits (in drainage channels and streams) that contain relatively high concentrations of pollutants.
o Develop and implement a program that provides a means of recording the observations of field inspection and maintenance personnel so that this information can be used to help locate the source(s) of pollutants.
o Determine the effectiveness of retrofitting existing stormwater retention basins to trap sediments from small storm events while maintaining acceptable water quality for public activities.
o Determine the effectiveness of building, maintaining, and testing relatively large detention basins at several locations in the lower reaches of the watershed.
o Determine the effectiveness of building, establishing, and testing wetlands and riparian vegetation in retrofitted and/or new drainage channels.
o Determine the effectiveness of building, establishing, and maintaining relatively large manmade wetland basins at several locations in the lower reaches of the watershed.

TABLE 6-7. List of Potential Best Management Practices (Continued)

"Public Agency" Control Measures (Continued)
o Develop and implement an aggressive field program to search for, detect, and correct situations where rainfall and/or runoff presently contact potential contaminants.
o Develop and implement intensified street sweeping programs in strategic locations (e.g., central business districts, shopping malls, major parking lots, industrial areas) and/or at strategic times (e.g., following extended periods of dry weather).
o Determine the effectiveness of retrofitting existing infiltration basins to accept and treat storm runoff.
o Develop and implement bimonthly cleanup days and corresponding curbside collection for trash and debris.
o Provide, collect, and maintain more litter receptacles in strategic public areas and during major public events.
o Provide generic plans and specifications and demonstrate project results that will encourage architects, engineers, and building departments to implement systems that temporarily retain rainfall peaks on rooftops and/or in detention facilities to minimize the peak rate of discharge to the storm sewer systems or drainage channels.
o Build, maintain, and assess the performance of several retention basins at selected locations in urbanized areas throughout the watershed (e.g., various city parks).
o Build, establish, maintain, and assess the performance of manmade wetlands at selected locations in urbanized areas throughout the watershed.
o Develop and implement an aggressive field program to search for, detect, and control sanitary sewer leaks in areas where surcharging and/or overflows are most likely.
o Develop and implement programs to actively search for, identify, evaluate, and prioritize erosion problems on undeveloped land, parkland, and agricultural land.

TABLE 6-7. List of Potential Best Management Practices (Continued)

"Public Agency" Control Measures (Continued)
o Develop and implement programs to work with landowners, tenants, and/or public agencies to apply practical erosion control and sediment control practices.
o Develop and implement practical programs for revegetating and otherwise restoring actively eroding areas (e.g., areas damaged by fires, overgrazing, landslides, improper tillage, and off-road vehicle use).
o Coordinate with the U.S. Soil Conservation Service and local resource conservation programs to support their activities to control erosion and sedimentation.
o Cooperate with public transportation agencies, public agency motorpools, and public works departments to provide effective air pollution controls on publicly owned vehicles and motorized equipment and/or to use alternative clean-burning fuel where practical.
o Determine the effectiveness of using street flushers to reduce pollutants in runoff.
o Determine the effectiveness of developing in-line infiltration facilities within selected reaches of large-capacity drainage channels to accept and treat storm runoff.
o Build, maintain, and assess the performance and potential impacts of several relatively small infiltration basins at selected locations in urbanized areas throughout the watershed.

CHAPTER 7

FISH, VEGETATION, AND WILDLIFE

This chapter describes the existing conditions, future conditions without the project, and impacts of the project alternatives on fish, vegetation and wildlife resources within the study area. Mitigation measures to offset project indirect impacts are also discussed.

EXISTING CONDITIONS

FWS provided a report based on joint agency Habitat Evaluation Procedures (HEP) studies on the vegetative cover, habitat types and the associated wildlife in the project area. Acreages of the cover types in the project area are presented in Table 7-1. Information on vegetation, associated wildlife, and habitat value for the Natomas and lower American River and upper American areas are summarized in Tables 7-2 and 7-3.

FISHERIES

Fishery habitats in the Natomas basin include a portion of the Sacramento River and several ponds, canals, irrigation ditches and streams, and the lower American River, including Folsom Reservoir and Lake Natoma, and the upper American River. Available information on fish resources in the study area focuses on the Sacramento and American Rivers because of their sport fishing popularity and importance as migration routes for anadromous fish.

Natomas

The Sacramento River provides important habitat for a diverse assemblage of fishes. It includes anadromous and resident species such as chinook salmon, steelhead trout, striped bass, American shad, largemouth bass, and various species of crappie, catfish, and bullhead. Figure 7-4, is a list of fish species known to occur in the Sacramento River.

The Sacramento River supports four distinct runs of chinook salmon: fall, late-fall, winter, and spring. The fall-run is most abundant, while the winter-run has recently been designated as a threatened species under the Federal Endangered Species Act. Lack of suitable habitat in the upper Sacramento watershed during their respective spawning seasons has contributed to the decline of all races. The Sacramento River sustains the largest chinook salmon run in California. Annual commercial catches average 2-14 million pounds and sport catches range between 40,000 and 130,000 fish.

More than 90 percent of the Central Valley salmon populations spawn in the Sacramento River system, contributing about one-half million chinook salmon annually to the commercial harvest of these fish in the Pacific Ocean. Steelhead trout also comprise an important recreational fishery. Most of California's American shad and approximately two-thirds of the striped bass spawn in the Sacramento system. The Sacramento perch, California's only native sunfish, is believed to be threatened, although it is now listed as status-undetermined pending collection of additional information in the Sacramento River (DFG, 1972).

The Natomas area contains several open-water areas which provide habitat for fish, including the NEMDC, Natomas Main Drain, NCC, and Fisherman's Lake. There are also many smaller agricultural irrigation and drainage canals which provide habitat for a variety of warm water species. Overall, these canal habitats are of somewhat poor quality due to undependable flows, contaminants, warm temperatures, disturbance, and lack of management. There are no estimates of the numbers or health of fish species inhabiting these areas.

Fisherman's Lake is a shallow, warmwater, 2.1-mile widened segment of the West Drainage Canal surrounded by a dense riparian canopy. It supports a small recreational fishery of largemouth bass, bluegill, green sunfish, bullhead, and other catfish species. The East and West Drainage Canals and the Natomas Main Drainage Canal are connected hydraulically to Fisherman's Lake. They likely contain similar species, but in smaller numbers due to lower habitat quality.

TABLE 7-1. Acreage of Cover Types in the Project Area

HEP COVER/HABITAT TYPE	NATOMAS	LOWER AMERICAN RIVER	UPPER AMERICAN RIVER (SELECTED PLAN)
Fish and Wildlife Service "Wetland" Cover Types			
Open Water		126	
Marsh	760	34	
Riparian Forest	12	1,258	
Riparian Scrub-Shrub	633	2,272	
Riverine			962
Subtotal	1,405	3,690	962
Fish and Wildlife Service "Upland" Cover Types			
Rice	12,936		
Grain	10,685	170	
Pasture	1,139	236	
Grassland	2,928	430	98
Orchard	1,140		
Row Crops	11,628		
Oak Woodland		109	
N. Slope Oak Woodland			1,189
S. Slope Oak Woodland			1,213
Chaparral			170
Conifer Forest			210
Vacant	4,879		
Rocky/Ruderal			147
"Upland" Subtotal	40,456	945	3,027
Total	46,740	4,635	3,989

TABLE 7-2. Summary of HEP Cover Type Information for Natomas and Lower American River

HEP COVER/HABITAT TYPE	COMPONENTS/VEGETATION	COMMON WILDLIFE ASSOCIATES	HABITAT VALUE	PROJECT AREA OCCURRENCE: NATOMAS	PROJECT AREA OCCURRENCE: LOWER AMERICAN RIVER
Open Water Aquatic Habitat	Sloughs, ditches, canals and large year round ponds slow moving water deeper than five feet. Typical species include submergent aquatic vegetation, pond weed, elodea, water milfoil, water primrose.	Muskrat, beaver, various waterfowl and water birds. Giant garter snakes.	High	Fisherman's Lake, portions of the NEMDC, NCC and Yolo Bypass.	Lake Natoma, Folsom Reservoir, Lower River channel and back water areas.
Emergent Wetland	Ponds, sloughs, canals with water shallower than five feet for prolonged periods. Typical species include tules, cattails, rushes, sedges, smartweed.	Numerous marsh birds and mammals listed above.	High (Scarce on a regional basis)	Various waterways including portions of NEMDC, Yolo Bypass and Fisherman's Lake	Lower River channel and back water areas.
Riparian Scrub and Shrub	Woody, shrub dominated habitat associated with wetland.Typical species include shrub willows, berry vines, elderberry, sapling trees. Herbaceous associates include brome, barley, grasses, wild mustard, sweet fennel.	Beaver and muskrat, songbirds such as western flycatcher, sparrows, warblers and black phoebe.	High	Along the canals, channels, streams and weir areas.	Lake Natoma, Lower River Parkway and back water areas.
Riparian Forest	Associated with river, stream and channel banksides. Typical species include tree willows, cottonwoods, Oregon ash, walnut, Valley oak, box elder, grape, blackberry.	Various waterfowl, water birds and Swainson's hawk. Various small mammals, reptiles and amphibians. Game species such as deer, turkey, pheasant and quail.	High (Scarce on a regional basis)	Narrow bands along Sacramento River east levees, NEMDC, Fisherman's Lake, NCC, Yolo Bypass, Dry Creek.	Lake Natoma, Lower River Parkway
Valley Oak Woodland	Typical species include Valley oak, cottonwood or sycamores. Ground cover dominated by herbaceous, ruderal grasses.	Small mammals such as raccoon and gray squirrel. Raptors including Swainson's hawk.	High (Scarce on a regional basis)	Scattered locations mainly adjacent to the landward side of the Sacramento west levees.	Folsom Reservoir, Upland areas along the Lower River Parkway.
Grassland Savanna	An Upland habitat with typical species of wild oats, rip-gut broam, Burmuda and rye grass, sallis grass. Common forbs include clovers, vetch, starthistle, horseweed.	Small mammals, coyotes, fox, skunk, various song and game birds, gopher snake and garter snake.	Moderate	Widespread within Natomas area and levees along the waterways.	Folsom Reservoir, Lower River Parkway
Agriculture land	Crops typical to interior Natomas include rice fields, orchards, row crops and fallow fields.	Herons, egrets, waterfowl, kingfishers, various raptors including Swainson's hawk. Assorted songbirds. Giant garter snakes.	High for species noted.	Interior of Natomas and adjoining bypasses.	Limited pasture along south bank of lower River.

TABLE 7-3. Summary of HEP Covertype Information for the Upper American River

HEP COVER /HABITAT TYPE	COMPONENTS/VEGETATION	WILDLIFE ASSOCIATES	HABITAT VALUE	PROJECT AREA OCCURRENCE: UPPER AMERICAN RIVER
Evergreen hardwood forest (N. slope oak woodland)	Occurs at north facing slopes and deep shaded canyons. Typical species include, Canyon and interior live oak as dominant. Additional species: black oak, California bay, douglas fir. Understory species include poison oak, deer brush, styrax buckeye and a variety of grasses and forbs.	Cover dependent species such as ringtail cat, deer, grey fox, owls, mountain quail and many species of songbirds. Ground litter home to amphibians, reptiles and ground foraging birds.	High	North facing slopes of the North fork drainage
Evergreen hardwood forest (S. slope oak woodland)	Occurs on drier, southwest to south facing slopes. Similar species composition as above, woodland characteristics, open canopy. Grass understory.	Species such as deer, bobcat, coyote, grey squirrel, many species of songbirds. Upland game such as cottontail rabbit, quail, turkey. Many species of snakes and lizards.	High	South to southwest facing slopes in the study area.
Conifer forest	Conifer forest is diffuse in occurrence and highly limited in extent. Small clusters of ponderosa or digger pine or douglas fir and knobcone pine.	Various song birds. Grey fox, coyote, deer, wood rat, scrubjay, badgers and bobcat.	Moderate	Lower elevations and western portions of the study area.
Chaparral	Comprised of woody shrubs. Typical species include chamise, manzanita, ceanothus, toyon and shrub interior and canyon live oaks.	Quail, turkey vulture, deer, mountain lion, many species of small mammals, reptiles and songbirds.	Dense stands- low to moderate Recently burned- low to moderate	South facing slopes in the Middle fork canyon.
Grassland/ Savanna	Annual grasses and their common forb associates occur both as understory for other cover types and as a distinct cover type.	Important foraging sites for deer, red-tailed hawk, golden eagle. Many small mammals, reptiles, amphibians, songbirds.	Moderate	Throughout the upper American River study area.
Riverine Riparian	Includes species common to palustrine forest, palustrine scrub-shrub and freshwater marshes.	Water and shore birds such as dipper, sandpipers, great blue heron. Amphibians and reptiles flourish here. Important to large mammals such as deer, bobcat, raccoon and ringtail.	High	Along both forks and below the confluence, side drainages.

TABLE 7-4. Fishes of the Lower Sacramento River

Common Name	Scientific Name
Anadromous Game Fish	
Chinook Salmon	Salmo gairdneri gairdneri
Steelhead	Oncorhynchus kisutch
Silver salmon	Oncorhynchus gorbuscha
Pink salmon	Oncorhynchus keta
White sturgeon	Acipenser transmontanus
Warmwater Game Fish	
* Spotted bass	Micropterus punctualatus
* Largemouth bass	Micropterus salmoides
* Smallmouth bass	Micropterus dolomieui
* Warmouth bass	Lepomis gulosus
* Green sunfish	Lepomis cyanellus
* Bluegill	Lepomis machrochirus
* Redear sunfish	Lepomis microlophus
* White crappie	Pomoxis annularis
Sacramento perch	Archoplites interruptus[1]
* Channel catfish	Ictalurus punctatus
* White catfish	Ictalurus catus
* Brown bullhead	Ictalurus nubulosus
* Black bullhead	Ictalurus melas
Non-game Fish	
Sacramento western sucker	Catostomus occidentalis
* Carp	Cyprinus carpio
* Goldfish	Carassius auratus
Sacramento blackfish	Orthodon microlepidotus
Hardhead	Mylopharodon conocephalus
Sacramento hitch	Lavinia exilicauda
Sacramento squawfish	Ptychocheilus grandis
Sacramento Splittail	Pogonichthys macrolepidotus[2]
* Mosquitofish	Gambusia affinis
Tule perch	Hysterocarpus traski
Riffle sculpin	Cottus gulosus
Pacific lamprey	Engonsphenus tridentatus
* Threadfin shad	Dorosoma petenense
* Golden shiner	Notemigonus crysoleucas

TABLE 7-4. Fishes of the Lower Sacramento River (Continued)

Common Name	Scientific Name
* Fathead minnow	Pimephales promelas
Western roach	Hesperoleucas symmetricus
Sacramento tui chub	Gila bicolor
Spreckled dace	Rhinichthys osculus
* Log perch	Percina macrolepida

Source: Modified from Gerstung 1971.

Notes:

*Introduced species
[1]Possibly extirpated
[2]Federal Candidate, Category 2

The NCC in south Sutter County links the Sacramento River to spawning areas in Markham and Auburn Ravines and Coon Creek. The NEMDC collects waters of Dry and Arcade Creeks, along with other rural and urban runoff sources. Salmon runs in the NCC and NEMDC and associated tributaries are small and variable, and both canals support a year-round sports fishery. Species include warmwater gamefish (catfish, bullhead, sunfish, and bass) and non-game species. The salmon run in Dry Creek is stocked by the DFG, resulting in a small run depending on yearly fluctuating flows. Flows in the creek generally remain sufficient to support reduced populations of warmwater gamefish. Sport fishing of non-game fish usually occurs year-round.

Arcade Creek supports populations of warmwater gamefish and non-game species such as sunfish, bullhead, carp and mosquito fish. Urban runoff, variable flows, high water temperatures, contribute to the poor quality of this habitat.

Lower American River

Folsom Reservoir supports both cold and warmwater fisheries. However, Folsom's productivity is low because of low levels of nutrients and annual reservoir water surface fluctuations. The DFG maintains the existing cold water fishery, consisting of previously planted, land-locked populations of salmon, and ongoing hatchery plantings of rainbow trout. The reservoir supports many resident non-game fish and warmwater game fish, including large and smallmouth bass, white catfish, brown bullhead, channel catfish, and several sunfishes.

The re-regulating afterbay for Folsom Reservoir, Lake Natoma, does not support natural warm or coldwater fish production. The lake receives controlled releases from Folsom resulting in lake levels fluctuating daily and weekly from 4 to 7 feet. Water-level fluctuations, cold temperatures, and limited food production result in few fish. The DFG now plants some 1,000 one-half-pound catchables on an annual "free fish day." The Nimbus Salmon and Steelhead Hatchery is located immediately downstream of Nimbus Dam.

In 1972, the lower American River became part of the State Wild and Scenic River System. In 1981, it joined the National Wild and Scenic Rivers System with "recreational" status. Its exceptional anadromous fishery and recreational values led to this national designation. The lower American River area harbors a greater abundance and variety of fish species than upstream segments.

Contributing to the species numbers is the artificial production of anadromous species at the Nimbus Hatchery. This section of the river, including backwaters and dredge ponds, supports at least 41 fish species, half of which are game fish (FWS 1991). Common species include chinook salmon, steelhead trout, American shad, rainbow trout, striped bass, black bass, carp, Sacramento squawfish, Sacramento suckers, and hardhead. Recreation and commercial values make the fall-run chinook salmon the most important species in the lower river. Today, an average of 47,500 adult salmon enter the river annually to spawn. This demonstrates the excellent habitat available for anadromous species along the lower American River. However, the schedule of reservoir releases during spring and summer can cause temperatures in the lower river to reach marginal to lethal thresholds, forcing these anadromous species to areas near Nimbus Dam, where they face increased predation and competition (FWS, 1991).

Because of the lack of access to the natural spawning areas in the headwaters of the American River and the lack of cold water during spring and summer, natural production of steelhead in the lower American is negligible. Hatchery production maintains the population. Striped bass and American shad are also important species. The other fish species inhabiting the lower river are generally considered of secondary importance because their value as commercial and sport fisheries is minor (FWS, 1990).

Flows in the lower American River are regulated by Folsom Dam, which was constructed in 1956 to provide flood protection to Sacramento, and is operated by the USBR. In 1958, the California State Water Resources Control Board issued Decision 893 (D-893) which established minimum flow releases in the river of 250 to 500 cfs. Since that time public attention to, and use of the river's fishery have increased, and there is concern that D-893 flows will not sustain the recreation and fishery activities that have developed in the lower river over the past 30 years. The instream flows required to protect the salmon and steelhead trout populations have been the subject of much public debate and governmental attention. In 1973, decision 1400 was issued by the State Water Resources Board which proposed an increased flow regime of 800 to 1,250 cfs in anticipation of the construction of the large multi-purpose Auburn Dam, which was never completed. Although the USBR is legally required only to maintain D-893 flows, it currently operates Folsom Dam at a level above the D-1400.

Upper American River

Steep rocky canyons characterize the upper reaches of the North and Middle Forks of the American River, while the lower reaches contain long and wide riffles and pools. Only limited historical documentation exists regarding fisheries in the area. Today, year-round residents of the North Fork include several warmwater species, among them smallmouth bass, bullhead, and sunfish. Many pools and riffles with gravels suitable for trout and smallmouth bass exist in the river. But low summer flows and high water temperatures greatly reduce the use of this habitat by cold water species. Surveys conducted by the FWS in September 20-28, 1989 found a total of 38 fish including warmwater species such as smallmouth bass, riffle sculpin, Sacramento sucker, Sacramento squawfish, and brown bullhead, while trout were scarce. Lake Clementine contains a similar species composition however, DFG periodically plants trout. A current and historic composition of fish species and habitats can be found in Table 7-5.

Historical records of fish resources in the Middle Fork are limited. In the past, rainbow and brown trout have been stocked. Construction of the Placer County Water Agency's Middle Fork American River project in 1962 resulted in cooler water temperatures in summer and fall, improving habitat suitability for resident and stocked cold water species, including rainbow and brown trout. FWS surveys in the Middle Fork, September 20-28 1989 recorded 51 fish including Sacramento hitch, Sacramento sucker, Sacramento squawfish, riffle sculpin, brown and rainbow trout.

VEGETATION

The vegetation affected by the project ranges from the agricultural landscape of Natomas to the various forests in the upper American River canyon. A discussion of jurisdictional wetlands is included in this section. The Federal definition of wetlands is for "waters of the United States," such as open water areas, mudflats, coral reefs, riffle and pool complexes, vegetated shallows, and other aquatic habitats for regulatory purposes. More specifically,

> "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

TABLE 7-5. Current and Historic Composition of the Fisheries on the North and Middle Forks of the American River.

COMMON NAME	SCIENTIFIC NAME	ENDEMISM[1]	OCCUPANCY[2]	BREDDING HABITAT	TEMPERATURE[3]	FORAGE PREFERENCE
Pacific lamprey	*Lampetra tridentata*	E	H	gravel bottom	<80	parasite on fish
Chinook salmon	*Oncorhynchus tshawytscha*	E	H	gravel riffles	50-55	drift; opportunistic
Kokanee salmon	*Oncorhynchus nerka*	I	P	gravel riffles	45-55	zooplankton
Rainbow trout	*Oncorhynchus mykiss*	E	P	gravel riffles	50-58	macroinverts; drift and bottom
Brown trout	*Salmo trutta*	I	P	gravel riffles	55-60	bottom feeder; drift
Eastern brook trout	*Salvelinus fontinalis*	I	P	gravel riffles	50-55	drift
Tui chub	*Gila bicolor*	E	P	vegetated beds	55-60 (S)	omnivorous
Thicktail chub	*Gila crassicauda*	E	*			small fish; invertebrates
Hitch	*Lavinia exilicauda*	E	P	sand/gravel bottoms	55-65 (S)	omnivorous
California roach	*Hesperoleucus symmetricus*	E	P	rocky bottoms	<90	algae
Hardhead	*Mylopharodon conocephalus*	E	P	gravel riffles		bottom; invertebrates and plants
Sacramento squawfish	*Ptychocheilus grandis*	E	P	rocky bottoms	60-70	fish ;invertebrates
Spreckled dace	*Rhinichthys osculus*	E	P	shallow gravels	<90	bottom inverebrates
Sacramento sucker	*Catostomus occidentalis*	E	P	gravel riffles	42-52 (S)	bottom feeder; omnivorous
Green sunfish	*Lepomis cyanellus*	I	P	gravel bottom	60-70	opportunistic predator
Smallmouth bass	*Micropterus dolomieui*	I	P	gravel/sand bottom	60-70	fish, amphibians, insects
Riffle sculpin	*Cottus gulosus*	E	P	under rocks in riffles		bottom; carnivorous

CODES:

(1) E = Endemic; I = Introduced; * = Extinct

(2) H = Historic Inhabitant; P = Present Inhabitant

(3) S = Preferred spawning temperature

SOURCES:

Bell (1986)
California Department of Fish and Game (1977, 1938, 1934)
California State Water Resurces Board (1955)
Gerstung (1971)
Gerstung (1989)
Harvey et al. (1982)
Harvey (1986)
McGinnis (1984)
Moffett et al. (1948)
Moyle (1976)
Moyle et al. (1989)
Sumner and Smith (1942)
U.S. Department of Agriculture (1978)
U.S. Fish and Wildlife Service (1991)

This Federal definition, which was developed for identifying wetlands subject to regulation under Section 404 of the Clean Water Act for the purpose of regulating the discharge of dredged and/or fill material, differs from the functional definition of wetlands used by the FWS. The FWS defines wetlands as follows:

> "wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water" (Cowardin et al. 1979).

This definition includes both vegetated and nonvegetated wetlands, recognizing that some types of wetlands lack vegetation (mud flats, sand flats, rocky shores, gravel beaches, and sand bars), but still provide functional habitat elements for fish and wildlife.

For the purposes of defining significance thresholds, it is necessary to distinguish between Section 404 wetlands, which are regulated by the Federal government, and the FWS-defined wetlands that are not necessarily subject to regulation under Section 404. For the purposes of defining significance thresholds for the State of California and affected local jurisdictions (i.e. Sacramento and Sutter Counties and the City of Sacramento), the DFG has adopted the FWS definition as a matter of policy (Rollins, 1987). As such, wetland impacts are generally more expansive under the California Environmental Quality Act (CEQA).

Natomas

Existing conditions in the Natomas area are quite different from those which prevailed prior to modern development of the region. Historically, the Natomas basin has flooded on a regular basis. Its proximity to the Sacramento and American Rivers and its unique physical topography produced a variety of wetland habitats. These marshes, channels, ponds, and vernal pools produced a unique combination of habitats supporting diverse vegetation, fish and water-associated wildlife. However, as land was reclaimed for agricultural production, the natural features of the basin that supported these valuable habitats were significantly altered (FWS, 1990).

Farming in the basin started as early as 1839 when John A. Sutter began raising livestock and growing wheat. Land reclamation was pursued for agricultural production and was aided by construction of levees along the Sacramento and American Rivers. The rate of levee construction was increased by the development of the clamshell dredge in the 1800's and the construction of the Sacramento River levee system which took place in the early 1900's.

The Sacramento River levee system isolated Natomas from the main Sacramento River channel bringing a large area into modern agricultural production. In 1911, Reclamation District 1000 was created under the authority of the State Reclamation Act to provide facilities to alleviate periodic flooding. These facilities, including the major canals, levees and pumping stations which currently surround Natomas, were completed in 1914 and have been maintained and operated by the district ever since. As a result of the Sacramento River levee system and the district's subsequent efforts to protect the Natomas basin from flooding, no major flooding has occurred in the area for over 75 years.

Today, urbanization and agricultural production have shaped the current Natomas landscape. It is characterized by agricultural vegetation types (such as rice and dry grains, pastures, orchards, vineyards, row and truck crops, and other less common crops) and by uncultivated and natural vegetation types, including wooded and non-wooded riparian/wetland cover types and grasslands. Wooded riparian sites generally occur along the borders of drainage canals and often are associated with narrow strips of emergent wetland vegetation, such as cattails and bulrushes. The most important of these sites include Fisherman's Lake and associated portions of the West Drainage Canal; scattered sites along the NEMDC, the NCC, and the Sacramento River along the Garden Highway; and a large riparian and marshy area northeast of the Sacramento Metropolitan Airport along Power Line Road. A list of representative vegetative species in the Natomas area is included in Table 7-6.

In terms of scarcity, riparian habitats occupy less than 5 percent of their historic range in California. Smith (1988) estimated that riparian vegetation occupied over 775,000 acres in 1848. By 1988, the acreage had declined to 12,000 acres. Wetlands in California were believed to occupy over 5 million acres prior to European settlement. Current estimates indicate that a 91 percent loss of wetland habitat has occurred in California leaving approximately 454,000 wetland acres. On this

TABLE 7-6. Representative Vegetation Within the Natomas Project Area

COMMON NAME	SCIENTIFIC NAME	TYPICAL COMMUNITY
Duckweed	Lemna sp.	PEM, RAB
Barnyard grass	Echinochloa crus-galli	PEM, PSS
Dallis grass	Paspalum dilatatum	PEM, PSS, PFO
Sedge	Carex Hassei	PEM
Umbrella sedge	Cyperus Eragrostis	PEM
Cattail	Typha latifolia	PEM
Creeping spikerush	Eleocharis palustris	PEM
River bulrush	Scirpus fluviatilis	PEM
Tule bulrush	Scirpus acutus	PEM
Rush	Juncus balticus	PEM
Broadleaf arrowleaf	Sagitarria latifolia	RAB
Smartweed	Polygonum lapathifolium	PEM, PSS
Persian wireweed	Polygonum argyrocoleon	PEM, PSS
Mugwort	Artemesia douglasiana	PEM, PSS
Pepperweed	Lepidium latifolium	PEM, PSS
Lycopus	Lycopus americanus	PEM
California waterprimrose	Ludwigia peploides	RAB
Cocklebur	Xanthium pennsylvanicum	PEM, PSS
Buttonbush	Cephalanthus occidentalis	PSS, PEM
Wild grape	Vitis californica	PFO
Blackberry	Rubus ursinus	PFO
Goodding's willow	Salix Gooddingii	PSS, PFO
Sandbar willow	Salix hindssii	PSS, PFO
Blue oak	Quercus douglasii	PFO
Valley oak	Quercus lobata	PFO
Fremont cottonwood	Populus fremontii	PFO
Black walnut	Juglans hindsii	PFO
Acacia	Acacia sp.	PFO
Squirreltail grass	Sitanion Hystrix	GRASS

TABLE 7-6. Representative Vegetation Within the Natomas Project Area (Continued)

COMMON NAME	SCIENTIFIC NAME	TYPICAL COMMUNITY
Wild oats	Avena fatua	GRASS
Crab grass	Digitaria sanguinalis	GRASS
Brome grass	Bromus rubens	GRASS
Ryegrass	Lolium sp.	GRASS
Johnson grass	Sorghum halepense	GRASS
Garden lippia	Lippia nodiflora	GRASS
Field bindweed	Convolvulus arvensis	GRASS
Curly dock	Rumex crispus	GRASS
Dodder	Cuscuta sp.	GRASS
Field mustard	Brassica campestris	GRASS
Wild radish	Raphanus sativus	GRASS
Pineappleweed	Matricaria matricarioides	GRASS
Cheeseweed	Malva sp.	GRASS
Annual sowthistle	Sonchus asper	GRASS
Russian thistle	Salsola Kali	GRASS
Yellow star thistle	Centaurea melitensis	GRASS
Common sunflower	Helianthus annuus	GRASS
Chicory	Cichorium Intybus	GRASS
Bristly ox-tongue	Picris echiodes	GRASS
Buckthorn plantain	Plantago lanceolata	GRASS
Sticky tarweed	Holocarpha virgata	GRASS
Bull thistle	Cirsium vulgare	GRASS
Gum plant	Grindelia procera	GRASS

Source: Fugro-McClelland, 1991.

COMMUNITY/COVER TYPE CODES:

PEM = Palustrine Emergent Wetland
RAB = Riverine Aquatic Bed
PFO = Palustrine Forested Wetland
GRASS = Grassland/Ruderal Habitat
PSS = Palustrine Scrub/Shrub

basis, riparian and wetland communities are considered Rare by the DFG (Holland, 1986). The riparian/wetland plant associations are valuable wildlife habitat on the basis of rarity and habitat value.

While significant development occurs up to Del Paso Road, making the southern area of Natomas the most urbanized, some 32 percent of the area remains in agricultural production. Large-scale offices, dense residential development, and associated commercial businesses have been increasing in number in recent years. Limited development in North Natomas includes Arco Arena, smaller, older farms, homes along the Garden Highway, and the Sacramento Metropolitan Airport. Primarily agricultural, most acreage in North Natomas consists of the various crops identified above.

In Natomas, a wetland evaluation was performed in August of 1990 (see Figure 7-1). Jurisdictional wetlands comprise approximately 379 acres and are concentrated in areas near the Sacramento River in historic drainage areas. Some wetland habitat, consisting mainly of vernal pool and associated swales, is present on the higher ground adjacent to the NEMDC. This evaluation was based predominantly upon aerial photographic interpretation, soils reports and surveys by air and automobile. Only limited on-site field investigation work was possible due to rights of entry difficulties with private property. Consequently, the delineated boundaries may be subject to modification.

As noted above, the Natomas area has been altered for agricultural purposes by a system of canals and ditches. Many of these areas do support wetland habitat; however, most of these drainage and irrigation canals are not considered to be "waters of the United States," and have not been identified as such. Normal farming, silviculture and ranching activities are exempt from regulation under Section 404, and for this reason, areas presently in agricultural production are not included in this evaluation. Impacts to jurisdictional wetlands will be discussed in the 404 (b)(1) evaluation in Chapter 6, Water Quality and Drainage.

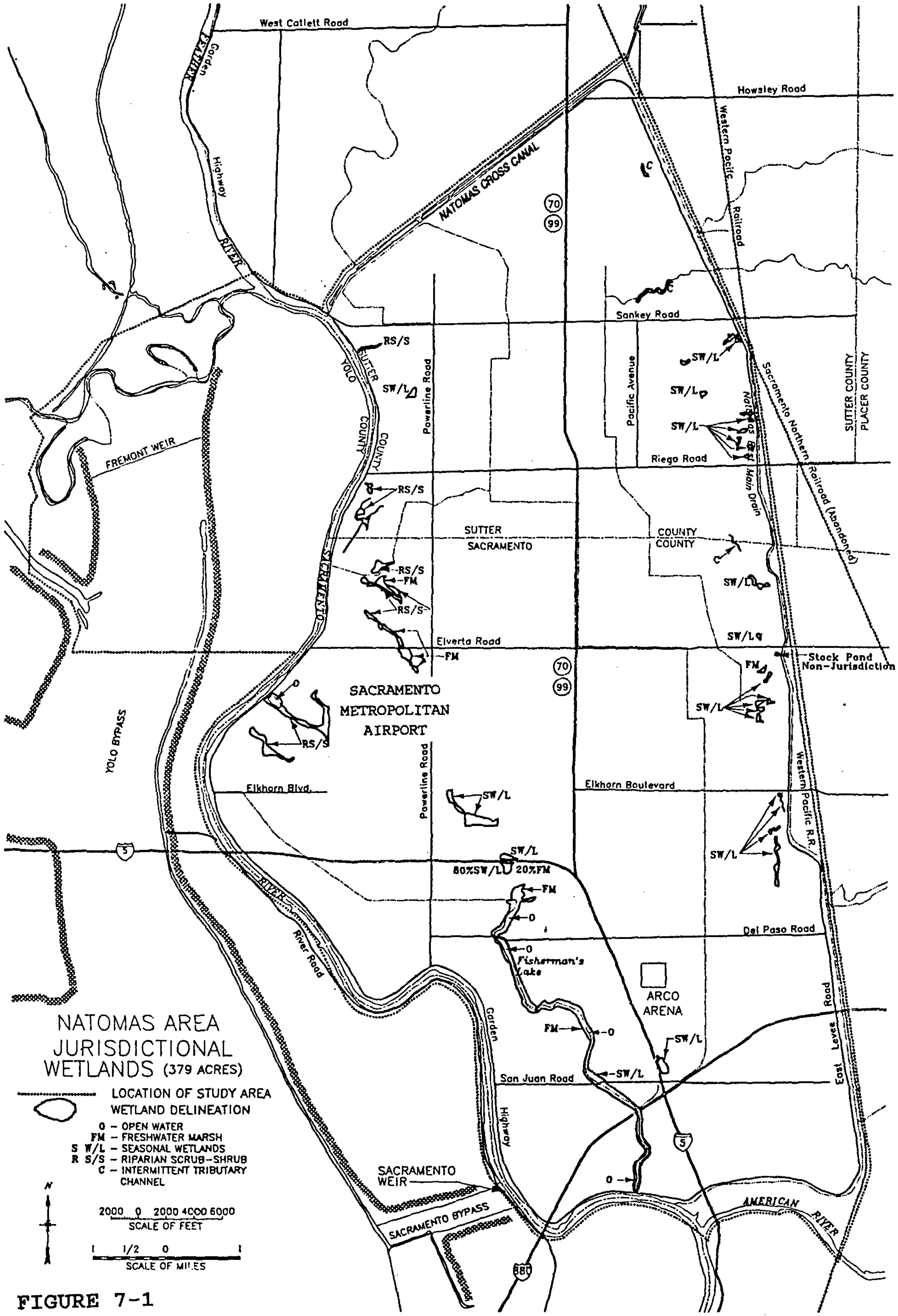
West Catlett Road
Howsley Road
FEATHER
Garden
Highway
RIVER
NATOMAS CROSS CANAL
70
99
Western Pacific Railroad
Sankey Road
RS/S
SUTTER
YOLO
COUNTY
SW/L
Powerline Road
Pacific Avenue
SUTTER COUNTY
PLACER COUNTY
Sacramento Northern Railroad (Abandoned)
Natomas East Main Drain
Riego Road
FREMONT WEIR
SUTTER
SACRAMENTO
COUNTY
COUNTY
FM
SACRAMENTO
Elverta Road
Stock Pond
Non-Jurisdiction
SACRAMENTO
METROPOLITAN
AIRPORT
YOLO BYPASS
Elkhorn Blvd.
Elkhorn Boulevard
Western Pacific R.R.
5
80%SW/L 20%FM
Del Paso Road
Fisherman's Lake
River Road
ARCO
ARENA
East Levee Road
NATOMAS AREA
JURISDICTIONAL
WETLANDS (379 ACRES)
LOCATION OF STUDY AREA
WETLAND DELINEATION
O - OPEN WATER
FM - FRESHWATER MARSH
S W/L - SEASONAL WETLANDS
R S/S - RIPARIAN SCRUB-SHRUB
C - INTERMITTENT TRIBUTARY CHANNEL
N
2000 0 2000 4000 6000
SCALE OF FEET
1/2 0 1
SCALE OF MILES
San Juan Road
SACRAMENTO
WEIR
SACRAMENTO BYPASS
AMERICAN RIVER
880

FIGURE 7-1

Lower American River

Like Natomas, lands along the American River were often flooded prior to construction of the lower American River levee system. Perennial and seasonal freshwater marshes and riparian habitat occupied what is now the Sacramento metropolitan area. Settlement and development disrupted these natural processes. Flood prevention and land reclamation allowed the flood plain areas of the lower American River to be developed. Today, the lower American River flows 23 miles through the American River Parkway (FWS, 1990). Managed by Sacramento County, the Parkway supports more than 5 million visitor-use days annually.

Folsom Reservoir, Lake Natoma, and the lower American River area extend across a natural transition zone from the higher elevation habitats of the lower Sierra foothills to the valley floor. Although the lower American River area contains the same vegetation cover types as Natomas, the distribution pattern of this vegetation differs from Natomas. Lands adjacent to Folsom Reservoir are characterized by savanna grassland and live oak woodland, while marsh, riparian scrub-shrub and forest, woodland, and grassland dominate the lower American River along the Parkway.

A wetland inventory was conducted along the lower American River area. The inventory was concentrated in the Parkway area downstream from Goethe Park to the confluence, the area where specific flood control features have been identified. The lateral limit of the surveyed corridor was defined by the levees. Specifically, wetlands above the average high water line were targeted. Approximately 655 acres of wetlands were found along the parkway. Additionally, the Lower American River Parkway is 23 miles of river, which is considered "Waters of the United States."

Upper American River

The study area encompasses 42,000 acres along the steep canyons of the North and Middle Forks of the American River which are within the project area for the authorized multipurpose Auburn Dam. However, only a portion of this area would be affected by the proposed flood control dam. The 200-year potential detention area covers approximately 4,000 acres while the 400-year potential detention area is approximately 5,450 acres.

Historically, the riverbed and bars of both the Middle and North Forks of the American River were explored for mining as early as the summer of 1848. Thousands of miners, working alone or in mining companies, invaded the canyons of the upper American River. They worked their way up from Oregon Bar to the confluence of the Middle and North Forks and then up each fork. Placer mining predominated in the beginning, but as more miners arrived, they formed mining companies and worked the river gravels. The methods they employed called for the diversion of the river by using wing dams and flumes, to expose the riverbed for mining. The river gravels were dredged and washed in pans or sluices.

Before too long another mining method came into use in the upland areas. To recover gold from older gravel deposits, hydraulic hoses were used to blast out the gravel from hillsides. These tailings, once scoured for gold, washed down the streams and caused considerable deposition problems.

In general, the portions of the American River Canyon in the study area have been subjected to intensive exploitation and destruction. River gravels, once the gold had been removed, were left piled on the banks of the river. Hydraulic debris washed down the streams, depositing sediment along the way. This was common along the Middle Fork. However, the North Fork Dam was specifically built to capture this debris on the North Fork of the river.

The areas disturbed by the mining boom were eventually abandoned and left to recover on their own. As evidenced in photo comparisons of the past and present, extensive vegetative regeneration has occurred and the area provides little visual evidence of its previous degradation (Turner, 1983). Mining destruction and subsequent recovery has significantly altered the river's qualities, the result of which is the terrestrial environment existing there today.

The study area serves as a transition zone between middle elevation foothill grassland, hardwood woodland and forest communities and the higher montane, largely evergreen conifer-dominated forest communities. This wide range of physiographic and microclimatic environments provides a diverse and complex vegetation mosaic. Forest dominants in the study area vary among deciduous broadleaved trees, evergreen broadleaved trees, evergreen coniferous trees, and other combinations. Riverine riparian vegetation along the main river corridor includes large areas of flowing open water, rocky shoreline, sand and gravel bars, river-edge willow and shrub thickets, many stands of tall moist forest of varied ages, higher terrace grasslands and mixed riparian thickets. Table 7-7 shows typical vegetation observed in the American river canyon.

Jurisdictional wetlands were identified in the upper American River in June and July of 1990. This identification focused on the inundation zone created by the selected plan. The area included the North and Middle Forks of the American River from the damsite to elevation 865 feet. Wetlands were not found above the high water mark.

WILDLIFE

Natomas

As noted, the landscape of the Sacramento area in general, and specifically the Natomas area, has been greatly altered since the time of European settlement. Nevertheless, owing to the city's location at the juncture of two major rivers and the terminus of several natural and artificial drainages, there remains abundant wildlife habitat in the project area to support diverse wildlife populations. Natomas functions as a high-value wildlife habitat area and as a critical migratory link for terrestrial wildlife species, as well as many resident and migratory birds (FWS, 1991).

Agriculture and, more recently, urbanization have replaced the natural flood plain. Although wildlife values are reduced with agricultural activity, they are greater than with commercial or urban development. However, the interspersion of agricultural fields for foraging with riparian habitats for roost, cover, water and migratory corridors provides required habitat components for a number of wildlife species.

Table 7-8 provides a listing of the potential and observed wildlife species occupying the various vegetative communities likely to be impacted by the project.

The Natomas area within the American River basin is located along the Pacific Flyway which is an essential corridor for migratory bird movement. Thousands of migratory waterfowl rely on the habitat in the basin each year for resting, foraging and breeding purposes (FWS, 1991). California Department of Fish and Game mid-winter surveys for waterfowl during the last 10 years and the Sacramento Audubon Society Christmas bird counts provide

TABLE 7-7. Typical Vegetation, by Cover Type Observed In the American River Canyon

SPECIES		COVER TYPES				
COMMON NAME	SCIENTIFIC NAME	OAK[1]	CHA[1]	BAR[2]	PINE[1]	RIP[2]
TREES AND SHRUBS						
Ponderosa pine	Pinus ponderosa	X	X		X	
Sugar pine	P. lambertiana				X	
Digger pine	P. sabiniana	X	X		X	
Douglar fir	Pseudotsuga menziesii				X	
Incense cedar	Calocedrus decurrens					
Oregon ash	Fraxinus latifolia					X
Locust	Robinia pseudo-acacia					X
White alder	Alnus rhombifolia					X
Fremont cottonwood	Populus fremontii					X
Willows	Salix sp.					X
Wild grape	Vitis californica					X
California buckeye	Aesculus californica	X	X	X		
Bigleaf maple	Acer macrophyllum	X				X
Poison oak	Toxicodendron radicans	X	X	X		
Coyotebush	Baccharis pilularis			X		
Elderberry	Sambucus mexicani			X		X
Black walnut	Juglans hindsii			X		X
Interior live oak	Quercus wizlensii	X	X	X		
Canyon live oak	Q. chrysolepis					
Black oak	Q. kelloggii					
Valley oak	Q. lobata					
Blue oak	Q. douglasii					
Tan-oak	Lithocarpus densiflora					
Sandbar willow	Salix hindsii					X
Acacia	Acacia sp.					X
Mulefat	Baccharis viminea					X
California brickellbush	Brickellia californica			X		
Dusky willow	Salix melanopsis					X
Coffeeberry	Rhamnus sp.					
Pacific madrone	Arbutus menziesii					
Western redbud	Cercis occidentalis					
California hazelnut	Corylus rostrata					
Saltbush	Atriplex sp.					
California bay	Umbellularia californica					
Buck brush	Ceanothus cuneatus					
Chamise	Adenostoma fasciculatum					

TABLE 7-7. Typical Vegetation, by Cover Type Observed In the American River Canyon (Continued)

SPECIES		COVER TYPES				
COMMON NAME	SCIENTIFIC NAME	OAK[1]	CHA[1]	BAR[2]	PINE[1]	RIP[2]
Western mountain-mahogany	Cercocarpis betuloides					
Flannelbush	Fremontodentron californica					
Toyon	Heteromeles arbutifolia					
Snowberry	Symphoricarpos sp.					
Oregon golden-aster	Chryopsis oregona			X		
Manzanita	Arctostaphylos sp.	X	X	X		
GRASSES AND FORBS						
Spike moss	Selaginella hansenii			X		
Carolina geranium	Geranium carolinianum		X	X		
Stocksbill	Erodium spp.		X	X		
Turkey mullein	Eremocarpus setigeris			X		
Spurge	Euphorbia spp.			X		
Durango root	Datisca glomerata			X		
Field mustard	Brassica campestris			X		
Black mustard	Brassica nigra			X		
Shepard's purse	Capsella bursa-pectoris			X		
Catchfly	Silene spp.			X		
Miner's lettuce	Montia perfoliata			X		
Milkweed	Asclepias cordifolia			X		
Gilia	Gilia capitata			X		
Popcorn flower	Plagiobothrys spp.		X	X		
Creek monkey flower	Mimulus guttatus			X		
Common mullein	Verbascum thaspus		X	X		
Gay penstemon	Penstemon laetus	X	X	X		
Foothill penstemon	Penstemon speciosus	X	X	X		
Bluecurls	Trichostema oblongum		X	X		
White hedge-nettle	Stachys albens					X
Sage	Salvia spp.			X		
Live-forever	Dudleya spp.		X	X		
Indian rhubarb	Peltiphyllum peltatum					X
California blackberries	Rubus vitifolius					X
California wild rose	Rosa california	X				X
Lupine	Lupinus stiversii	X	X	X		
Spanish broom	Spartium junceum		X	X		
Bird's foot trefoil	Lotus micranthus		X	X		
California vetch	Vicia californica		X	X		
Pacific sanicle	Sanicula spp.		X	X		

TABLE 7-7. Typical Vegetation, by Cover Type Observed In the American River Canyon (Continued)

SPECIES		COVER TYPES				
COMMON NAME	SCIENTIFIC NAME	OAK[1]	CHA[1]	BAR[2]	PINE[1]	RIP[2]
Mule-ears	Wyethia spp.		X	X		
Aster	Aster spp.	X	X	X		
Fleabane	Erigeron divergens	X	X	X		
Mugwort	Artemisia douglasiana			X		X
Bull thistle	Cirsium vulgare	X	X	X		
Yellow star thistle	Centaurea melitensis	X	X	X		X
Blue-eyed grass	Sisyrinchium bellum			X		
Sedge	Carex spp.					X
Ripgut brome	Bromus diandrus	X	X	X		
Foxtail barley	Hordeum jubatum	X	X	X		
Italian ryegrass	Lolium multiflorum	X	X	X		
Cocklebur	Xanthium strumarium			X		X
Buckthorn plantain	Plantago lanceolata			X		
Fiddleneck	Amsinckia intermedia		X	X		
Smartweed	Polygonum lapathifolium			X		X
Horsetail fern	Equisteum sp.			X		X
Yarrow	Achillea lanulosa			X		X
Globe lily	Calochortus albus	X	X	X		
Indian paintbrush	Castilleja sp.		X	X		
Monkeyflower	Mimulus sp.			X		
Wild oak	Avena fatua	X	X	X		
Dallis grass	Paspalum dilatatum			X		X
Red brome	Bromus rubra	X	X	X		
Bottlebrush squirreltail	Sitanion hystrix	X	X	X		

Notes:

OAK -- Associated with North Slope Oak Forests and/or South Slope Oak Woodlands
CHA -- Associated with Chaparral Community
BAR -- Associated principally with Gravel Bar Scrub Community
PIN -- Associated with Pine Forest Community
RIP -- Associated with Riparian Shrub/Scrub Community

[1] Based on reconnaissance surveys conducted by U.S. Fish and Wildlife Service.
[2] Based on reconnaissance surveys conducted by Fugro-McClelland (West), Inc.
Source: Fugro-McClelland (1991)

TABLE 7-8. Potential Wildlife Species Inhabiting the Natomas Project Area

COMMON NAME	SCIENTIFIC NAME	COVER TYPE AND SUITABILITY			HABITAT USE
		RIP	GRASS	AGRIC	
REPTILES AND AMPHIBIANS					
Western Toad	Bufo boreas	O	M	M	B/F
Bullfrog*	Rana catesbeiana	O	-	-	B/F
Pacific Treefrog	Hyla regilla	O	-	-	B/F
Garter Snake	Thamnophis sp.	O	S	S	B/F
Gopher Snake	Pituophis melanoleucus	O	S	S	B/F
BIRDS					
Great Blue Heron*	Ardea herodias	S	M	M	F
Green-backed Heron*	Butorides striatus	S	-	-	F/B
Great Egret*	Casmerodius albus	S	S	S	F/B
Snowy Egret	Egretta thula	S	-	-	F/B
Mallard	Anas platyrhynchos	S	S	S	F/B
Killdeer*	Charadrius vociferus	-	S	S	F/B
Turkey Vulture*	Cathartes aura	M	O	O	F/B
Black-shouldered Kite*	Elanus caeruleus	S	O	O	F/B
Northern Harrier*	Circus cyaneus	M	O	O	F
Red-shouldered Hawk*	Buteo lineatus	O	-	-	F/B
Red-tailed Hawk*	Buteo jamaicensis	M	O	O	F/B
American Kestrel*	Falco sparverius	S	O	O	F/B
Ring-necked Pheasant*	Phasianus colchicus	-	S	O	F/B
California Quail*	Callipepla californica	M	M	M	F
California Gull	Larus californica	-	S	O	F
Ring-billed Gull	Larus delawarensis	-	M	O	F
Mourning Dove*	Zenaida macroura	M	O	O	F/B
Rock Dove*	Columbia livia	-	O	O	F/B
Common Barn Owl	Tyto alba	-	S	S	F
Great Horned Owl	Bubo virginianus	O	-	-	F/B
Anna's Hummingbird*	Calypte anna	S	-	-	F/B
Belted Kingfisher*	Ceryle alcyon	S	-	-	F
Nuttall's Woodpecker*	Picoides nuttallii	S	-	-	F/B
Western Kingbird*	Tyrannus verticalis	S	O	O	F/B

TABLE 7-8. Potential Wildlife Species Inhabiting the Natomas Project Area (Continued)

COMMON NAME	SCIENTIFIC NAME	COVER TYPE AND SUITABILITY			HABITAT USE
		RIP	GRASS	AGRIC	
Black Phoebe*	Sayornis nigricans	O	-	-	F
Ash-throated Flycatcher*	Myiarchus cinerascens	S	-	-	F/B
Rough-winged Swallow*	Stelgidopteryx serripennis	O	S	S	F/B
Tree Swallow*	Tachycineta bicolor	O	-	-	F/B
Cliff Swallow*	Hirundo pyrrhonota	M	S	S	F
Barn Swallow*	Hirundo rustica	S	O	O	F
Scrub Jay*	Aphelocoma coerulescens	S	-	-	F/B
Yellow-billed Magpie*	Pica nuttalli	S	S	S	F/B
American Crow*	Corvus brachyrhynchos	S	S	S	F/B
Plain Titmouse*	Parus inornatus	S	-	-	F/B
American Robin*	Turdus migratorius	O	-	S	F/B
Loggerhead Shrike*	Lanius ludovicianus	S	S	S	F/B
Bushtit*	Psaltriparus minimus	M	-	-	F/B
Ruby-crowned Kinglet	Regulus calendula	S	-	-	F/B
Hermit Thrush	Catharus guttatus	O	-	-	F/B
Northern Mockingbird*	Mimus polyglottos	S	-	-	F/B
European Starling*	Sturnus vulgaris	S	S	S	F/B
Rufous-sided Towhee*	Pipilo erythrophthalmus	S	-	-	F/B
California Towhee*	Pipilo crissalis	S	-	-	F/B
Song Sparrow	Melospiza melodia	O	-	-	F/B
White-crowned Sparrow	Zonotrichia leucophrys	O	-	-	F/B
Dark-eyed Junco	Junco hyemalis	O	-	-	F/B
Red-winged Blackbird*	Agelaius phoeniceus	S	O	O	F/B
Brewer's Blackbird*	Euphagus cyanocephalus	S	S	S	F/B
Northern Oriole*	Icterus galbula	O	-	-	F/B
Western Meadowlark*	Sturnella neglecta	-	O	O	F/B
House Finch*	Carpodacus mexicanus	S	S	S	F/B
American Goldfinch	Carduelis tristis	O	-	S	F/B
House Sparrow*	Passer domesticus	-	M	M	F/B

TABLE 7-8. Potential Wildlife Species Inhabiting the Natomas Project Area (Continued)

COMMON NAME	SCIENTIFIC NAME	COVER TYPE AND SUITABILITY			HABITAT USE
		RIP	GRASS	AGRIC	
MAMMALS					
Virginia Opossum	Didelphis virginiana	S	-	-	F/B
Broad-footed Mole	Scapanus latimanus	S	O	O	F/B
Black-tailed Hare*	Lepis californicus	-	O	S	F/B
California Ground Squirrel*	Spermophilus beecheyi	M	O	O	F/B
Western Gray Squirrel	Sciurus griseus	M	-	-	F/B
Deer Mouse	Peromyscus maniculatus	S	M	M	F/B
California Vole	Microtus californicus	S	O	S	F/B
House Mouse	Mus musculus	S	S	S	F/B
Muskrat*	Ondatra zibethicus	O	-	-	F/B
Striped Skunk	Mephitis mephitis	O	-	-	F/B
Coyote*	Canis latrans	M	S	S	F/B
Gray Fox*	Urocyon cinereoargeneus	S	S	S	F/B
Domestic Dog*	Canis familiaris	S	S	S	F/B
Domestic Cat*	Felis domesticus	S	S	S	F/B

Source: McClelland Consultants, 1991.
* Observed on project site

Suitability Codes:

O = Optimal
S = Suitable
M = Marginal

Habitat Use Codes:

B = Breeding
F = Foraging

Sources: Brown et al. (1986); Miller (1951); City of Sacramento (1984); U.S. Army Corps of Engineers (1991); Ingles (1965); Zeiner et al. (1988; 1990a,b); Jameson and Peeters (1988).

evidence of the high use in the basin (FWS, 1991). Additionally, the Natomas area is known to be the major mallard nesting area of the Sacramento Valley and is a high use area for pintail ducks (FWS, 1991).

Field sampling of the various cover types was performed by the FWS and COE, in conjunction with the Habitat Evaluation Procedures (HEP) evaluation for the project. A relative rating of the value of the various cover types was made based on representative species typically occupying various feeding and/or breeding guilds within those cover types (COE, 1991; FWS, 1990). For example, species selected to represent the upland cover types included, California vole, Short-eared owl, red-winged blackbird and ring-necked pheasant. The Riparian/Wetland cover types were represented by great blue heron, muskrat, wood duck, yellow warbler, black-shouldered kite, downy woodpecker, western flycatcher, sora rail, red-legged frog, northern oriole and mink. A complete list of species chosen can be found in the FWS Coordination Act Report (Appendix R).

The HEP analysis was divided into two subanalyses, upland habitat and wetland habitat. This subdivision was made because of the resource categories into which the cover types were placed and the related compensation goals (see Appendix R, HEP analysis appendix for further explanation). Baseline average HSI values for wetland species were 0.58 in the wetland cover types. This value indicates that the total available habitat within the project impact area is above average in its capacity to support the evaluation species. For all upland species combined, average HSI values were approximately 0.74 for the existing upland habitat in the Natomas area. This value indicates that the total available habitat within the project impact area is above average in its capacity to support the evaluation species (FWS, 1991).

Lower American River

The lower American River and Parkway area support diverse wildlife populations. However, two vegetation cover types, oak-woodland and grassland, limit overall species diversity in the Folsom Reservoir area. The oak woodland provides an abundance of trees for nesting and observation sites for red-tailed hawks, American kestrels and other raptors. The evergreen oaks supply a food source for mast eaters such as acorn woodpecker, scrub jays, black-tailed deer, ground squirrels and gray squirrels (FWS, 1991). The shrub layer provides cover for many species of songbirds, California quail, bobcat, coyote, gray fox and rodents (FWS, 1991). Other characteristic wildlife of this ecosystem includes the raccoon, opossum, bats, western skink and king snake.

The grassland areas in the Folsom Reservoir area serve as the food base for a wide variety of herbivores such as the kangaroo rat, meadow mice, pocket mice and pocket gophers. These species provide food for the carnivorous species of the area, which include owls, hawks, coyote, gray fox, gopher snakes and the Pacific rattlesnake. The Lake Natoma area supports the same wildlife species as found along the lower American River (FWS, 1991).

The high species diversity in the Parkway results from the amount, variety, and quality of habitat and existing protective management measures. Each of the six vegetative cover types are valuable to wildlife. They provide for permanent residency and breeding, and serve as a migratory corridor or a buffer from urban developments. Freshwater marsh and riparian forest are the most significant for wildlife. Their tremendous declines statewide makes them especially significant.

More than 220 species of birds have been recorded along the Parkway and over 60 nest in central valley riparian habitats (FWS, 1991). Common species along the floodway include the great blue heron, mallard, red-tailed hawk, red-shouldered hawk, American kestrel, California quail, killdeer, belted kingfisher, scrub jay, northern flycatcher,, tree swallow and American robin. More than 30 species of mammals also reside along the floodway including striped skunk, Virginia opossum, brush rabbit, raccoon, western gray squirrel, California ground squirrel, meadow vole, muskrat, black-tailed deer, gray fox and coyote (FWS, 1991). Additionally, reptiles and amphibians depend on the indigenous habitats of the lower American River. The most common include the western toad, Pacific tree frog, bullfrog, western pond turtle, western fence lizard, southern alligator lizard, western skink, common garter snake, and gopher snake (FWS, 1991).

Field sampling was preformed in conjunction with the HEP evaluation and a relative rating of the value of the various cover types was made based on representative species typically occupying various feeding and/or breeding guilds within those cover types (COE, 1991; FWS, 1990). For example, species selected to represent the upland cover type include Western fence lizard, rufous-sided towhee, gray squirrel, California vole, short eared owl and ring-necked pheasant. Species chosen to represent wetland cover types include great blue heron, muskrat, wood duck, black-shouldered kite, and red-legged frog. A complete list of species chosen can be found in the FWS Coordination Act Report, (Appendix R).

The HEP analysis was divided into two subanalyses, wetland habitat losses and all other habitat losses which included the upland cover type losses. This subdivision was made because of the resource categories into which the cover types were placed and the related compensation goals. (See Appendix R, HEP analysis appendix for further explanation.) The baseline average HSI value of 0.58 for wetland cover types along the lower American River indicates that the total available habitat within the project impact area is above average in its capacity to support the evaluation species. The average baseline HSI value for upland habitats was approximately 0.77 which indicates the available habitat within the project area is above average in its capacity to support the evaluation species (FWS, 1991).

Upper American River

The proposed damsite is in a region of high wildlife species diversity (FWS, 1991). Six broad vegetation cover types were recognized in the study area for HEP analysis purposes. Many macro- and microhabitats occur throughout, including seeps, springs, small ponds, and pools, rock outcrops, limestone outcrops, talus slopes, cliffs, crevices, and caves. All contribute to the diversity and abundance of plant and animal life in the area. Much of the area is characterized by steep, often densely vegetated slopes. The canyon bottoms provide surface moisture and associated vegetation cover critical to most area wildlife species.

Species common to this general area include black-tailed deer, coyote, raccoon, fox and many species of reptiles and amphibians. Black-tailed deer commonly occur in densities of 10 to 30 per square mile (FWS, 1991). Although cover and browse conditions for deer vary from excellent to poor throughout the area, in general, conditions are good to very good (FWS, 1991). The relatively high deer populations (indicated by the extent of visibly browsed shrubs and forbs) and the extensive mosaic of fire adapted vegetation types, indicate the important and dynamic role fire plays in maintaining high habitat values in the region (FWS, 1991). Fires thin dense monotypic stands of trees and shrubs, which are often undesirable as forage, permitting seed regeneration of other species that serve as browse for wildlife. Typical species of the upper American River canyons can be found in Table 7-9.

Specifically, the north slope forest cover type provides a dense tree habitat with undisturbed drainages used for nesting and denning. Species found in this habitat include; ringtail cat, grey fox, deer, owls, and many songbird species (FWS, 1991). Thick ground litter provides habitat for amphibians, reptiles and invertebrates. The ground litter also provides habitat for woodrats and ground foraging birds. In contrast, the south slope forest is a relatively dry open area in which some of the same species of the north slope forest intermix with species more exclusive to the south slope habitat. These species include, turkey vulture, bandtail pigeon, scrub jay, acorn woodpecker, various warbler species, California thrasher and various species of vireos and sparrows (FWS, 1991). Additionally, the open sunny exposures and rocky outcrops provide habitat for the western fence lizard and other species of snakes and lizards.

The drier digger pine conifer forests provide habitat for overlap species from the nearby chaparral such as gray fox, coyote, deer, wood rat, wrentit, scrub jay, thrasher, brush mice, badger and bobcat (FWS, 1991). The more mesic ponderosa pine and incense cedar stands often support red fox, porcupine, mountain lion, raccoon, beaver, deer mouse, California vole, mink, and forest birds such as Townsend's solitaire, pine siskin, gnatcatcher, nuthatch, western wood pewee, various thrushes, warblers and grosbeak (FWS, 1991).

The chaparral cover type is usually a fire-adapted type of habitat that can vary greatly in its value to wildlife. Dense stands with little ground vegetation and almost complete canopy closure present low value to wildlife compared to a recently burned area with open areas and young plants and shrubs for foraging. These open areas with available forage will support species such as wrentit, quail, turkey vulture, deer, mountain

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
AMPHIBIANS AND REPTILES							
California Newt	_Taricha torosa_	S	S	-	M	O	B/F
California Slender Salamander	_Batrachoseps attenuatus_	S	S	-	-	-	B/F
Arboreal Salamander	_Aneides lugubris_	O	O	-	S	O	B/F
Western Toad	_Bufo boreas_	S	M	-	M	O	B/F
Pacific Treefrog	_Hyla regilla_	M	M	-	S	O	B/F
Red-legged Frog	_Rana aurora_	S	S	-	-	O	B/F
Foothill Yellow-legged Frog	_Rana boylei_	S	S	-	M	O	B/F
Bullfrog*	_Rana catesbeiana_	O	O	-	M	O	B/F
Western Pond Turtle	_Clemmys marmorata_	O	O	-	S	O	B/F
Western Fence Lizard*	_Sceloporus occidentalis_	O	O	-	M	O	B/F
Western Skink	_Eumeces skiltonianus_	S	O	-	S	O	B/F
Gilbert's Skink	_Eumeces gilberti_	S	S	-	S	O	B/F

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Western Whiptail	Cnemidophorus tigris	S	O	-	M	S	B/F
Southern Alligator Lizard*	Gerrhonotus multicarinatus	S	O	-	M	O	B/F
Ringneck Snake	Diadophis punctatus	S	O	-	M	O	B/F
Sharp-tailed Snake	Contia tenuis	S	S	-	S	O	B/F
Racer	Coluber constrictor	S	O	-	M	S	B/F
California Whipsnake	Masticophis lateralis	S	O	-	S	O	B/F
Gopher Snake	Pituophis melanoleucus	O	O	-	S	O	B/F
Common Kingsnake	Lampropeltis getulus	O	O	-	M	O	B/F
Common Garter Snake	Thamnophis sirtalis	O	O	-	S	O	B/F
Western Terrestrial Garter Snake	Thamnophis elegans	O	O	-	S	O	B/F
Western Aquatic Garter Snake	Thamnophis couchi	O	O	-	S	O	B/F
Night Snake	Hypsiglena torquata	S	O	-	-	M	B/F
Western Rattlesnake	Crotalus viridis	O	O	-	S	O	B/F

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
BIRDS							
Pied-billed Grebe	Podilymbus podiceps	S	S	-	S	S	F/B
Eared Grebe	Podiceps nigricollis	S	S	-	S	S	F
Western Grebe	Aechmophorus occidentalis	M	M	-	M	M	F
Great Blue Heron	Ardea herodias	S	S	-	S	S	F
Green-backed Heron	Butorides striatus	M	-	-	-	S	F/B
Black-crowned Night-Heron	Nycticorax nycticorax	S	-	-	-	S	F/B
Wood Duck	Aix sponsa	S	-	-	M	O	F/B
Mallard	Anas platyrhynchus	S	S	-	S	S	F/B
Common Merganser*	Mergus merganser	S	S	-	S	S	F/B
Turkey Vulture*	Cathartes aura	S	S	-	M	M	F/B
Bald Eagle	Haliaeetus leucocephalus	M	M	-	S	M	F/B
Sharp-shinned Hawk	Accipiter striatus	S	S	-	S	S	F

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Cooper's Hawk	Accipiter cooperi	S	M	-	S	O	F/B
Red-tailed Hawk*	Buteo jamaicensis	S	M	S	M	M	F/B
Golden Eagle*	Aquila chrysaetos	S	S	-	M	M	F/B
American Kestrel*	Falco sparverius	S	S	-	M	S	F/B
Peregrine Falcon	Falco peregrinus	S	S	-	S	S	F/B
Prairie Falcon	Falco mexicanus	S	S	-	M	M	F/B
California Quail*	Lophortyx californicus	S	O	-	M	M	F/B
Killdeer*	Charadrius vociferus	M	S	S	M	-	F/B
Spotted Sandpiper*	Actitus macularia	S	S	O	S	S	F/B
Common Snipe	Capella gallinago	M	S	-	M	-	F/B
Band-tailed Pigeon*	Columba fasciata	S	M	-	S	S	F/B
Mourning Dove*	Zenaida macroura	S	S	-	S	M	F/B
Greater Roadrunner	Geococcyx californianus	M	S	-		-	F/B
Barn Owl	Tyto alba	O	S	-	M	-	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Western Screech Owl	Otus asio	O	S	-	S	O	F/B
Great Horned Owl	Bubo virginianus	O	O	-	O	O	F/B
Northern Pygmy-Owl	Glaucidium gnoma	O	O	-	O	O	F/B
Burrowing Owl	Athene cunicularia	S	S	-	-	-	F/B
California Spotted Owl	Strix occidentalis	M	-	-	M	S	F/B
Long-eared Owl	Asio otus	S	M	-	S	S	F/B
Common Nighthawk	Chordeiles minor	M	S	-	M	-	F/B
Common Poor-Will	Phalaenoptilus nuttallii	S	S	-	S	-	F/B
Black Swift	Cypseloides niger	M	M	-	S	S	F/B
Vaux's Swift	Chaetura vauxi	M	M	-	M	M	F/B
White-throated Swift	Aeronautes sacatalis	S	S	-	S	S	F/B
Black-chinned Hummingbird	Archilochus alexandri	S	M	-	S	S	F/B
Anna's Hummingbird*	Calypte anna	S	S	-	S	S	F/B
Belted Kingfisher*	Megaceryle alcyon	S	M	-	O	S	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Acorn Woodpecker*	_Melanerpes formicivorous_	S	-	-	M	M	F/B
Nuttall's Woodpecker	_Picoides nuttallii_	S	M	-	-	S	F/B
Downy Woodpecker	_Picoides pubescens_	M	-	-	M	O	F/B
Western Wood Pewee	_Contopus sordidulus_	S	-	-	S	S	F/B
Willow Flycatcher	_Empidonax traillii_	-	-	-	-	O	F/B
Hammond's Flycatcher	_Empidonax hammondii_	M	M	-	S	-	F
Pacific-slope Flycatcher*	_Empidonax difficilis_	M	M	-	S	-	F/B
Black Phoebe*	_Sayornis nigricans_	S	S	-	S	O	F/B
Say's Phoebe	_Sayornis saya_	S	O	-	S	-	F/B
Ash-throated Flycatcher	_Myiarchus cinerascens_	S	O	-	S	S	F/B
Western Kingbird*	_Tyrannus verticalis_	S	S	-	M	-	F/B
Tree Swallow	_Iridoprocne bicolor_	S	S	-	S	O	F/B
Violet-green Swallow*	_Tachycineta thalassina_	S	M	-	S	O	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Northern Rough-winged Swallow	Stelgidopteryx ruficollis	O	O	-	S	O	F/B
Cliff Swallow*	Petrochelidon pyrrhonota	O	O	-	M	M	F/B
Barn Swallow	Hirundo rustica	O	O	-	S	S	F/B
Scrub Jay*	Aphelocoma coerulescens	S	M	-	M	S	F/B
American Crow	Corvus brachyrhynchos	M	M	-	M	S	F/B
Common Raven	Corvus corax	O	O	-	S	S	F/B
Plain Titmouse*	Parus inornatus	S	D	-	M	S	F/B
Bushtit	Psaltriparus minimus	S	M	-	M	M	F/B
White-breasted Nuthatch	Sitta carolinensis	O	-	-	S	M	F/B
Canyon Wren	Catherpes mexicanus	S	S	-	S	M	F/B
Bewick's Wren*	Thryomanes bewickii	S	O	-	M	M	F/B
American Dipper*	Cinclus mexicanus	-	-	-	-	O	F/B
Ruby-crowned Kinglet*	Regulus calendula	O	O	-	M	S	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Blue-gray Gnatcatcher	_Polioptila caerulea_	S	M	-	M	M	F/B
Western Bluebird*	_Sialia mexicana_	M	-	-	-	-	F/B
Swainson's Thrush	_Catharus ustulata_	M	-	-	M	S	F/B
Hermit Thrush*	_Catharus guttatus_	S	S	-	M	O	F/B
American Robin*	_Turdus migratorius_	S	S	-	S	O	F/B
Wrentit*	_Chamaea fasciata_	S	O	-	M	-	F/B
Northern Flicker*	_Colaptes auratus_	S	M	-	S	S	F/B
California Thrasher	_Toxostoma redivivum_	S	O	-	-	-	F/B
Phainopepla	_Phainopepla nitens_	O	S	-	-	M	F/B
Loggerhead Strike	_Lanius ludovicianus_	S	M	-	-	M	F/B
European Starling	_Sturnus vulgaris_	O	O	-	-	S	F/B
Warbling Vireo	_Vireo gilvus_	M	-	-	S	O	F/B
Orange-crowned Warbler	_Vermivora celata_	S	O	-	S	O	F/B
Yellow Warbler	_Denroica petechia_	O	S	-	S	O	F/B
Black-throated Gray Warbler	_Dendroica nigrescens_	S	S	-	S	M	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Common Yellowthroat	Geothlypis trichas	S	S	-	S	O	F/B
Yellow-breasted Chat	Icteria virens	-	-	-	-	S	F/B
Black-headed Grosbeak*	Pheucticus melanocephalus	S	M	-	M	O	F/B
Lazuli Bunting*	Passerina amoena	S	S	-	S	S	F/B
Rufous-side Towhee*	Pipilo erythrophthalmus	S	O	-	M	S	F/B
California Towhee*	Pipilo fuscus	S	O	-	-	S	F/B
Chipping Sparrow*	Spizella passerina	S	S	-	S	-	F/B
Lark Sparrow*	Chondestes grammacus	S	O	-	M	-	F/B
Sage Sparrow*	Amphispiza belli	-	O	-	-	-	F/B
Song Sparrow*	Melospiza melodia	M	-	-	M	O	F/B
Golden-crowned Sparrow*	Zonotrichia atricapilla	S	S	-	M	M	F
Dark-eyed Junco*	Junco hyemalis	S	M	-	S	O	F/B
Tricolored blackbird	Agelaius tricolor	M	-	-	-	S	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Brewer's Blackbird	Euphagus cyanocephalus	S	S	-	M	S	F/B
Brown-headed Cowbird	Molothrus ater	S	M	-	M	O	F/B
Northern Oriole	Icterus galbula	S	M	-	M	O	F/B
House Finch	Carpodacus mexicanus	S	S	-	-	S	F/B
Lesser Goldfinch	Carduelis psaltria	O	S	-	S	S	F/B
American Goldfinch*	Carduelis tristis	S	S	-	-	O	F/B
MAMMALS							
Virginia Opossum	Didelphis virginiana	M	M	-	S	S	F/B
Ornate Shrew	Sorex ornatus	M	M	-	M	S	F/B
Broad-footed Mole	Scapanus latimanus	M	M	-	M	S	F/B
Yuma Myotis	Myotis humanensis	S	M	-	S	S	F/B
California Myotis	Myotis californicus	S	S	-	M	M	F/B
Western Pipistrelle	Pipistrellus hesperus	O	M	-	M	M	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Big Brown Bat	Eptesicus fuscus	S	M	-	M	M	F/B
Red Bat	Lasiurus borealis	O	S	-	S	O	F/B
Hoary Bat	Lasiurus cinereus	S	M	-	S	M	F/B
Brazilian Free-tailed Bat	Tadarida brasiliensis	M	S	-	S	M	F/B
Brush Rabbit	Sylvilagus bachmani	S	O	-	-	-	F/B
Desert Cottontail	Sylvilagus audubonii	S	O	-	-	-	F/B
Black-tailed Hare	Lepus californicus	S	O	-	M	-	F/B
Long-eared Chipmunk	Eutamias quadrimaculatus	-	-	-	S	M	F/B
California Ground Squirrel	Spermophilus beecheyi	S	S	-	S	M	F/B
Western Gray Squirrel	Sciurus griseus	S	M	-	S	M	F/B
California Pocket Mouse	Perognathus californicus	M	S	-	-	-	F/B
California Kangaroo Rat	Dipodomys californicus	S	S	-	-	-	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Beaver	Castor canadensis	-	-	-	-	O	F/B
Deer Mouse	Peromyscus maniculatus	S	S	-	S	S	F/B
Brush Mouse	Peromyscus boylii	S	S	-	S	-	F/B
Pinyon Mouse	Peromyscus truei	S	O	-	S	S	F/B
Dusky-footed Woodrat	Neotoma fuscipes	S	S	-	S	S	F/B
Muskrat	Ondatra zibethicus	-	-	-	-	O	F/B
Coyote	Canis latrans	S	O	-	S	M	F/B
Gray Fox*	Urocyon cinereoargenteus	S	O	-	S	M	F/B
Ringtail	Bassariscus astutus	S	S	-	M	O	F/B
Raccoon	Procyon lotor	M	M	-	M	O	F/B
Long-tailed Weasel	Mustela frenata	M	S	-	S	O	F/B
Mink	Mustela vison	-	-	-	-	O	F/B
Badger	Taxidea taxus	S	S	-	S	S	F/B
Western Spotted Skunk	Spilogale gracilis	S	S	-	S	M	F/B
Striped Skunk	Mephitis mephitis	S	S	-	S	O	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	
Mountain Lion	<u>Felis concolor</u>	M	S	-	S	-	F/B
Bobcat	<u>Felis rufus</u>	S	S	-	S	M	F/B
Mule Deer*	<u>Odocoíleus hemionus</u>	S	S	-	S	S	F/B

TABLE 7-9 Typical Species Inhabiting the Upper American River Canyons (Continued)

		HABITAT SUITABILITY BY COVER TYPE[1]					HABITAT[3] USE
COMMON NAME	SCIENTIFIC NAME	OAK	CHA	BAR	PINE	RIP	

* Observed during field surveys.

[1]Cover Type Code
- OAK = Oak Woodland
- CHA = Chaparral
- BAR = Gravel Bar Scrub
- PINE = Conifer Forest
- RIP = Riparian Shrub/Scrub

(2) Habitat Suitability
- O = Optimal
- S = Suitable
- M = Marginal

American Birds (Tate 1986).

(3) Habitat Use:
- B = Breeding
- F = Foraging

Sources: Brown et al. (1986); Clark and Wheeler (1987); Jameson and Peeters (1986); Peterson (1990); Stebbins (1966); Tate (1986); Verner and Boss (1980); Zeiner et al.(1988, 1990a, 1990b).

lion, bobcat, coyote, gray fox, reptiles and song bird species. In the Auburn area, chaparral areas are not usually allowed to experience the natural fire regime because of fire avoidance and prevention. Therefore, the chaparral areas are indirectly allowed to mature to decadent, essentially monoculture stands of one or two dominant shrubs with relatively low wildlife values (FWS, 1991).

The grassland habitats in the upper American River area vary in terms of their value for wildlife depending on the location (elevation) and size of the area. Generally, grasslands provide foraging sites for many of the species residing in the adjacent habitats such as mammals, raptors, reptiles and amphibians.

The riverine areas along the upper American River support a high diversity of habitats (FWS 1991). The vegetation here and at the major and minor tributaries that are adjacent to the main river, provide a variety of habitats supporting many water and shore birds such as the dipper, sandpiper, great blue heron, killdeer, bufflehead, bittern, egret, mallard, merganser, goldeneye, and wood duck. The location of water sources in relation to vegetative cover, attracts large mammals, amphibians and reptiles such as foothill yellow-legged frog, western toad, slender salamander, California newt, western pond turtle, gopher snake, night snake, western whiptail and common kingsnake.

Field sampling was performed in conjunction with the HEP evaluation and a relative rating of the value of the various cover types was made based on representative species typically occupying various feeding and/or breeding guilds within those cover types (COE, 1991; FWS, 1990). For example species chosen to represent upper American River area include Northern alligator lizard, mountain quail, Western flycatcher, desert cottontail, brush rabbit, Pygmy nuthatch, Western bluebird, American dipper, bobcat and Western rattlesnake. For a complete list of species chosen please see the FWS Coordination Act Report, (Appendix R).

The HSI value for each cover type was derived from the composite rating of the individual species within each cover type. This revealed an average baseline HSI value of 0.73 for the existing habitats in the upper American River area. This value indicates that the total available habitat within the project impact area is well above average in its capacity to support the evaluation species.

IMPACTS

This section evaluates direct and indirect impacts of the no-action, selected plan, 400-year, 150-year, and 100-year (FEMA) alternatives. Direct impacts are summarized in Tables 7-10 and 7-11. Impacts were analyzed by the FWS using the HEP methodology in accordance with the Federal Fish and Wildlife Coordination Act. The FWS analysis, the Final Coordination Act Report is in Appendix S. An additional operational impact analysis of the Upper American River portion of the selected plan was undertaken by the State of California and the Corps, this analysis is in Appendix Q. Both analysis are summarized in this section.

Inherent in any attempt to predict impacts and future scenarios of any given action, there are area(s) of uncertainty that exist. In the case of predicting reasonably foreseeable impacts for the proposed flood-control dam, uncertainty exists in the lack of data dealing with the environmental effects of a flood detention dam in a setting similar to the proposed project. The CEQ guidelines state that in situations where uncertainties exist, impact analyses should, "summarize credible scientific evidence relevant to evaluating these impacts and evaluate these impacts based upon theoretical approaches or research methods generally accepted in the scientific community" (Mandelker, 1989). In this case, impacts were evaluated using available scientific data, anecdotal evidence, field observations and professional judgement. This approach is in accordance with the CEQ guidelines and represents a reasonable prediction of future impacts.

The indirect impacts analysis for the project alternatives was conducted according to future land use scenarios discussed in Chapter 4. In Natomas, in accordance with Corps policy, indirect environmental impact assessments were based on the adopted general plan scenario. This scenario assumed that development would occur as anticipated under the adopted general plans of the City of Sacramento, Sacramento County and Sutter County. The FWS based its analysis of indirect impacts in Natomas on a maximum growth scenario. This scenario anticipates development far beyond the scope of any existing or contemplated local plans. The indirect impacts of both scenarios will be discussed in this section.

TABLE 7-10. Direct Impacts of Flood Control Alternatives (in acres)

COVER TYPE	SELECTED PLAN AND 400-YEAR FLOOD CONTROL ONLY DAM				150-YEAR PLAN			100-YEAR PLANS: LEVEE/STORAGE 100-YEAR LEVEE PLAN ALTERNATIVE			100-YEAR PLANS: 100-YEAR STORAGE PLAN			100-YEAR PLANS: 100-YEAR AND SPILLWAY		
	NATOMAS	UPPER AMER. RIVER 200 YEAR	UPPER AMER. RIVER 400 YEAR	TOTAL	NATOMAS	LOWER AMER. RIVER	TOTAL	NATOMAS	LOWER AMER. RIVER	TOTAL	NATOMAS	LOWER AMER. RIVER	TOTAL	NATOMAS	LOWER AMER. RIVER	TOTAL
Open Water						125	125		125	125		6	6		125	125
Marsh	17			17	17	21	38	17	5	22	17	1	18	17	0	17
Riparian Forest/Montane Riverine	1	305	764	306	1	248	249	1	107	108	1	55	56	1	106	107
Riparian Scrub-Shrub						285	285		225	225		81	81		223	223
Sand, Gravel Ruderal		46		46												
Subtotal	18	351	764	369	18	679	697	18	462	480	18	143	161	18	454	472
Upland	272	1,576	1,597	1,848	272	+679[1]	272	272	+462[1]	272	272	+143[1]	272	272	+454[1]	272
Total Habitat Loss	290	1,927	2,361	2,217	290	679	969	290	462	752	290	143	433	290	454	744

[1] This figure indicates a conversion of wetland habitat to upland.

TABLE 7-11. Indirect Impacts of Flood Control Alternatives (in acres)

COVER TYPE	200 AND 400-YEAR PLANS			150-YEAR PLAN 100-YEAR FEMA PLANS		
	NATOMAS	UPPER AMER. RIVER[1]	TOTAL	NATOMAS	UPPER AMER. RIVER[1]	TOTAL
Open Water		no impact			no impact	
Marsh	128		128	128		128
Riparian Forest/ Montane Riverine	16		16	16		16
Riparian Scrub-Shrub	104		104	104		104
Subtotal	248		248	248		248
Upland	7,665		7,665	7,665		7,665
Total Habitat Loss	7,913		7,913	7,913		7,913

1 The construction and operation of the flood control dam would not affect land use in the in the Upper American River area.

SIGNIFICANCE CRITERIA

Department of the Army policy guidance contained in Engineering Regulation 1105-2-100 (U.S. Army Corps of Engineers 1990) establishes the following significance criteria:

- Significance based on institutional recognition means that the importance of the effect is acknowledged in the laws, adopted plans and other policy statements of public agencies and private groups. Institutional recognition of an effect is often explicit in the form of specific criteria for determining whether an effect is significant.

- Significance based on public recognition means that some segment of the general public recognizes the importance of the effect. Public recognition may take the form of controversy, support, conflict, or opposition; it may be expressed formally (as in official letters) or informally. Environmentally related customs and traditions should also be considered in determining sources of public recognition.

- Significance based on technical recognition means that the importance of an effect is based on technical or scientific criteria related to critical resource characteristics.

In addition, significance thresholds were identified from the California Environmental Quality Act (California Office of Planning and Research 1988) and local/regional plans and ordinances for the environmental issues analyzed in this report. Using these guidelines, the proposed project was evaluated to determine if significant impacts to biological resources would result from project implementation. Significance thresholds were based on the following:

- Conflicts with adopted environmental plans and goals of the affected jurisdictions (appendix G (a) of CEQ guidelines):

- Substantially affect a rare or endangered species (appendix G (c));

- Interfere substantially with movement of any resident or migratory fish or wildlife species (appendix G (d)).

- Substantially diminish habitat for fish, wildlife, or plants (appendix G (t));

- o Involve the use, production or disposal of material which pose a hazard to animal or plant populations in the area affected (appendix G (v));
- o Adversely affect a plant or animal taxa considered locally important.

NO-ACTION ALTERNATIVE

Natomas, Lower American River and Upper American River.

Flood Related Impacts. This alternative assumes that the Federal and State governments would not participate in flood control efforts. Impacts to certain resources will occur even without a flood control project. Flooding will occur in the flood plain areas in accordance with existing conditions. Very few studies on the adverse effects of flooding on plant and animal populations exist (McClelland Consultants, 1991). Considerable work has shown disruptions to riparian zones are capable of affecting fish and aquatic insect populations (McClelland Consultants, 1991). Flooding, especially if it occurs outside of the growing season, is not known to cause extensive damage to the riparian vegetative community (provided its duration is not artificially extended, as in a reservoir). Nor is there evidence of significant or long-term damage to upland vegetative communities due to flooding of this type (McClelland Consultants, 1991).

However, some special status species that occur in the Sacramento area 200-year floodplain could be susceptible to significant impacts from flooding (McClelland Consultants, 1991). (See Endangered Species chapter.) Flooding could temporarily displace other species from some sites, but because species not known to be rare, threatened, or endangered have relatively extensive ranges and relatively large populations, they would be capable of recolonizing the sites from which they were displaced. Short-term impacts are certainly likely, but recovery, including recolonization, would be expected within a few years.

Sites in the upper American River would continue to be impacted by flooding events as they have in the past. These impacts include temporary inundation, erosion and sloughing. Land previously acquired for the authorized 2.3 million acre-foot USBR Auburn Dam would remain as public lands. If the USBR project is deauthorized, it is assumed that the agency would dispose of the lands in accordance with Federal regulations. According to the significance criteria, there would be no significant impacts related to flooding associated with the no-action alternative in the Natomas, lower American River or upper American River areas.

Growth-Related Impacts. Impacts related to growth associated with the no-action alternative include those that would result from any development that would occur without the project. Without-project conditions under the adopted general plan scenario indicate that no growth would occur in Natomas beyond the base year 1992. The maximum growth scenario, used by FWS anticipates significant development in Natomas. See Chapter 4, Land Use for further discussion. In the lower American River area, the without-project conditions under the adopted general plan scenario assumed that development would proceed as planned except for a 1,400 acre area of the City below Meadowview Road. Under the maximum growth scenario, it was assumed that development would proceed in all portions of the lower American River area at the same rate and magnitude as contemplated under existing plans.

Fisheries. Assuming that management of fishery resources would remain the same as today, anadromous fish resources in the Sacramento River Basin would experience continued declines in the future (FWS, 1991). Agricultural use and urban growth in the watershed areas of these rivers would continue to reduce water quality, reduce stream flows, increase water temperatures, elevate non-point source contaminant discharges, and contribute to other water quality and quantity problems.

Natomas. In the Natomas area, with no growth assumed without the project, resident fishery resources would likely continue their gradual decline. Urban growth outside Natomas, but along adjacent streams and inlets to the Natomas system, will worsen the water quality due to increased drainage and runoff problems. Resident fish losses associated with warmer temperatures, lower flows, and increased contaminants, all of which lower water quality, will likely be most noticeable in the larger creeks, canals and drains of Natomas. These continued losses would be cumulatively significant. However, the anadromous chinook salmon resource in this area should not change significantly from existing conditions as their movement through this area is usually under high flow conditions when water quantity and quality are best.

Lower American River. Without the project, some decline of the fish resources of Folsom Reservoir is expected. This decline of fish resources in the reservoir is due to an increase in the demand for water associated with the growing residential and commercial developments surrounding the reservoir (FWS, 1991). Fishery impacts in the reservoir would result from increase in reservoir fluctuations and drawdown. Additionally, the inflow of contaminants and sediments associated with development would impact spawning cycles (FWS, 1991).

Fishing pressure is expected to increase somewhat because of the substantial increase in population of the area (FWS, 1991). However, as fishing activities increase, the catch per effort declines leading to the average annual angler-use days at Folsom Reservoir remaining at the same level of 120,000 days.

No significant changes in the fishery resources are expected at Lake Natoma (FWS, 1991). However, in the lower American River, increased in-basin water demands and water exports without the project would adversely affect the fisheries (FWS, 1991). Reduced flows, higher temperatures and general decrease in water quality would impact naturally spawning chinook salmon and American shad. Hatchery production of chinook salmon and steelhead trout would also be adversely affected by increased water temperature and reduced water quality. Hatchery production of chinook salmon is expected to decline approximately 10 percent. Steelhead trout would also be adversely affected along with other game and non-game fish.

Upper American River. Habitat quality for fisheries in both the North and Middle Forks of the upper American River will decline in the future without the project. Habitat conditions are less than ideal now, and increased water diversions, construction activities, public use, mining and other activities will contribute to worsening conditions (FWS, 1991). Water temperatures and water level fluctuations will increase while a decrease in pool depth will occur, all adversely affecting fish populations.

Vegetation and Wildlife.

Natomas. As previously discussed in Chapter 4, under the adopted general plan scenario, it was assumed that without the project, regional growth would shift to other parts of Sacramento and virtually no growth would occur in Natomas beyond the base year of 1992. Therefore, without the project, no growth related impacts to vegetation in the Natomas area would occur.

Under the maximum growth scenario the FWS assumed significant development would occur in Natomas based on local construction of cross and ring levees and approval of flood proofed commercial projects. Vegetation losses under the maximum growth scenario are estimated to be 565 acres of wetland and 15,947 acres of upland habitats, for a total loss over the existing conditions of 16,512 acres (FWS, 1991). These cover types provide significant habitat for migratory waterfowl, and other water-associated birds, raptors, songbirds, small mammals, and upland game birds. The majority of the losses would occur as agricultural lands are taken out of production and converted to urban uses.

Lower American River. Most of the lower American River area is already developed with the remainder anticipated to build out in accordance with the existing city and county general plans between 1992 and 2010. Much of the area to be developed is in areas of minimal base flood elevations and it was assumed that these areas would be developed with or without the project. Accordingly, under the adopted plan scenario, urban uses in the lower American River area would grow by 6,045 acres. This level of development would be about 1400 acres less than the projected local plan buildout due to the lands in the Meadowview area left vacant by the absence of adequate flood protection. Therefore, without the project, potentially significant impacts to vegetation would take place as part of the existing city and county plans.

Under the maximum growth scenario, it was assumed that even without the project, growth would proceed in all portions of the lower American River in accordance with adopted local plans. Flood proof developments would allow areas with high base flood elevations to proceed with residential development. Therefore, the total acreage developed under this scenario would be the same as that projected under the existing adopted local plans. Accordingly, there would be no net difference between the "with" and "without" project conditions. (See Chapter 4.) The FWS identified approximately 1,480 acres lost without the project.

In the Parkway itself, reductions and changes in the existing riverine environment resulting from Folsom Dam operations, future water deliveries and urban growth would cause approximately 1,480 acres of wetland habitat to be converted to upland habitats.

Upper American River. Without the project, lands previously acquired for the authorized multipurpose Auburn Dam would remain in public ownership and the existing authorization for that project would remain undisturbed. The vegetation and wildlife resources will not change significantly without the project. It is assumed that these lands would be managed to create the highest and best environmental and recreational uses.

Outside of the inundation area, regional growth would continue in the upper American River areas of western El Dorado and Placer Counties as anticipated under existing General Plans. Vegetation within the general plan areas would change significantly as existing open space would be converted to urban uses.

SELECTED PLAN

Direct Impacts

Under the selected plan, direct impacts would occur in Natomas as a result of raising portions of the existing levee system around the perimeter of Natomas and Arcade Creek, Dry Creek, and Pleasant Grove Creek Canal, constructing new levees along both banks of Dry Creek, installing a gated pump structure along the Natomas East Main Drainage Canal near its confluence with Dry Creek, constructing a flood detention basin and removing borrow material for levee construction. Chapter V in the Main Report and Appendix N both contain complete descriptions of the measures included in each alternative. One bridge replacement and several road rampings will be also needed along with a 150-foot wide 2 mile-long trapezoidal grass-lined channel in the upper reach of the NEMDC.

The selected plan would require no construction and result in no construction related impacts in the lower American River area. However, during large floods, the flood-control-only dam would reduce peak inflows into Folsom Reservoir and permit reservoir operators to sustain releases of 115,000 cfs into the lower river for a longer period of time. This could affect the geomorphology of the lower river. No change in duration of flood flows for events up to a 63-year are expected. For greater events, up to about 250-years, flows large enough to cause levee failure, significant erosion and major disturbance to the parkway environment would be reduced. However, there will be an increase in the objective release of 115,000 cfs for two to three days.

Direct impacts would occur in the upper American River area as a result of dam construction, replacing Highway 49, constructing a new Ponderosa Way Bridge, periodic inundation and transporting and processing of aggregate for dam construction. A description of these project features is contained in Chapter 2 (Project Description).

Construction of the flood-control dam would require approximately 5.1 million cubic yards of aggregate material. This material would be processed into concrete and used to construct the dam. The DEIS/EIR discussed removing the bulk of the aggregate from the Middle Fork American River Sand and Gravel deposits and acknowledged that further studies were needed before selecting a final aggregate source. An analysis of potential aggregate sources and impacts associated with each source is included in the Geotechnical Appendix M. Additionally, great public concern regarding the environmental impacts associated with extracting material from the Middle Fork deposits was expressed through comment letters and statements in the public participation process. In response to public sentiment and considering the results of the aggregate analysis which indicates that material from the Old Cool Quarry contains the types and quantities needed to construct the dam and is less environmentally damaging than other alternatives, the aggregate source has been shifted to the Old Cool Quarry.

Direct impacts would also result from periodic inundation behind the flood control dam. Two analyses were preformed to predict direct impacts of the selected plan and appear as appendices to this report.

In response to comments received on the DEIS/EIR, two additional studies to assist in predicting adverse affects associated with periodic inundation were undertaken. The first study involved the examination of flood control reservoirs in Southern California for the purpose of determining impacts of periodic inundation of chaparral vegetation (Cummings, 1991) and the second study evaluated of soil stability at the proposed dam site associated with the periodic flooding of the canyon (Appendix M). Methodologies used in both analyses to predict the affects of periodic inundation on vegetation and wildlife in the detention zone can be found in each respective analysis.

Fisheries.

Natomas. Construction activities associated with levee raising in the Natomas area would not impact fisheries. The work would be performed during low flow conditions, outside of the aquatic environment and no impacts to fisheries are expected.

The proposed pump station would be located approximately 1 mile upstream from Dry Creek on the NEMDC. This facility is needed due to the backup of water from the Sacramento and American Rivers into the NEMDC during flood events and is considered an alternative to extensive levee work along both sides of the NEMDC. The pump would have a capacity of 700 cfs, 2 sluices, and a plug to stop backflow up the canal. In normal flow conditions, water would flow down Pleasant Grove Creek Canal into the NEMDC and through the sluices to the Sacramento and American Rivers as is does now. During flood conditions, floodflows would be kept from reaching the upper portions of NEMDC. Behind the pump station, floods could cause the backup of flows from local drainages, the water would be pumped into the NEMDC.

As a result of the pumping, an increased volume of water would flow into the NEMDC during floods. Fish screens would be installed on the pump to prevent resident and migrating fishes from getting into the pump during operation. During extreme high flows, fish migration would be impeded; however, no long-term damage to the fishery is likely to occur.

Since no loss of fish habitat would occur from construction activities, and migratory fish movement would only be temporarily affected during very high flow situations, the selected plan would have no significant impacts to fish resources.

Lower American River. The selected plan does not include any features in the lower American River and no direct construction impacts would occur.

Upper American River. There would be no direct construction impacts to fisheries in the upper American River. The selected plan would periodically inundate approximately 17.5 miles of stream habitat in the Middle and North Fork American Rivers for short periods of time.

The fishery impacts from this temporary inundation are not expected to be significant over the without-project conditions. Periodic temporary inundation presently occurs without adverse effect during the winter months prior to spawning and incubation periods. The additional volume of water and length of inundation generated by dam operations would not alter this effect, although dam operations could cause additional sedimentation and sloughing during floods.

In the North Fork, little adverse affects are expected for the Lake Clementine fish resources (FWS 1991). Since the habitat and fish populations are of the reservoir type, inundation would have less adverse effect than on riverine habitat. For riverine areas upstream from the detention dam, adverse affects would stem from sloughing material making its way to the river and depositing sediment over spawning riffles. However, since the fishery habitat above the flood detention dam is only sparsely populated, the impact would be minimal. The area above Lake Clementine could be vulnerable to adverse sloughing impacts as there is bass and trout habitat there but that area is at the tip of the inundation zone and is only likely to be inundated under rare large flooding events.

Fish resources of the Middle Fork area are not likely to be adversely affected by inundation as storm events typically occur prior to spawning season. Fish resources in the Upper American River area were not considered to be of high value and the direct impacts of the selected plan are considered less than significant.

Vegetation.

Natomas. Construction of project features in Natomas would directly affect 290 acres. Seventeen acres of wetland habitat would be lost mostly along the alignment of the 2-mile drainage canal. A total of 272 acres of upland habitat would be disrupted due to equipment movement and the creation of temporary roadways needed during levee construction. The equipment would cause disruption of habitat by excessive noise, dust, loss of vegetation, and human interference. This, in turn, would result in displacement of wildlife which have made the construction sites and surrounding areas their home. Wetland losses are considered significant. Construction related impacts on upland habitats are not considered significant as they would generally be temporary in nature and would not diminish a substantial portion of the 47,742 acres of upland habitat available in the Natomas area. However, these impacts when combined with projected indirect impacts would be cumulatively significant.

Lower American River. The selected plan does not include any construction in the lower American River area and therefore, no direct construction impacts would occur.

Upper American River. Construction related vegetation losses include those associated with the replacement of Highway 49 and Ponderosa Way bridge, dam construction and aggregate transportation and processing. Direct impacts also include affects of periodic inundation on the resources behind the detention dam.

Construction associated with the Ponderosa Way replacement includes cutting into the side of the hill and filling to the downslope side of the roadway. No borrow or spoil areas will be required. The replacement of Hwy 49 would result in adverse affects due to clearing for staging areas, permanent roadway and bridge abutment areas, areas under the bridge which have less than 50 feet of clearance, construction access roads and the construction of the piers. No borrow or spoil areas are required.

Construction at the dam site includes clearing of the dam site footprint for construction, excavation for dam foundation and abutments, placement of the foundation, and concrete placement for dam construction. The excess spoil material from excavation will be placed in two areas: the existing foundation keyways and the Salt Creek boat ramp area. No impacts to existing vegetation are expected from this spoil disposal as the margins of the boat ramp are sparsely vegetated in non-native grasses and ruderal forbs. A thin stringer of riparian shrub-scrub comprising less than 1/4 of an acre has invaded the cracks in the concrete along the west keyway. The loss of this minimal acreage of riparian shrub-scrub and non-native grassland/ruderal land would not constitute a significant impact.

No loss of vegetation would occur as a result of quarry operations because it is an existing operation in a disturbed area. Adverse affects would result from construction of access roads and conveyer lines. Quarried material would be transported from the quarry to the processing plant, to the south on the bluffs above the river. A conveyer system would be used to transport processed material to the dam site. The processed aggregate would likely continue to the production plants by conveyer.

In summary, construction related impacts are estimated to total 227 acres and include the loss of 3.9 acres due to replacing the Ponderosa Way Bridge, 26.9 acres due to replacing Hwy 49, 177.2 acres due to dam construction, and 19 acres due to transport and processing of the aggregate. The loss of 227 acres in the upper American River area would not substantially diminish habitat for species inhabiting the canyon areas. Therefore, this loss was not considered a significant impact. However, in combination with the projected losses due dam operations, construction impacts were considered cumulatively significant.

The detention dam, by design, detains water only in connection with high flows in the North and Middle Forks of the river. Inundation periods would be longest immediately behind the dam and would be significantly shorter as the inundation extends up the canyon. The prediction of future storms and flood frequency is a complex process and often uncertain. Historical flow frequency and magnitude of storms, and hypothetical and artificial storms based upon computed and measured data are integrated to estimate future conditions. The methodologies used for estimating the frequency of various floods are contained in Chapter III of the Main Report.

Table 7-12 illustrates the function of the flood detention dam and display the elevation, probability, and duration of inundation that would occur during a flood. Information in these tables was derived from a flood risk table and a frequency duration curve. The flood risk table is a statistical tool that shows the probability of occurrence of two significant flood events, (100-year and 200-year) at numerous points in time.

TABLE 7-12. Elevation, Probability and Duration of Inundation for the Selected Plan.

	200-yr. event	100-yr. event
Maximum elevation (ft) of inundation.	869	847
Probability of occurrence of flood event.		
In any given year.	0.5%	1%
In the 100 yr. project life.	40%	64%
Duration of inundation by elevation bands at the dam site, streambed at elevation 500'.[1]		
490 - 530	20 days	18 days
530 - 580	12 days	10 days
580 - 640	10 days	8 days
640 - 720	8 days	6 days
720 - 880	6 days[2]	2 days[3]
880 - 920	--------	--------
920 - 950	--------	--------

[1] Duration times reflect those for the average elevation of the band.

[2] The maximum surface elevation for the 200-year event is 869. Duration represents average duration of elevation 720-869. Duration at maximum water surface elevation (869) is 12 hours.

[3] The maximum surface elevation for the 100 year event is 847. Duration represents average duration of elevation 720-847. Duration at maximum water surface elevation (847) is less than 12 hours.

The impact analyses prepared by the FWS (Appendix R) and the Corps and State analysis (Appendix Q) are considered below. Both analyses support the estimate of direct construction impacts discussed above. However, results of the inundation impact studies differ. Table 7-13 compares the FWS and Corp/State analyses and Table 7-14 shows the losses by cover type.

Table 7-13 Comparison of Direct Impacts for the Selected Plan (in acres).

	Construction Impacts	Inundation and sloughing impacts	Total Impacts
FWS	227	1,155	1,382
Corps/State	227	1,700	1,927

Table 7-14 Comparison of Inundation and Slope Stability Impacts for the Selected Plan by Cover Type (in acres).

Cover Type	FWS Analysis	Corps/State
Grassland	234	23
Rocky/Ruderal	-	46
South Slope Oak Woodland	305	550
North Slope Oak Woodland	326	551
Chaparral	41	163
Conifer Forest	36	90
Montane Riverine	447	277
TOTAL	1,155	1,700

Both analyses based the estimated loss of vegetation attributable to periodic inundation on the following considerations; (1) reported physiological impacts (lack of oxygen, chemical changes in the soil), (2) physical impacts (toppling, land slides, erosion), (3) published inundation tolerance data on a number of species occupying the various vegetation communities, (4) the frequency and duration of expected inundation during the period of analysis, (5) seasonality of flooding (dormant season vs. growing season flooding), (6) age and vigor of individual plants, and (7) field examinations of sites with similar vegetative cover that have experienced periodic flooding in the past. For a complete description of the methodologies used in each analysis, please see Appendix S and Appendix Q.

Table 7-15 presents available published data on flood tolerances of woody plants (Chapman et al., 1982 and Walters, 1980). The tolerance categories in Table 7-15 range from very tolerant (trees which can withstand flooding for periods of two or more growing seasons) to intolerant (species which cannot withstand flooding 1 month or less during their growing season). Based on hydrologic projections, flooding is not likely to exceed 20 days during the period of analysis, which is well within the growing season tolerance ranges for all but the most intolerant species.

Flooding, however, is not likely to occur during the growing season for most of the vegetation in the canyon. During winter, most plants are dormant or undergoing reduced physiological activity and are less prone to flooding impacts than plants actively growing. However, certain chaparral species actively grow during the winter period, albeit at reduced levels.

TABLE 7-15. Growing Season Flood Tolerances of Typical Species Found in the Upper American River Study Area [1]

SPECIES	TOLERANCE RATING[2]	FLOOD TOLERANCE (Days of Inundation)
Oak Woodlands		
California buckeye (Aesculus californica)	IT	30-90
Pacific madrone (Arbutus menziesii)	IT	30-90
Manzanita (Arctostaphylos sp.)[3,4]	IT	30-90
Saltbush (Atriplex sp.)	T-IT	30-90+
Ceanothus (Ceanothus spp.)[5]		ND[6]
Redbud (Cercis occidentalis)[7]	IT	30-90
California hazelnut (Corylus rostrata)[8]		ND
Shrub tan-oak (Lithocarpus densilora)[9]		ND
Ponderosa pine (Pinus ponderosa)[10]	IT	30-90
Digger pine (P. sabiniana)[11]		ND
Douglas fir (Pseudotsuga menziesii)	IT	30-90
Canyon live oak (Quercus chrysolepis)[12]		ND[3]
Black oak (Q. kelloggii)	T	>90
Valley oak (Q. lobata)[13]	IT	30-90
Interior live oak (Q. wislizenii)	IT	30-90
Coffeeberry (Rhamnus sp.)[3,14]	IT	30-90
Poison oak (Rhus diversiloba)[15]		ND
California bay (Umbellularia californica)[16]	IT	30-90
Conifer Forest		
Ponderosa pine (P. ponderosa)	IT	30-90
Digger pine (Pinus sabiniana)		ND
Douglas fir (Pseudotsuga menziesii)	IT	30-90

TABLE 7-15. Growing Season Flood Tolerances of Typical Species Found in the Upper American River Study Area (Continued)[1]

SPECIES	TOLERANCE RATING[2]	FLOOD TOLERANCE (Days of Inundation)
Chaparral		
Chamise (Adenostoma fasciculatum)		ND
Manzanita (Arctostaphylos sp.)	IT	30-90
Ceanothus (Ceanothus sp.)[21]		ND
Western mountain-mahogany (Cercocarpis betuloides)[22]		ND
Flannel bush (Fremontodendron californica)[23]		ND
Toyon (Heteromeles arbutifolia)[24]		ND
Canyon live oak shrubs (Quercus chrysolepis)		ND
Blue oak shrubs (Q. douglasii)	T	>90
Interior live oak shrubs (Q. wislizenii)	IT	30-90
Snowberry (Symphoricarpos sp.)	IT	30-90
Riverine/Riparian		
White alder (Alnus rhombifolia)	T	>90
Western serviceberry (Amelanchier alnifolia)	IT	30-90
Mulefat (Baccharis viminea)	T	>90
Red-osier dogwood (Cornus stolonifera)	IT	30-90
Mountain dogwood (C. nuttalli)	T	>90
Oregon ash (Fraxinus latifolia)	T	>90
Black walnut (Juglans hindsii)	T	>90
Western sycamore (Platanus racemosa)	IT	30-90
Fremont cottonwood (Populus fremontii)	IT	30-90
Gooseberry (Ribes sp.)	T	>90
Elderberry (Sambucus sp.)	IT	30-90
Wild grape (Vitis californica)[25]		ND

[1]Sources: Chapman et al. (1982), Walters et al. (1980)

[2]Tolerance Ratings: VT = Very Tolerant; T = Tolerant; IT = Intermediately Tolerant; I = Intolerant.

[3]Flood tolerances for manzanita and coffeeberry were based on congenerics, Arctostaphylos nevadensis and Rhamnus betulaefolia, respectively, and may not accurately reflect the tolerances of the species found at the site.

TABLE 7-15. Growing Season Flood Tolerances of Typical Species Found in the Upper American River Study Area

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[4]Arctostaphylos spp. At least two species commonly flooded at Keswick-Redding site. Several species in the American River Canyon show no adverse effects of previous flooding events.

[5]Ceanothus spp. At least two species survive regular flooding at the Keswick-Redding site with no adverse effects. At least two species survive in excellent condition on the American River below 600 feet. No signs of damage or dieback.

[6]ND = No Data

[7]Cercis occidentalis. Flooded at Keswick-Redding site.

[8]Corylus rostrata. Should read Corylus cornuta var. californicus. (Syn.: C. rostrata). Occurs in damp places (Munz). Therefore, it is probably dormant season flood tolerant.

[9]Lithocarpus densiflora. Probably rare. In cultivation it thrives with irrigation and is not water intolerant as are many chaparral species.

[10]Pinus ponderosa. Same comments as for P. sabiniana (Table 3).

[11]Pinus sabiniana. Occasional below 600 feet, common below 900 feet. Shows no evidence of flood damage (Table 3).

[12]Quercus chrysolepis. Common in the American River Canyon even down almost to water's edge. It has withstood dormant season flooding with no apparent ill effect. See Table 3.

[13]Q. lobata. Common in riparian forests. Large stand at Caswell State Park is regularly flooded.

[14]Rhamnus californica var. tomentella. Same comments as for Q. chrysolepis.

[15]Rhus diversiloba. Common at other locations in California that are subject to dormant flooding. Occasional in the American River Canyon below 650 feet and shows no detrimental effects of flooding.

[16]Umbellularia californica. Common in riparian woodlands in some areas. See Table 3.

[17]Abies concolor. Not found, or rare, below 3,000 feet.

[18]Calocedrus decurrens. Not found, or rare, below 2,400 feet.

[19]Pinus Attenuata. Rare. Not seen during field surveys.

[20]Pinus lambertiana. Not found, or rare, below 2,500 feet.

[21]Ceanothus. See note 4.

[22]Cercocarpus betuloides. Rare in the American River Canyon below 600 feet but no evidence of damage from previous flood events were noted.

[23]Fremontodendron californica. Not seen on field trips. Rare, or not found below 2,000 feet (Munz).

[24]Heteromeles arbutifolia. Common and thriving from 500 feet and higher in the American River Canyon.

[25]Vitis californica. Common California riparian forest species (Munz). Vigorous and thriving down to river's edge in the American River Canyon.

The main differences in the two impact analyses stem from the methodologies used to predict slope stability losses and assumptions regarding the effects of periodic inundation on riparian/wetland habitats. The Corps/State analysis considered slope stability losses based on an evaluation of the effects of temporary inundation on the soils present in the inundation zone. (See Geotechnical Appendix M.) FWS analyzed slope stability based on information from the coffer dam break and aerial photos. Additionally, the Corps/State assumed that montane riverine and grassland vegetation types, would not experience significant mortality resulting from periodic inundation. Riparian vegetation is adapted both physiologically and physically to very prolonged flooding and any grassland vegetation adversely affected by flooding is assumed to recover within the next growing season due to the annual growth strategies of the predominant species in the area (McClelland 1991). The FWS included riparian vegetation along with the other cover types in their assessment of habitat loss due to inundation.

The results of the two impact analyses represent a range of possible adverse affects associated with periodic inundation of the flood control dam. Under both approaches, periodic inundation would substantially diminish habitat for species inhabiting the area and therefore, would be considered a significant adverse impact.

Wildlife.

Natomas. Construction in Natomas would last approximately 2 years. Construction activities during this time would result in displacement of wildlife using the construction zone. These impacts would be temporary. Displaced wildlife species would reoccupy their habitats when construction activities cease and levee slopes are revegetated with grasses.

Lower American River. The selected plan contains no construction in the lower American River, and, therefore, no impacts would occur.

Upper American River. Vegetative cover and wildlife habitat losses would occur from the direct impacts mentioned above. Habitat losses were quantitatively analyzed by the FWS using the HEP procedures. The State of California provided an impact assessment of the flood control dam on wildlife species inhabiting the canyon, which is provided in Appendix Q. Adverse affects to wildlife are discussed in qualitative manner due to the lack of specific information pertaining to population levels, recruitment rates, etc., of principal wildlife species inhabiting the canyon.

Wildlife would be lost or adversely impacted through a variety of mechanisms including drowning, increased predation while stranded, intra-specific aggression in foreign territory, relocation to less-than-optimal cover, and/or permanent displacement. In a review of pertinent literature, no specific studies on the effects of a flood control dam on wildlife species could be found. Numerous studies were reviewed concerning river flood plain inundation and flood pool inundation at reservoirs. For the purposes of this study, it was assumed that these impacts would be similar to those expected with a flood control dam.

The effects of flooding on wildlife will vary depending primarily on the ability of the affected species to escape to areas that are high and dry. This mobility will depend on the species activity pattern. Animals which are hibernating or otherwise in a reduced activity state will be less mobile. Similarly, animals which are breeding or have immobile young will be less able to stay ahead of the flood.

Large mammals, most birds, and some small mammals would escape the rising floodwaters and occupy adjacent habitats. However, based on the information derived from the literature, it is likely that significant losses of the smaller, less mobile species would occur during periodic inundation. Because of the adjacency of similar habitats and the reproductive rates of the impacted species, recovery will occur over relatively short periods. It is likely that net population levels of the most vulnerable species will be lower than occur presently. Unless more tolerant species replace the net loss, secondary predators will also be impacted by the reduction of prey base. Some of the inundation areas would remain habitable for many species. These are considered significant adverse impacts.

A list of the wildlife species most susceptible to flooding is presented in Table 7-16. This list includes species common to the region which may or may not occupy the area during the flood season.

Table 7-16. Typical Species of the Upper American River Canyons Susceptible to Periodic Inundation

Common Name	Habitat Use	Breeding Period
Western Fence Lizard	Breeding, Foraging	March-June
Western Skink	Breeding, Foraging	March-July
Gilbert's Skink	Breeding, Foraging	June-Aug
Western Whiptail	Breeding, Foraging	May-Aug
Southern Alligator Lizard	Breeding, Foraging	June
Ringneck Snake	Breeding, Foraging	April-July
Sharp-tailed Snake	Breeding, Foraging	June-Aug
Racer	Breeding, Foraging	July-Aug
California Whipsnake	Breeding, Foraging	April-May
Gopher Snake	Breeding, Foraging	March-May
Common Kingsnake	Breeding, Foraging	Aug-Sept
Common Garter Snake	Breeding, Foraging	July-Aug
Western Terrestrial Garter Snake	Breeding, Foraging	July-Aug
Western Aquatic Garter Snake	Breeding, Foraging	July-Aug
Night Snake	Breeding, Foraging	Aug-Sept
Western Rattlesnake	Breeding, Foraging	Aug-Oct
Killdeer	Breeding, Foraging	Feb-Aug
Bewick's Wren	Breeding, Foraging	Feb-Aug
Dark-eyed Junco	Breeding, Foraging	March-Aug
Virginia Opossum	Breeding, Foraging	Jan-Mar
Ornate Shrew	Breeding, Foraging	Mar-Apr
Vagrant Shrew	Breeding, Foraging	Mar-May
Broad-footed Mole	Breeding, Foraging	Feb-May
Brush Rabbit	Breeding, Foraging	Feb-Jul
Desert Cottontail	Breeding, Foraging	Jan-Jul
Black-tailed Hare	Breeding, Foraging	All year
Long-eared Chipmunk	Breeding, Foraging	May-Aug
California Ground Squirrel	Breeding, Foraging	May-Jul
California Pocket Mouse	Breeding, Foraging	Apr-Jul
California Kangaroo Rat	Breeding, Foraging	Feb-Sep
Deer Mouse	Breeding, Foraging	All year
Brush Mouse	Breeding, Foraging	Mar-Nov
Pinyon Mouse	Breeding, Foraging	May-Sept
California Vole	Breeding, Foraing	All year
Long-tailed Vole	Breeding, Foraging	Apr-Oct
Dusky-footed Woodrat	Breeding, Foraging	Dec-Sept

Indirect Impacts

Implementation of the project would allow growth to occur in areas of the floodplain where high base flood elevations would otherwise make urban development infeasible. The indirect impact analysis for the project was based on the assumption that the project would enable the local agencies controlling land use in the Natomas basin (City and County of Sacramento and Sutter County) to complete development of the basin pursuant to their approved General Plans. FWS conducted an analysis based on the assumption that the project would facilitate considerably more growth than allowed under current plans (maximum growth scenario). Both of these future land use scenarios are described in Chapter 4. Under the adopted general plan scenario, it is estimated that 7,913 acres would be affected by future development. FWS estimates that the project would result in the conversion of approximately 22,491 acres to urban uses.

In the lower American River area, the selected plan would enable the city and county to complete development in accordance with the existing city and county general plans between 1992 and 2010 (Chapter 4).

Implementation of the selected plan would require replacement of Highway 49 (see direct impact discussion). This replacement would not measurably shorten the time required to commute from western El Dorado County to job centers along the I-80 corridor in Placer County. Therefore, there would be no indirect impacts associated with the selected plan since the realignment would not result in growth inducement to the area. However, relocation of the highway is a State responsibility and would likely require a route adoption study and approval of the California Transportation Commission. Indirect impacts associated with any future route other than the one selected by the Corps would be analyzed in the environmental documents prepared in connection with the State relocation process (see Chapter 17).

Fisheries.

Natomas. Under with-project conditions, resident fish populations would continue to decline at an accelerated rate above that expected under without-project conditions. Agricultural waterways, major canals and open drainages would be lost to development and resident fisheries would be adversely impacted (FWS, 1991).

Operation of the North Natomas drainage system could periodically result in copper and lead concentrations in the canal system that would exceed EPA criteria for freshwater aquatic life. Concentrations of these metals would fluctuate seasonally, causing mortality in sensitive resident species. These pollutants could also adversely affect the fish resources in Fisherman's Lake. Additionally, pump station discharges containing elevated copper and lead levels during fall storm events could coincide with upstream mitigation or several anadromous fish species in the Sacramento River. These impacts would substantially degrade available habitat for resident fish population in Natomas and therefore, would constitute a significant adverse impact.

Lower American River. Under the adopted general plan scenario, the project would facilitate growth in the area south of Meadowview Road (approximately 1400 acres). This is not expected to have a significant affect on fishery resources.

Upper American River. No indirect impacts are expected to occur in the upper American River area with the selected plan.

Vegetation and Wildlife.

Natomas. Under the adopted general plan scenario 7,913 acres will be adversely affected by future development. This loss includes 248 acres of wetland habitat and 7,665 acres of upland habitat. The maximum growth scenario used by the FWS showed that development would result in converting 22,491 acres of agricultural, vacant, and wild lands to urban uses. This loss includes 770 acres of wetland habitat and 21,721 acres of upland habitat. These conversions would destroy or disturb existing habitat for a variety of wildlife species which occupy or use the Natomas basin on a seasonal or year-round basis. Among the significant habitat losses from urbanization, are the wetland habitats.

Wetland habitat losses would be likely from conversion of the existing agricultural drainage system to urban uses, and expansion of this system to adequately handle urban drainage. This could destroy valuable riparian and wetland habitat and degrade fisheries and other aquatic resources which are dependent on the existing system. Wooded riparian areas and emergent wetlands in the Natomas area occur almost exclusively along existing agricultural drainage canals along with the majority of the wetlands under Section 404 jurisdiction. The indirect impacts of the project on these areas would largely depend on the drainage plan adopted for Natomas by the City. The recommended drainage plan for North Natomas would enlarge the East and West Drainage canals, build several new canals, and replace existing smaller canals with storm drains. The NEMDC and its associated riparian and wetland vegetation would not be directly affected by this plan, although it could potentially be affected by increased development.

There would be many riparian and wetland areas which would be affected by the proposed drainage plan. The largest and most important of these areas is Fisherman's Lake, a 2.1 mile-long widened segment of the West Drainage Canal. The mature riparian forest and marsh associated with this area provides potential nest-sites for Swainson's hawks and other raptors, communal roosts for black-shouldered kites and black-crowned night-herons, and high quality habitat for a great diversity of bird, animal species including the giant garter snake.

Additionally, approximately 2,185 acres of rice fields and 1,813 acres of grain fields would be converted under the adopted plan scenario. These habitats provide important forage for wintering and migrating waterfowl using the Pacific Flyway. In addition, some rice fields are inundated over the winter to provide nesting habitat for these species. Approximately 90 percent of the wetlands along the Flyway have been lost and the remaining areas are diminishing rapidly.

The wildlife value of all agricultural lands including rice is greatly enhanced by their close proximity to riparian habitats located along the waterways in the Natomas area. These habitats are used for nesting and resting in conjunction with foraging in the agricultural fields. The overall habitat value of this wildlife complex is correspondingly diminished by the loss or degradation of one habitat or the other. Due to the high value of the Natomas habitats, their relative scarcity, and their importance as a corridor for migratory and resident waterfowl, the loss of 7,913 acres is considered a significant impact.

Lower American River. The selected plan would allow approximately 1,400 acres of grassland to be developed in the area south of Meadowview Road. This area is surrounded by urban development but still provides moderate habitat value to wildlife species. Loss of this habitat would be a significant impact.

Upper American River. No indirect impacts to vegetation or wildlife resources would be expected with the selected plan.

400-YEAR ALTERNATIVE

Direct Impacts

Natomas and Lower American River. The direct impacts associated with the 400-year alternative for Natomas would be substantially the same as those described for the selected plan. There would be no direct construction impacts in the Lower American River.

Upper American River. The dam design for the 400-year facility allows detention waters to be released at a slower rate that the 200-year design. This lower drawdown rate would minimize slope stability problems in the detention area (Appendix M).

Fisheries. The direct construction impacts for the 400-year alternative would be the same as those described for the selected plan.

Vegetation. The direct construction impacts from Hwy 49 and Ponderosa Way replacements, dam construction and aggregate transportation and processing for the 400-year detention dam total 254 acres. These impacts are slightly greater than those for the selected plan because the dam footprint is larger with this alternative. These direct impacts remained constant with both analyses.

Table 7-17 shows the estimated probability of inundation for several events associated with the 400-year alternative. Under this alternative, approximately 700 acres of habitat would be lost due to the physiological effects of periodic inundation.

FWS estimated total impacts due to inundation and sloughing to be 2,106 acres.

Wildlife. Construction impacts for the 400-year alternative would displace wildlife using the area. The affects of periodic inundation on wildlife and their habitat would be similar to the affects of the selected plan. The potential inundation area is larger with this alternative. The same species listed in Table 7-17 will be susceptible to inundation with the 400-year alternative. Large mammals, most birds, and some small mammals would tend to escape the rising floodwaters and occupy adjacent habitats. However, there would be losses of small mammals, reptiles, and other species that could not readily move to adjacent habitats. Some of the inundation areas would remain habitable for many species. These affects represent diminished habitat for species occupying the area and would likely interfere with the movement of resident and migratory species and therefore, would indicate a significant adverse impact.

TABLE 7-17. Elevation, Probability and Duration of Inundation for the 400-year Alternative.

	400-yr. event	200-yr. event	100-yr. event
Maximum elevation (ft) of inundation	942	869	847
Probability of occurrence of flood event			
In any given year	0.25%	0.5%	1%
In the 100 yr. project life	20%	40%	64%
Duration of inundation by elevation bands at the dam site, streambed elevation at 500'. [1]			
490 - 530	>21 days	>21 days	>21 days
530 - 580	19 days	18 days	16 days
580 - 640	17 days	16 days	13 days
640 - 720	16 days	14 days	11 days
720 - 880	11 days	8 days[2]	6 days[3]
880 - 920	5 days	-------	---------
920 - 950	3 days	-------	---------

[1] Duration times reflect those for the average elevation of the band.

[2] The maximum surface elevation for the 200-year event is 869 feet. Duration represents average duration of elevation 720-869. Duration at maximum water surface elevation (869) is one day.

[3] The maximum surface elevation for the 100-year event is 847 feet Duration represents average duration of elevation 720-847. Duration at maximum water surface elevation (847) is one day.

Indirect Impacts.

Natomas, Lower American and Upper American River. Indirect impacts associated with the 400-year alternative would be the same as described for the selected plan.

150-YEAR ALTERNATIVE

Direct Impacts

The 150-year plan includes various measures in the Natomas and Lower American River areas which would result in direct impacts to fish, vegetation and wildlife resources. These measures include: raising 11.4 miles of levees, protecting 10 miles of bank and levee with riprap, and constructing 7.8 miles of subsurface drains along the landside of the levees. Additionally, 4.1 miles of slurry wall, 1 mile of new levee, raising of the right trestle of the Union Pacific Railroad at river mile 2.5, raising the right side of the H Street Bridge at river mile 6.4, replacing the Howe Avenue Bridge at river mile 7.8, replacing 2,400 feet of Parkway Road, 21,800 feet of Park Bike Trail, and 2,400 feet of fence. The Sacramento Bypass would have to be widened by 3,600 feet and extensive levee raising would occur on both sides of the Yolo Bypass, extending on the east side to Rio Vista.

In addition to the levee reinforcement work, this alternative would require increasing the flood control pool in Folsom Reservoir from 400,000 to 650,000 acre-feet; lowering the Folsom Dam spillway, and passing sustained flows of 180,000 cfs in the lower American River.

This redistribution of flood space in Folsom could produce significant changes for the resources of the lower American River. With this alternative, the timing of water releases from Folsom Reservoir down the Lower American River would change. Depending on the water year classification (wet or dry), flows and impacts differ. In general, there would be a decrease in mean flow peaks during early spring and summer flows would increase.

Natomas. The levee features of the 150-year alternative in Natomas are essentially the same as those described for the selected plan. For a complete description of the measures of the alternatives, see Chapter V of the Main Report and Appendix N. Therefore, the assessment of direct and indirect impacts in Natomas was assumed to be the same as the selected plan

Lower American River.

Fisheries. Increasing the flood control space at Folsom Reservoir, and thereby changing water fluctuations, would impact the warmwater fish spawning in the reservoir during April-June (FWS, 1991). Additionally, the existing thermocline patterns of the reservoir would be altered. This would eliminate the coldwater storage pool, reduce the shallow littoral zone habitat, which is the most productive area of a lake or reservoir, and increase predation on smaller fish which normally seek shelter in shallow water.

This loss of cold water and change in thermocline would essentially eliminate the cold water fishery of the reservoir (FWS, 1991). Land-locked salmon and rainbow trout will not survive the summer without cool deep, well-oxygenated water. Annual stocking of rainbow trout could be continued to provide recreational fishing; however, the present carryover of larger-size fish to the following winter and spring would not occur. This would in turn affect the angler-use of the reservoir. The average annual angler-use is expected to decrease to 92,500 days, a decline of 27,500 days (FWS, 1990).

The 150-year alternative is not expected to have an impact on the fishery resources at Lake Natoma, they are expected to remain as described in the no-action alternative.

Construction associated with levee raising would not likely impact the fish resources in the lower river as the levees are generally setback from the river itself. However, impacts are expected to fisheries from the bank stabilization work. The specific locations of bank stabilization work can be found in Chapter V of the Main Report and Appendix N. Riprapping would be conducted differently depending on existing bank characteristics. Riprapping would be accomplished by the following methods displayed in figure 7-2. They are channel-bank only, levee work only, channel-bank-and-levee and bridge abutment riprap.

The channel-bank-only and channel-bank and levee methods of riprap place material into the channel to the channel bottom. This would adversely affect the fishery resources in the lower American river due to increased sedimentation and turbidity. Conducting construction at non-spawning times of the year would minimize these impacts. Additionally, the placing of riprap material on the channel bank and berms would remove vegetation which provides valuable riverine aquatic habitat. Overhanging vegetation helps to lower instream temperatures and provides cover and a food source for aquatic species. Approximately 6 acres of shaded riverine vegetation would be lost with the bank protection planned for this alternative.

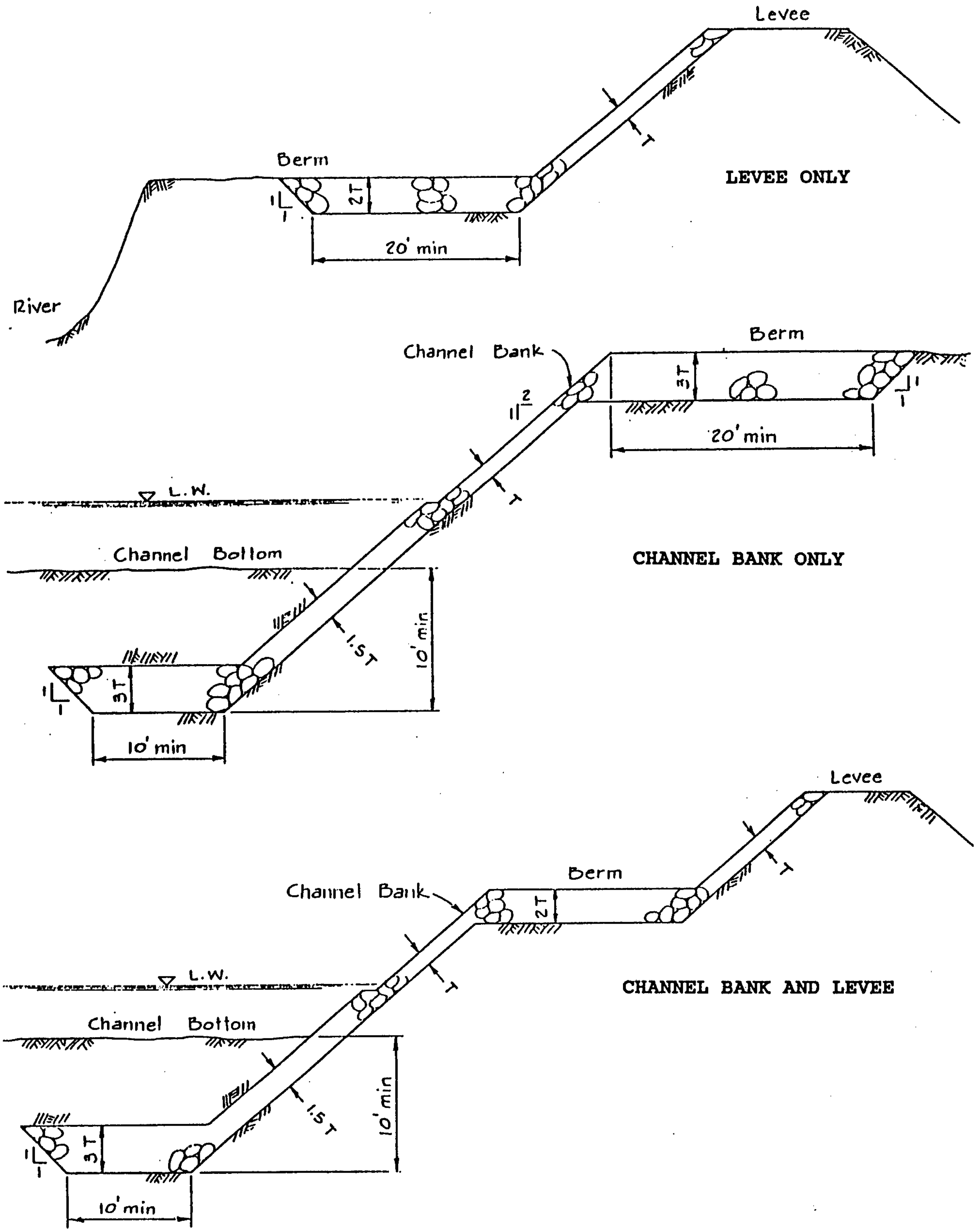


FIGURE 7-2. Lower American River Riprap Detail

The increase in flows (180,000 cfs) of the lower American river is not expected to adversely affect the fishery resources of the river (FWS 1991). Since storms that require downstream releases of 180,000 cfs are so rare, significant impacts over existing and without-project conditions are not expected. Some loss of spawning gravels would occur as higher flows are released down the river. However, Folsom Dam physically prevents the movement of river gravels and the increase in flows would add to the existing long-term losses of spawning gravels.

Significant adverse fishery impacts in the lower American river are expected from the reoperation of Folsom Reservoir. Increasing the flood storage pool would reduce fall chinook salmon spawning flows and usable spawning habitat in dry and critical water years, decreasing spawning success (FWS, 1990). This would crowd fish into the usable spawning areas, resulting in overcrowding, increased predation and increased stress on the available food sources.

Temperatures in the river would likely increase due to the increased flood control space in Folsom Reservoir. This increase would reduce the pool of cold water potentially available for fish rearing. Although temperature increases are not expected each year, increases in temperature in November would have a significant adverse impact on naturally spawning stocks, especially chinook salmon, over the existing and without-project conditions.

Spring water temperatures are expected to increase more often causing increased losses in emigrating salmon smolts over the without-project conditions. The American River chinook salmon must reach a minimum size of about 75 millimeters before mid-May to June if they are to successfully outmigrate (FWS, 1991). If they don't reach this size, they are forced to over-summer in the river. Under existing conditions, high temperatures exist in the lower river, and juveniles concentrate in the reach immediately below the Nimbus Dam. Survival is low due to overcrowding and predation. These less than ideal conditions are expected to be exacerbated under this alternative.

Chinook salmon numbers are expected to decline. FWS determined fishery impacts using a salmon habitat index model. This model was based upon a FWS Instream Flow Study in the lower river in 1981; information developed by Jones and Stokes Associates, Inc., for the USBR's 1988 draft environmental impact statement on the American River Service Area Water Contracting Program; information from the Environmental Defense Fund (EDF) et al vs. East Bay Municipal Utilities District (EBMUD) court reference (Leidy and Li, 1987); and other FWS field studies on the lower American River.

The model addresses flows and water temperatures for fall spawning conditions, juvenile winter and spring rearing conditions, and spring emigration of salmon smolts. It does not account for Delta or ocean rearing phases of the salmon life cycle. The model calculates an overall habitat index which is based on fall, winter and spring flows and water temperature criteria. The results reflect relative numbers and gross trends of salmon, not population numbers. The FWS does not believe there is adequate information available to develop criteria for a model that would accurately predict actual population numbers. The results of this study follow in Table 7-18.

The above comparison reveals a 21 percent change or loss of fish resources with the project over the without-project conditions. Additionally, the project would result in an average annual decline in ocean and freshwater sport fishing of 4,100 and 5,6000 angler days respectively.

The steelhead fishery would not be affected by the project because it is essentially dependent on hatchery production. The 8,000 to 10,000 fish that naturally spawn in the lower river apparently do not return as adults. The existing rearing habitat is not conducive to steelhead production. The hatchery production is expected to remain as it is today and the average annual angler-use will remain at approximately 27,700 days.

American shad, striped bass and other game species in the river would not be adversely affected by the project. Angler-use would remain at an average annual of 75,000 and 8,000 days. Additionally, the potential exists for anadromous fish losses in the Sacramento river system due to potential changes in water delivery schedules which may become necessary with this alternative.

TABLE 7-18. Lower American River Chinook Salmon Production, 150-Year Alternative
(Average annual production under the with- and without-project conditions of the 150-year alternative)

	Without-Project	With-Project	Change
Harvest (catch)	135,090	106,817	-28,273
Escapement (spawners)	42,750	33,803	-8,947
Production	177,840	140,620	-37,220
Ocean, Commercial	81,090	64,118	-16,972
Ocean, Sport Catch	43,200	34,159	-9,041
River Sport Catch	10,800	8,540	-2,260
Harvest (total)	135,090	106,817	-28,273

Note: This table assumes that baseline condition will be the same as those levels defined for the FWS Folsom Reservoir Reoperation without project analysis (FWS, 1990).

Due to impacts from bank stabilization, fluctuations of Folsom Reservoir and flow changes in the lower American River, it can be concluded that the 150-year alternative would result in significant adverse impacts on fishery resources by diminishing existing habitat and interfering with migratory movements.

Vegetation. The drawdown zone at Folsom Reservoir is unvegetated and therefore, no impacts would occur in this area from increasing the flood control pool. Lake Natoma would continue to fluctuate within existing ranges; therefore, no vegetation impacts are anticipated. However, direct impacts from levee raising and bank stabilization required with the 150-year alternative would result in a loss of 679 acres of riparian, marsh and scrub-shrub vegetation over without project conditions (FWS, 1991). Due to the close proximity of residential dwellings, levee work would be conducted from the waterside of the levees.

In addition to these construction impacts, the reoperation of Folsom Reservoir associated with this alternative would change the timing of water releases from the reservoir down the American River. The reduction in spring flows would limit scouring flows and inundation of the active zone (point bars) where early succession is occurring. The scouring flows are an important element in seed and sediment transport. Backwater areas along the river would also be affected by the lack of spring flows and the diversity of the riparian vegetation would be reduced by the altered streamflows and sediment regimes. Loss of vegetative diversity also adversely affects the wildlife species dependent on them. Prolonged water surface elevations resulting from increased summer flows could impact species in the border zones such as cottonwood, elderberry, various oak species, blackberry, sycamore, ash and boxelder. The result would be a general lowering of the habitat and woody species diversity and a subsequent loss of wildlife species.

Regeneration and maintenance of diverse riparian areas, like the American River Parkway, depend upon the timing of high and low flooding and sediment deposition. Higher flows in the spring provide water to banks and deposits sediments that provide regeneration sites for young growth riparian species. Without these processes, much of the area would slowly change from riparian forest, scrub-shrub and emergent marsh to oak-dominated woodlands. Over the project life, it is estimated that a conversion of 679 acres to upland vegetation would occur (FWS 1991). Due to the importance and scarcity of riparian type vegetation on a regional basis and the relatively high value of this habitat, the conversion of 679 acres of riparian/wetland vegetation to upland habitats is a significant adverse impact.

Wildlife. Wildlife inhabiting Folsom Reservoir would be adversely affected due to a larger drawdown zone. This would reduce aquatic vertebrate and invertebrate food sources, expose wildlife species to greater predation as they must travel a longer distance to reach food and water, and eliminate existing wildlife habitat for small mammals such as California quail, and others that will not travel long distances to food and water.

Bird species such as mergansers, grebes, terns and gulls would be impacted adversely by the reduction in the fish population. The large numbers of geese and ducks which annually winter on the open water at Folsom Reservoir would also be adversely affected by the reduced water levels. The backwater wetlands and sloughs in the upper arms of the reservoir are favored by these species and would likely be dewatered during the winter season. The wildlife at Lake Natoma would not be adversely affected by the project, conditions here would essentially be the same as under the without-project conditions.

Wildlife impacts resulting from a loss of 679 acres of riparian, marsh and scrub-shrub in the lower American River area would be significant. The parkway contains habitat of very high value to wildlife, considering what is remaining on a regional basis and any loss of this habitat would be significant.

Upper American River. There are no project features in the 150-year plan associated with the Upper American River, and therefore, no impacts would occur.

Indirect Impacts

Natomas and Lower American River. The 150-year alternative would provide the minimum FEMA level of flood protection to all areas of the American River floodplain including Natomas. Thus the indirect impacts associated with this alternative in the Natomas and lower American area would be the same as the selected plan.

Upper American River. The 150-year alternative would not result in any impacts in the upper American River.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Direct Impacts

Natomas. The primary flood control features of this alternative are levee and channel work along the lower American River and in the Natomas area. The plan components in Natomas are essentially the same as the selected plan and the impacts would be as described in that section.

Lower American River. Bank stabilization and levee modifications included in this alternative would allow 145,000 cfs to flow down the lower American River. The modifications needed to meet this objective release are described in Chapter V of the Main Report. The 100-year levee alternative would not reallocate any flood-control space at Folsom Reservoir or lower the spillway. Therefore, none of the impacts associated with reoperation would occur with this alternative.

Fisheries. Impacts to fisheries resources would stem from the bank stabilization work along the lower American River associated with this alternative. Fish resources at Folsom Reservoir and Lake Natoma are not expected to be adversely affected. Impacts due to the stabilization work were assumed to be the same as those described in the 150-year alternative.

Vegetation. Vegetation losses due to this alternative would result from the levee raising and bank stabilization work. A conversion of 462 acres from riparian forest, scrub-shrub and marsh type wetland habitats to upland habitats along the lower river would occur. The bank stabilization construction methods would be the same as discussed for the 150-year plan. Locations of the bank protection are described in Chapter V of the Main Report and Appendix N. Due the scarcity of these types of wetland habitats on a local and regional basis, the loss of 462 acres is considered a significant adverse impact. Vegetation around Folsom Reservoir and Lake Natoma is not expected to be affected.

Wildlife. Wildlife inhabiting the Folsom Reservoir and Lake Natoma areas are not expected to be adversely affected by this alternative. Wildlife impacts along the lower river would result from the loss of 462 acres of wetland habitat. These types of habitat are very valuable for wildlife and the loss of 462 acres would be considered significant.

Upper American River. The 100-year levee alternative has no plan components in the upper American River, and there would be no impacts in this area.

Indirect Impacts

Natomas and Lower American River. Indirect impacts will be as described in the selected plan.

Upper American River. The 100-year levee alternative does not affect the upper river area; therefore, there would be no indirect impacts.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Direct Impacts

Natomas. The Natomas plan components for the 100-year storage alternative are essentially the same as those for the selected plan and impacts were assumed to be the same.

Lower American River. The 100-year storage alternative would increase the flood control storage in Folsom Reservoir from 400,000 acre-feet to 590,000 acre-feet. No channel work would be required in the lower American River and the existing channel capacity of 115,000 cfs would be maintained. No modifications of the spillway at Folsom Dam would be required.

Fisheries. The impacts to the fishery resources of Folsom Reservoir would be similar to those described for the reoperation portion of the 150-year alternative. The magnitude of the impacts would be less with this alternative because the reservoir drawdown would less with a 590,000 acre-feet storage pool than with a 650,000 acre-feet storage pool. FWS determined that some cool water would be maintained in the reservoir which would reduce the adverse effects of cool water loss on salmonids described in the 150-year plan. This would allow some carryover of larger-size salmonids to the following winter and spring but at a reduced level. Additionally, FWS determined that under with-project conditions, average annual angler-use is expected to be 101,000 days, a decline of 19,000 days over the without-project conditions.

No levee construction or bank stabilization is proposed for this alternative, eliminating adverse fishery impacts from this type of construction activity in the lower river. However, increasing the flood control space from 400,000 acre-feet to 590,000 acre-feet would have an adverse affect on the lower American River fish resources. These impacts would be similar to those described for the 150-year alternative. The FWS determined impacts to the chinook salmon numbers using the same model as described in the 150-year plan discussion. Table 7-19 describes their results.

This comparison reveals a 19 percent change or loss of fish resources with the project over the without-project conditions. Additionally, the project would result in an average annual decline in ocean and freshwater sport fishing of 3,800 and 5,100 angler days, respectively. Due to the importance and high quality of the habitat in the lower American River for fish, these impacts represent a significant adverse impact.

During the Folsom Reoperation Study, the Corps analyzed fishery impacts from various temporary reoperation scenarios. The model used to determine these impacts was a hybrid of the FWS model, modified to some extent including information from other available models. A range of impacts was determined and was expressed as percent mortality. For 590,000 acre-foot temporary reoperation, a range of 4.3 to 31 percent mortality was estimated.

TABLE 7-19. Lower American River Chinook Salmon Production, 100-Year Storage Alternative
(Average annual production under with- and without-project conditions of the 100-year storage alternative)

	Without-Project	**With-Project**	**Change**
Harvest (catch)	135,090	110,021	-25,069
Escapement (spawners)	42,750	34,817	-7,933
Production	177,840	144,838	-33,002
Ocean Commercial	81,090	66,041	-15,049
Ocean Sport Catch	43,200	35,184	-8,016
River Sport Catch	10,800	8,796	-2,004
Harvest (total)	135,090	110,021	-25,069

Note: This assumes that baseline condition will be the same as those levels defined for the FWS Folsom Reservoir Reoperation without project analysis (FWS, 1990).

Vegetation. There is no levee and bank stabilization work included in the 100-year storage alternative; therefore, vegetation impacts would result from the reallocation of flood control space at Folsom. Vegetation at Folsom Reservoir and Lake Natoma would not be affected because the fluctuation zones are currently devoid of vegetation. In the lower river, the FWS estimated that 143 acres of wetland habitats would be lost due to flow changes over the life of the project. This loss would effect the vegetative communities along the river as described in the 150-year plan. This represents a potentially significant impact to the lower American River area.

Wildlife. The increased drawdown, an additional 24-feet from existing conditions, would adversely affect the wildlife resources at Folsom Reservoir. As described in the 150-year alternative, food sources would be reduced and travel to reach food would be increased. Conditions for wildlife at Lake Natoma would remain the same as the without-project conditions. Impacts to wildlife along the Parkway area would result from the conversion of 143 acres of wetland habitats to upland. Wetland habitats provide diversity of food sources and cover that often is not found in upland areas. This would result in a potentially significant impact to the area.

Upper American River. There are no project features in the 100-year storage plan associated with the Upper American River, and therefore, no impacts would occur.

Indirect Impacts

Natomas and Lower American River. Indirect impacts would be the same as described for the selected plan.

Upper American River. Plan components do not include any work in the Upper American River area; therefore, no impacts would be realized.

100-YEAR (FEMA) LEVEE, STORAGE, SPILLWAY ALTERNATIVE

Direct Impacts.

Natomas. Plan components in Natomas for this alternative are essentially the same as described for the selected plan and impacts were assumed to be the same.

Lower American River. Flood control storage space at Folsom Reservoir would be increased from 400,000 acre-feet to 470,000 acre-feet with the this alternative. The spillway at Folsom Reservoir would be lowered 15 feet and releases would increase to 130,000 cfs. Levee raising and bank stabilization are also a part of this alternative, the locations of work and methods of construction are discussed in Chapter V of the Main Report and Appendix N.

Fisheries. Fishery impacts associated with this alternative would be similar to the 150-year alternative. Impacts would occur due to bank stabilization work and changing the flow regime of the lower river. The magnitude of the fishery impacts resulting from reoperation of Folsom Reservoir would be less with a 470,000 acre-feet storage pool in the levee, storage, spillway alternative than with 650,000 acre-feet storage pool in the 150-year plan. However, fishery impacts associated with the bank stabilization would be similar to those described in the 150-year alternative. FWS estimated fish losses in connection with the reoperating of the reservoir and are summarized in table 7-20.

TABLE 7-20. Lower American River Chinook Salmon Production, 100-Year Levee, Storage and Spillway Alternative.
(Average annual production under the with- and without-project conditions of the levee, storage, spillway alternative)

	Without-Project	**With-Project**	**Change**
Harvest (catch)	135,090	111,089	-24,001
Escapement (spawners)	42,750	35,155	-7,595
Production	177,840	146,244	-31,596
Ocean, Commercial	81,090	66,682	-14,408
Ocean, Sport Catch	43,200	35,525	-7,675
River Sport Catch	10,800	8,882	-1,918
Harvest (total)	135,090	111,089	-24,001

Note: This table assumes that baseline condition will be the same as those levels defined for the FWS Folsom Reservoir Reoperation without project analysis (FWS, 1990).

This comparison reveals a 17 percent change or loss of fish resources with the project over the without-project conditions. Due to the importance and high quality of the habitat in the lower American River for fish, these impacts represent a potentially adverse impact.

Vegetation. Impacts to vegetation associated with this alternative would result from levee raising and stabilization and the change in flood control storage space at Folsom Reservoir. The impacts would be similar to those described for the 150-year alternative. The FWS determined that there would be a conversion of 454 acres of wetland habitat to upland. The bank stabilization construction methods would be the same as discussed for the 150-year plan. Locations of the bank protection are described in Chapter V of the Main Report and Appendix N. Due the scarcity of these types of wetland habitats on a local and regional basis, the loss of 454 acres is considered a significant adverse impact. Vegetation around Folsom Reservoir and Lake Natoma is not expected to be affected.

Wildlife. The increased drawdown at Folsom Reservoir, levee raising and stabilization work will result in a loss of 454 acres habitat that would adversely affect the wildlife species inhabiting the lower American River area. This alternative would affect wildlife similar to the discussion of the 150-year plan. The loss would be significant for the Parkway area.

Upper American River. There are no project features in the 100-year levee, storage, spillway plan associated with the Upper American River, and therefore, no impacts would occur.

Indirect Impacts

Natomas and Lower American River. Indirect impacts would be the same as those described for the selected plan.

Upper American River. Plan components do not include any work in the Upper American River area; therefore, no impacts would be realized.

MITIGATION

MITIGATION, SELECTED PLAN

Mitigation for the various alternatives including the selected plan, was developed based on recommendations from the FWS as set forth in the Final Coordination Act Report, November 1991, analysis provided by the State/Corps, independent judgement and an Incremental Mitigation Analysis (Appendix R). Under the Fish and Wildlife Coordination Act, FWS is authorized to conduct surveys and investigations "for the purpose of determining the possible damage to wildlife resources and for the purpose of determining means and measures that should be adopted [by the Corps] to prevent the loss of or damage to such wildlife resources." The reports and recommendations of the FWS must be made an integral part of any (Corps) report that seeks congressional or other Federal authority to construct a project.

FWS Mitigation Methodologies

FWS mitigation recommendations are based on the mitigation policy of the agency (Federal Register 46:15, January 23, 1981) which provides guidance for establishing appropriate compensation for projects. Under this policy, fish and wildlife habitat is divided into four resource categories to assure that recommended compensation is consistent with fish and wildlife values involved. The resource categories cover a range of habitats from those considered to be unique and irreplaceable to those believed to be of relatively low value to fish and wildlife. This policy does not apply to federally listed endangered or threatened species.

The four resource categories are:

- Resource Category 1 -This designation is reserved for one-of-a-kind areas of high value to evaluation species and that are unique and irreplaceable on a national or ecoregion basis. These areas cannot be replaced or mitigated for on an in-kind basis based on present-day scientific and engineering skills.

- Resource Category 2 - This designation is reserved for areas of high value to evaluation species and that are relatively scarce or becoming scarce on a national or ecoregion basis. These areas can only be mitigated or replaced with in-kind habitat.

- Resource Category 3 - This designation is reserved for habitat types of high to medium value for evaluation species and that are relatively abundant on a national basis. The mitigation goal for this habitat is no net loss of habitat value while minimizing loss of in-kind habitat value and if necessary, out-of kind replacement would be allowed.

- Resource Category 4 - This designation is reserved for habitat types of medium to low value for evaluation species. Generally, losses of these habitats will not have a significant adverse effect on important fish and wildlife resources. However, depending on the significance of a potential loss, the Service may make a recommendation for compensation.

During the impact assessment process, FWS identified specific habitat types that may be impacted by the project and evaluation species were chosen to represent those habitats in the HEP process and to represent the resource category designation of the specific habitat. The resource category assigned to each habitat plays a large role in the HEP for determining appropriate mitigation for project induced losses. The FWS Final Coordination Act Report, (Appendix S) details the evaluation species selected for each habitat. The following affected habitats in the Natomas area were designated resource category 3; aquatic habitat, upland (agriculture) habitat including rice and grain fields. Riparian and wetland habitats were designated resource category 2.

Mitigation in the HEP analysis is determined differently depending on the resource category in which the habitat was placed. For example, mitigation for resource category 2, in which the in-kind mitigation goal is to precisely off-set the habitat unit loss for each evaluation species, is determined by using the compensation acreage for the species with the largest mitigation requirement. This allows the compensation requirements of all of the other evaluation elements to be met. The mitigation goal of resource category 3 is to precisely offset the habitat units lost through a gain of an equal number of habitat units. Therefore, mitigation is determined from the averaging of the habitat units lost for all species. This is called equal compensation and allows for trade-offs, the losses of one species can be offset by gains provided to one or more other species. Because of the values associated with the habitats and the mitigation requirements connected with resource category 2, compensation acreages are generally greater than those with resource categories 3 or 4.

FWS Mitigation Recommendations, Natomas

The following mitigation measures are recommended by the FWS for the selected plan in the Natomas area. These measures are more fully discussed in the Final Coordination Act Report.

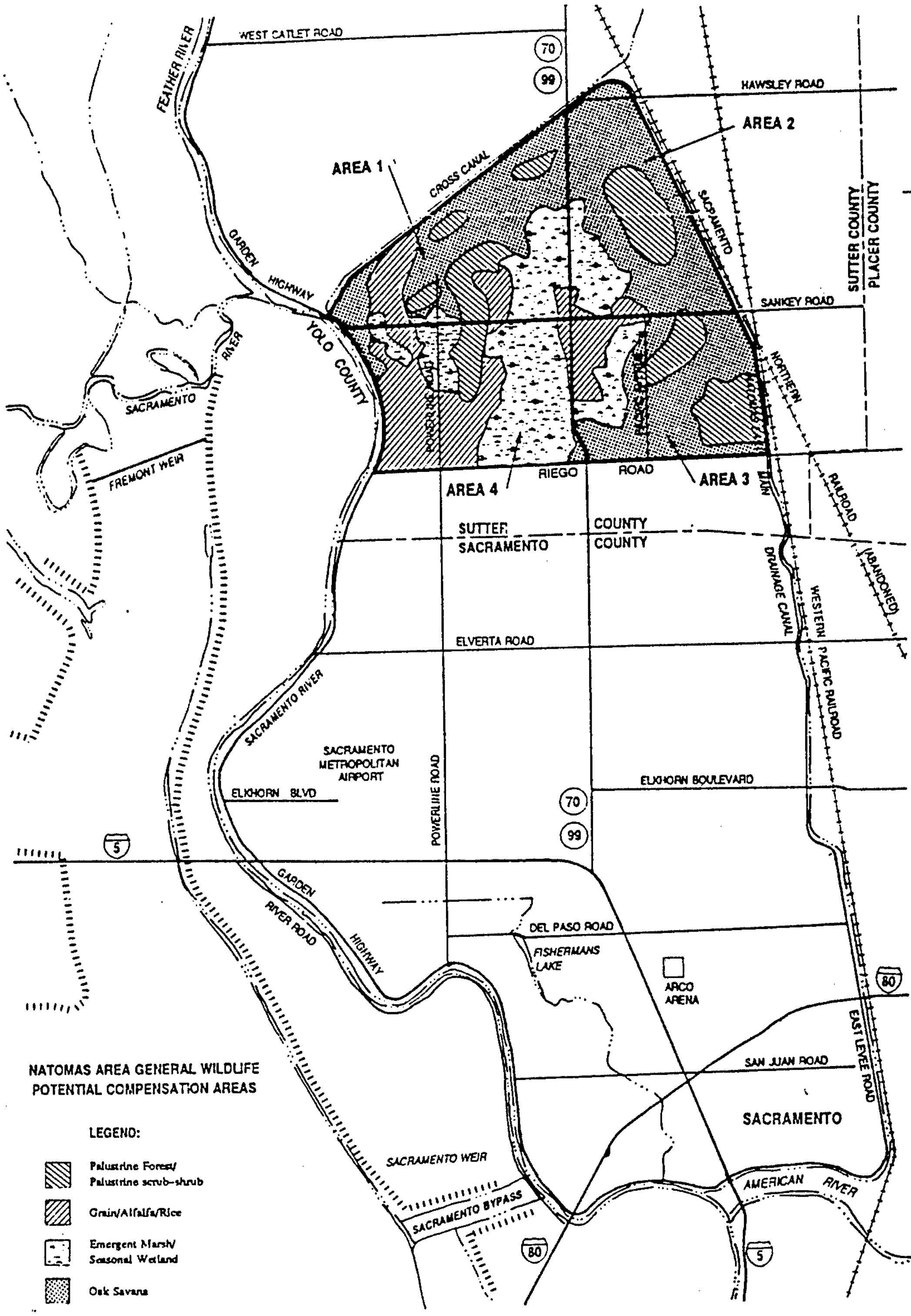
1. Mitigation for construction and operation impacts of the pump station on fish resources in the NEMDC, FWS would require construction activity in the channel to be limited to June 1 through August 31, and installation of fish screens on the pump. These measures should be coordinated with the FWS and DFG.

2. To mitigate for the loss of 787 acres of wetlands and 21,930 acres of upland habitat due to direct and indirect affects of the project, FWS recommends acquiring in fee title, 17,650 acres in the Natomas area for management as a wetland/upland complex (see Figure 7-3 for location). The mitigation area is located on a hypothetical site in the northern area of Natomas and was selected because of its strategic location for wildlife. However, this area was chosen to act as a guide for what a mitigation site would look like wherever it is located. FWS mitigation is proposed in areas 1 and 4 of the location map. This recommendation includes planting and, watering of riparian and upland plantings for a minimum of 6 years, and monitoring for at least 20 years beyond the initial establishment period.

3. Another mitigation option presented by the FWS is an impact avoidance plan. This conceptual plan would substantially reduce identified project impacts and mitigation costs. A complete HEP analysis has not been performed on this plan but would be required upon development of a detailed plan. The preliminary components of this plan are described below and include management areas for migratory waterfowl, Federally listed valley elderberry longhorn beetle habitat, State-listed Swainson's hawk habitat and giant garter snake habitat. If adopted, this plan would be developed as a cooperative venture between public agencies, resource interest groups and private entities .

a. Acquire conservation easement or fee title on approximately 10,000 acres of existing agricultural lands in South Sutter County and 12,000 acres in Sacramento County. These lands would be managed for migratory waterfowl and giant garter snake respectively.

b. Acquire conservation easement on approximately 12,000 acres in South Sutter County and Sacramento County in a 1 mile wide band along the Sacramento River from Sankey Road to near the mouth of the American River. These lands would be managed to optimize habitat for the Swainson's hawk.



Area 1 Acreages		Area 2 Acreages		Area 3 Acreages		Area 4 Acreages	
Palustrine Forest/ Palustrine scrub-shrub	721.79	Palustrine Forest Palustrine Scrub-Shrub	699.33	Palustrine Forest/ Palustrine scrub-shrub	798.57	Palustrine Forest Palustrine Scrub-Shrub	298.97
Grain/Alfalfa/Rice	511.98	Grain/Alfalfa/Rice	88.28	Grain/Alfalfa/Rice	877.60	Grain/Alfalfa/Rice	1465.49
Emergent Marsh/ Seasonal Wetland	955.91	Emergent Marsh/ Seasonal Wetland	583.56	Emergent Marsh/ Seasonal Wetland	449.97	Emergent Marsh/ Seasonal Wetland	2164.06
Oak Savana	1366.44	Oak Savana	1814.24	Oak Savana	1416.46	Oak Savana	104.54
Subtotal	3558.12	Subtotal	3135.41	Subtotal	3542.60	Subtotal	4033.06

Grand Total 14267.19

FIGURE 7-3

c. There are numerous waterways within the Natomas area that are of high value to the giant garter snake and other general wildlife. FWS recommends, under the avoidance plan, that these areas be protected with a 100-foot-wide buffer zone on each side. These zones would be managed to continue prescribed water conveyance, improve garter snake habitat and restore wetland riparian corridors.

d. An additional component of the avoidance plan is to restore riparian and fisheries habitat along the Natomas East Main Drain. Of the four major waterways in Natomas, this one has the highest potential for habitat restoration. FWS suggests revegetation, channel clean up and contouring, fencing, instream structure placement, and an improved water supply for the Drain.

In summary, this avoidance plan calls for a total of 34,000 acres of lands in agricultural use to be placed in some form of fish and wildlife management category. In order to insure that lands are managed in perpetuity for fish and wildlife purposes, the FWS suggests that a resource agency such as the FWS, California Department of Fish and Game, Nature Conservancy, or similar agency should be the responsible manager to implement the plan and other cooperators should assist in developing the plan and monitoring its success. Additionally, the Central Valley Joint Habitat Venture for the North American Waterfowl Management Plan has identified a goal of expanding wetlands for waterfowl in the general area of Natomas by 4,500 acres. Part or all of this could occur in the future at or near the Natomas area.

Project Mitigation Plan, Natomas

The project mitigation plan is a combination of measures to mitigate direct impacts that will be undertaken as part of the project and measures to mitigate indirect impacts which will be undertaken by the local agencies controlling land use in the project area. The plan will contain assurances from the local agencies as to how they will exercise their land use authorities so as to avoid or minimize growth related impacts associated with this project including impacts to species protected under the California Endangered Species Act.

Direct-Impact Mitigation.

1. The Corps and project sponsors concur with the FWS recommendation that fish screens be installed on the pumping facility in the NEMDC to reduce fish losses and that in-water construction will be limited to June 1 through August 31. These

activities will be coordinated with the FWS and the California Department of Fish and Game. These mitigation measures are expected to reduce impacts to fish resources to a less than significant level.

2. To offset direct impacts affecting vegetation and wildlife in Natomas, the Corps and project sponsors will acquire and manage 280 acres in eastern Natomas close to the NEMDC in the general area depicted in Figure 7-4. A preliminary planting design will consist of 20 acres of riparian forest and riparian shrub-scrub, 101 acres of a combination of grain/alfalfa/rice, 151 acres of marsh and 8 acres of oak savanna. These acres were developed from the FWS mitigation recommendations and final designs will be coordinated with the FWS and DFG. The species planted would consist of native trees such as Fremont cottonwood, valley, interior live, blue oak, and shrubs such as sandbar, yellow, arroyo willow, elderberry and vines such as blackberry and wild rose. The mitigation area will be monitored by the Corps. Mitigation monitoring will occur for approximately 5-7 years while the project is in construction. After this time the local sponsors will continue to monitor and maintain the mitigation and provide semi-annual reports on mitigation progress. This mitigation measure is expected to reduce the direct impacts on vegetation and wildlife resources to a less than significant level.

Indirect Impact Mitigation. The non-federal sponsors have proceeded with the development of a Habitat Conservation Plan for the Swainson's Hawk and Giant Garter Snake which are State listed threatened species. The non-federal sponsor is working with the DFG and FWS to develop an acceptable plan to avoid jeopardy to these species due to increased development in the Natomas area. Chapter 8 has a complete discussion of the progress of this proposed plan.

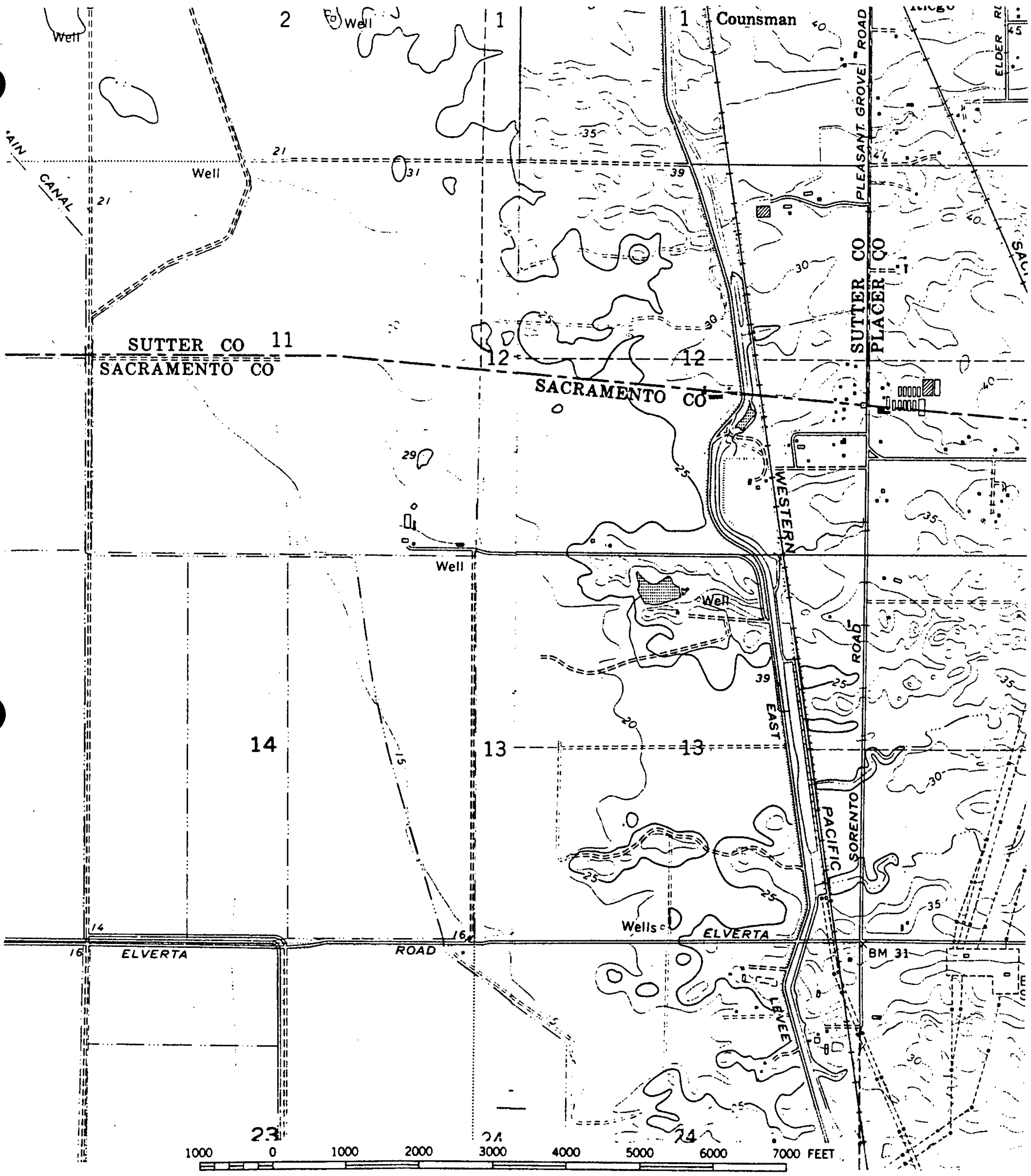


FIGURE 7-4. Potential Mitigation Area, Natomas

Additionally, the non-federal sponsors, including State and local agencies, have been actively working with the State and Federal resource agencies in drafting an agreement regarding local assurances. This agreement, in combination with the Conservation Plan, is expected to provide an integrated approach to mitigating for general habitat losses and those losses associated with the threatened species. Therefore, this has been a long evolving process. The final agreement will set forth commitments with respect to mitigating the impacts associated with growth in Natomas in five resource areas protected under Federal law, including fish and wildlife resources protected under the Fish and Wildlife Coordination Act and jurisdictional wetlands protected under the Clean Water Act.

Generally, the agreement will commit local government to deal with these impacts on a project-by-project basis as required by State law. This approach is not in agreement with the FWS recommendation for the purchase of 17,650 acres to be managed as a wetland upland complex. However, the selected plan is believed to be consistent with current Federal and State policy, which leaves local government with the responsibility of addressing secondary or growth-inducing impacts. These impacts are inevitably tied to the local land use decision-making process, where the jurisdictional primacy of local government has long been recognized.

The local agreement in combination with the Habitat Conservation Plan is expected to reduce the indirect impacts associated with the selected plan in the Natomas area to a less than significant level.

Upper American River

In the Upper American River area, mitigation for direct impacts due to construction, inundation and slope instability will be combined with mitigation for Federal listed species. This will be accomplished by the Corps and non-Federal sponsors in an integrated mitigation area. This plan is based on mitigation recommendations provided by the FWS, independent impact assessment conducted by the State/Corps and an incremental mitigation analysis prepared by the Corps. The Corps will participate in the development of a wildlife management plan. The non-federal sponsor will participate in the development of a fishery management plan and will implement an adaptive management plan for the mitigation of sloughing in the detention area under the operation and maintenance phase of the project.

FWS Mitigation Recommendations, Upper American River.

During the impact assessment process, FWS identified specific habitat types that may be impacted by the project and evaluation species were chosen to represent those habitats in the HEP process and to represent the resource category designation of the specific habitat. The resource category assigned to each habitat plays a large role in the HEP for determining appropriate mitigation for project induced losses. The FWS Final Coordination Act Report, (Appendix S) details the evaluation species selected for each habitat. The FWS found the canyons of the American River to be extremely important ecological areas, diverse in wildlife habitats, buffered from urban disturbance and with undammed river corridors (FWS, 1991). These types of canyon habitats were determined to be scarce and of high value on a local and regional basis (FWS, 1991). It was then determined that all of the habitat types in the canyon fall into the resource category 2 designation, which allows for no net loss of in-kind habitat value.

As discussed in the Natomas mitigation section, resource category 2 habitat has an in-kind mitigation goal which is to precisely off-set the habitat unit loss for each evaluation species. This is accomplished by using the compensation acreage for the species with the largest mitigation requirement. This directly relates to the FWS recommendation of 51,987 acres of mitigation due to project induced impacts of the detention facility.

The mitigation recommendations of the FWS are:

1. To assure adequate evaluation of impacts on fish and wildlife resources of any future expansion of the dam, the authorizing document for the flood control only dam should include a statement that any alteration of flood control only facilities, or project purpose, be authorized by additional legislation, and that evaluation studies be conducted prior to such authorization. Studies required are (1) an impact analysis on the biological resources of the Auburn area, lower American River, Sacramento-San Joaquin Delta, San Francisco Bay, and water service areas; and (2) a detailed reanalysis of water allocation for fish and wildlife.

2. FWS identified a loss of 1,382 acres of riverine canyon and upland wildlife habitat due to direct project-related impacts in and near the North and Middle Fork American River Canyons. To mitigate this loss, FWS suggests 51,987 acres along the South Fork American River be acquired and managed for wildlife and fisheries, in perpetuity.

3. FWS identified significant impacts to fisheries due to increased sedimentation and resultant stream habitat degradation in the lowest elevation zone (490-800 feet). To mitigate this impact FWS recommended that stream habitat be improved above Lake Clementine and above streambed elevation 800 feet in the Middle Fork. FWS further recommended preparation of a long-term fishery management plan in consultation with the California Department of Fish and Game and the U.S. Fish and Wildlife Service.

4. To minimize any additional impacts on the remaining wildlife lands in the project inundation zone, a wildlife management plan be developed cooperatively by the Corps, U.S. Fish and Wildlife Service and the California Department of Fish and Game, and implemented throughout the project life.

5. To mitigate the impact of sloughing of canyon walls and resultant river sedimentation, slipouts be stabilized and revegetated with indigenous species, and sediment be removed from the channel and the streambed recontoured to normal gradient. Work should be done promptly after sloughing. Planning and implementation of slipout repair should be coordinated with the California Department of Fish and Game and the Fish and Wildlife Service.

Project Mitigation Plan

The principal focus of the project mitigation plan for the Upper American River is on the effects of temporary inundation of the 4,000 acre detention area. The plan was formulated by assessing the impacts and developing a mitigation goal to replace the losses incurred by the project. As previously discussed, for the selected plan, two impact analyses were performed to predict impacts associated with the construction and operation of the flood detention dam. Both use acceptable methodologies and the results were similar in nature. The more conservative of the two analyses was chosen and a mitigation plan was formulated to offset a loss equivalent to 1,927 acres (1,010 average annual equivalent acres lost over the period of analysis).

In the Draft EIS/EIR, the Knickerbocker site near the town of Cool was considered a potential site for mitigation. After further consideration and in response to public comments on the draft document, it was determined that the site did not provide in-kind replacement for the habitat losses. Another consideration was that the Knickerbocker area is already an area of high habitat value and was assumed to remain in government ownership under the without-project scenario and would therefore, not be suitable for mitigation. In the Draft Coordination Act Report, the FWS suggested the South Fork of the American River be used as an alternative mitigation site because of its similar topographic and ecological features to the North and Middle Fork canyons. Since the Knickerbocker site was deemed unfeasible for mitigation, the South Fork was considered along with the Consumnes River as possible mitigation areas in the incremental analysis. The results of the incremental analysis indicated that the South Fork of the American River would be the most effective place to replace habitat values.

Corps policy requires an incremental analyses (Appendix R) be performed as part of the mitigation planning process to identify the least cost plan that meets the mitigation goal. The mitigation goal of this analysis is no net loss of habitat units. The alternatives to achieve this objective are detailed in Appendix R.

The FWS recommended acquisition of 51,987 acres to offset project induced losses. This would constitute a 52-1 compensation ratio based on an average annual equivalent loss of 1,010 acres. This recommendation has been carefully reviewed and considered and has been found not to be justifiable within the meaning of 33 USC 662 of the Fish and Wildlife Coordination Act. Rather than follow this recommendation and basing the mitigation on the species with the largest mitigation requirement, the Corps chose an equal compensation analysis of replacing the cover types lost with the same cover types of equal quality. This analysis assumed a relationship between the quality and amount of habitat. For example, the loss of high quality habitat, as expressed by Habitat Suitability Indices (HSI), could be compensated by acquiring proportionally greater amounts of lower quality of the same cover type. Using this rationale, mitigation acreage would be acquired to satisfy the mitigation goal of in-kind replacement of lost acreage.

Using HEP data, composite HSI values for each cover type were used to compare habitat quality at the study area and at the mitigation area. The composite HSI values were determined by using the average HSI value of all the evaluation species and multiplied by the acreage that would be lost as a result of the project (1,927 acres). The resulting values (habitat units) quantitatively describe habitat losses for each of the cover types, the overall project impact, and the mitigation objective.

It was determined that the loss of 1,927 acres of the six cover types in the study area would result in the loss of 1,392 habitat units. Habitat units were then summed over the period of analysis and annualized for the with- and without-project scenario to determine the net average annual habitat unit impact of the project. The net impact figure reflects in AAHU's the difference between future with and without the project. The net impact of 726 HU's indicates that those HU's will not be available for habitat each year during the life of the project. In mitigating this net impact, in-kind habitat value for the individual habitat types will be provided to replace those habitat values lost.

According to the incremental analysis (Appendix R), offsite mitigation credit from habitat preservation along the South Fork of the American River, is the most cost effective mitigation measure. Lands along the South Fork have the best potential for mitigation because these lands are likely to be developed in the near future and their habitat values largely lost (Appendix S). It was estimated that 80 percent of the habitat value at the lands along the South Fork would be lost in the next 30 years. It was estimated that the remaining 20 percent will be constant over the remaining life of the project. Therefore, acquiring these lands and preserving them will provide very effective mitigation value. The effectiveness results from preserving the existing high habitat values of mature vegetation that would otherwise be lost versus planting new vegetation which takes considerable time to reach maturity and develop full mitigation credit.

Sufficient lands exist in the South Fork area to accomplish the mitigation goal. An candidate area was selected for analysis purposes which contained similar cover types to those in the detention area although the area generally has lower HSI values due to grazing and other land uses. Compared to the detention area, there is proportionally less north slope oak woodland habitat than south slope due to the gentler slopes along the South Fork.

Mitigation value from preservation is calculated by comparing future conditions of the mitigation site under the with- and without project scenario (Appendix R). Using HSI values from the candidate mitigation area, it was determined that 2,685 acres were needed to meet the mitigation goal of replacing 726 AAHU's. This 2,685 acre mitigation site will consist of 1,551 acres of south slope oak woodland, 449 acres of north slope oak woodland, 143 acres of chaparral, 79 acres of conifer forest, 137 acres of grassland and 326 acres of montane riverine habitat. These lands will be fenced to preserve these values.

In addition to mitigation for actual losses anticipated, the mitigation plan has another objective which is to maintain habitat values of affected habitat which is not anticipated to be lost. More than half of the habitat affected in the inundation area is not expected to be lost. Continuing management actions such as an on-site revegetation plan in the project O&M program are necessary to ensure this over the long term as periodic inundation events occur.

Plan Elements

The project mitigation plan consists of the following elements:

1. The Corps and local sponsors concur with the FWS recommendation that any alteration of flood control only facilities, or project purpose, be authorized by additional legislation, and that the impact evaluation studies be conducted prior to such authorization.

2. The incremental mitigation analysis determined the most cost effective way to mitigate for the loss of 1,927 acres of habitat, due to the construction and operation of the selected plan was to preserve land along the South Fork of the American River. To replace the values lost, 2,685 acres of land threatened for development on the along South Fork will be acquired and preserved. These lands will be located contiguous to the lands purchased to compensate for impacts to endangered species (see Chapter 8). Figure 7-5 shows the general area within which mitigation lands will be acquired. This land would be purchased and preserved only, no revegetation or management measures to improve the existing habitat values are proposed.

However, at the detailed design stage, some adjustments in this strategy may be required to deal with encountered site specific constraints. For example, it may be difficult to acquire a large block of land with all the cover types required for mitigation. It may be advantageous to acquire more grassland than is necessary in order to obtain the desired block of land with cover types that are less abundant in the area. Where preservation credit through land acquisition becomes less cost effective, other measures such as conversion of grassland into

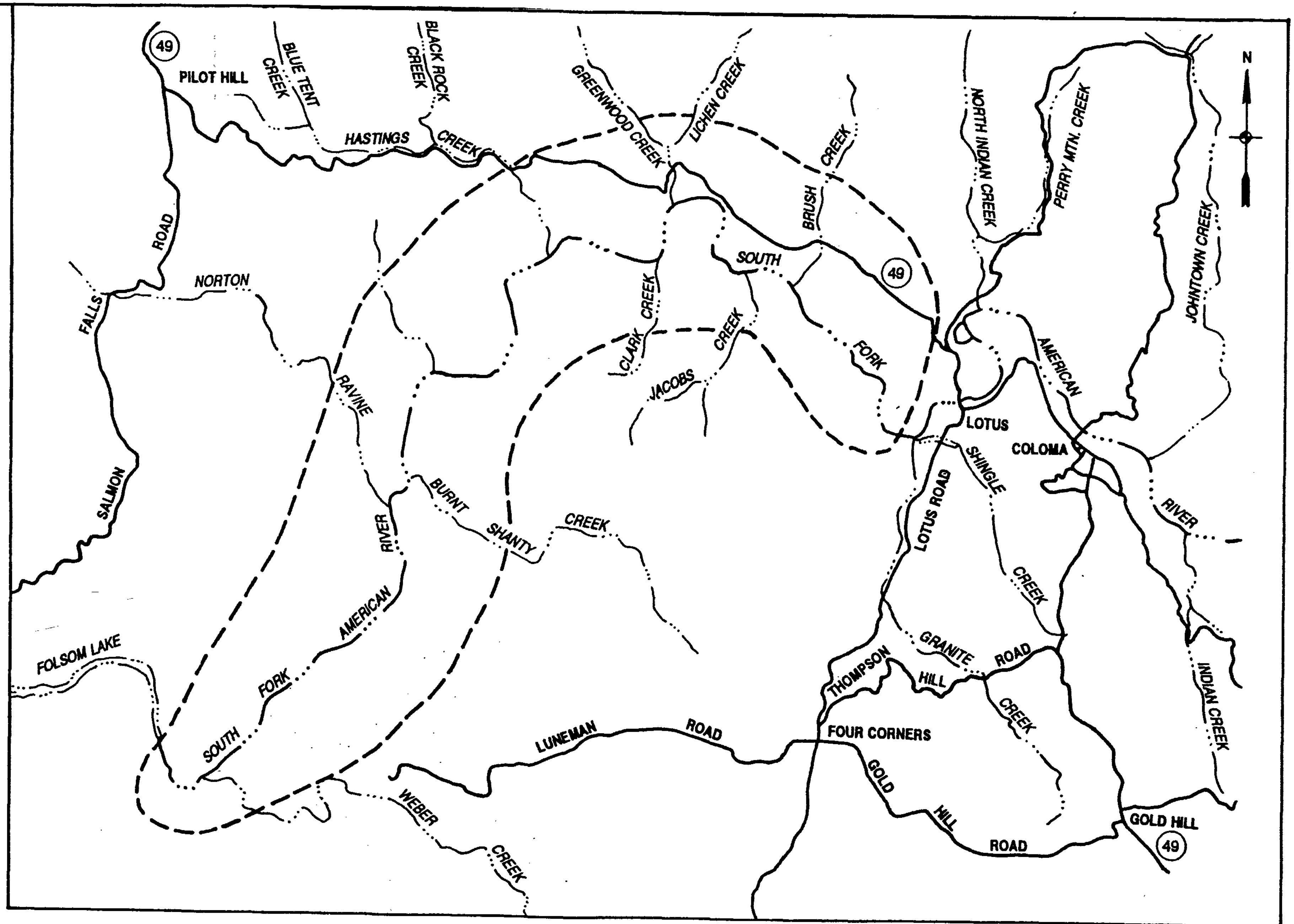


FIGURE 7-5. Potential Mitigation Site, South Fork American River

other cover types or enhancement to increase the habitat quality of lands already acquired will be considered as well as other increments identified in the incremental analysis.

3. FWS recommends the development of a fishery management plan, for the upper canyon area. The Corps and local sponsors concur with this recommendation and this plan will be included in the adaptive management plan discussed below.

4. FWS recommends the development of a wildlife management plan to minimize any additional impacts on the remaining wildlife lands in the project inundation zone. The Corps and local sponsor concur with this recommendation and a wildlife management plan will be part of the adaptive management.

5. FWS recommends mitigation of the impacts associated with sedimentation and sloughing that may occur on the canyon walls and the need to stabilize slipouts through revegetation. This will be accomplished by implementing an on-site revegetation program. This plan supplements the natural revegetation of slide areas and will be part of the adaptive management plan.

As stated, the South Fork mitigation area is planned to offset all expected adverse significant impacts to wildlife and vegetation resulting from the construction of the detention dam and resulting periodic inundation. However, to insure the goal of reducing all impacts to vegetation and wildlife to a less than significant level, an adaptive management plan will be developed and implemented.

An on-site revegetation program would stabilize eroding banks and slopes and replace areas cleared of vegetation from dam operations. Landslide areas can be stabilized and revegetated using biotechnical methods. The use of wattling is especially useful in these situations. This program is referred to as an adaptive management plan and will be implemented in the operation and maintenance phase of the project by the non-Federal sponsor. This remediation would be performed concurrently with other potential repairs that would occur after damaging floods.

During the first and second seasons following a flood, areas should be evaluated for natural regeneration and for the need for increasing densities of vegetation. Many of the desired species for planting are not available in the preferred sized at commercial nurseries. The plants needed for revegetation must be contract grown and a 12 to 24 month lead time is generally required. A range of planting densities are discussed in Appendix Q.

Planting for treatment of slide areas should be done immediately following inundation events so that remedial work can be performed during the fall or early winter planting window to allow sufficient time for biotechnical plantings to root and establish by the following spring thereby minimizing additional erosion during the succeeding rainy season. Plantings should be performed with small quality transplanting stock or by direct spot seeding. If quality stock is planted at the proper time and in the proper manner, irrigation systems should not be necessary. Provisions should always be made to replant a percentage of the original planting.

Indirect Impacts. The selected plan is not expected to be regionally growth inducing in the Upper American River area and therefore, no indirect impact mitigation is planned. However, if an alternate relocation of Highway 49 is desired by the local sponsors and route adoption studies undertaken, mitigation for any indirect impacts associated with the relocation would be undertaken by the local agencies.

400-YEAR MITIGATION MEASURES

Direct Impacts

Natomas and Lower American River. Mitigation measures for Natomas and the Lower American River would be the same as described for the selected plan.

Upper American River.

FWS Mitigation Recommendations, November 1991

1. To assure adequate evaluation of impacts of fish and wildlife resources of any future expansion of the dam, the authorizing document for the flood control only dam should include a statement that any alteration of flood control only facilities, or project purpose, be authorized by additional legislation, and that evaluation studies be conducted prior to such authorization. Studies required are (1) an impact analysis on the biological resources of the Auburn area, lower American River, Sacramento-San Joaquin Delta, San Francisco Bay, and water service areas; and (2) a detailed reanalysis of water allocation for fish and wildlife.

2. To mitigate the loss of 2,360 acres of riverine canyon wetlands and uplands resulting from dam construction and ongoing operation impacts during the project life in the North and Middle Fork American River Canyons, 78,341 acres along the South Fork

American River be acquired and managed for wildlife and fisheries, in perpetuity.

3. To mitigate the increased sedimentation and resultant stream habitat degradation in the lowest elevation zone (490-800 feet), stream habitat be improved above Lake Clementine and above streambed elevation 800 feet in the Middle Fork. Preparation of a long-term fishery management plan in consultation with the California Department of Fish and Game and the U.S. Fish and Wildlife Service will be required prior to any revegetation, replacement of structures such as log barriers, downfall trees, and rick gabions or similar instream devices to created pools and instream cover.

4. To minimize any additional impacts on the remaining wildlife lands in the project inundation zone, a wildlife management plan be developed cooperatively by the Corps, U.S. Fish and Wildlife Service and the California Department of Fish and Game, and implemented throughout the project life.

5. To mitigate the impact of sloughing of canyon walls and resultant river sedimentation, slipouts be stabilized and revegetated with indigenous species, and sediment be removed from the channel and the streambed recontoured to normal gradient. Work should be done promptly after sloughing. Planning and implementation of slipout repair should be coordinated with the California Department of Fish and Game and the Fish and Wildlife Service.

Project Mitigation Plan. If the 400-year alternative was ultimately selected, agency negotiations regarding the selection of the final mitigation requirements would take place in the advance planing phase. Mitigation measures found justifiable would be included in the recommended project. The Corps and non-federal sponsors would likely adopt a mitigation plan similar to that described for the selected plan. Potential mitigation measures could include acquiring acreage in the South Fork area, implementing the adaptive management plan, developing a fishery management plan and developing a wildlife management plan.

Indirect Impacts.

Natomas, Lower American River, and Upper American River.

Mitigation for indirect impacts of the 400-year alternative would be the same as described for the selected plan.

150-YEAR ALTERNATIVE, MITIGATION

Direct Impacts

Natomas. Mitigation recommended in Natomas for this alternative would be the same as that described for the selected plan.

FWS Recommendation/Lower American River

1. Water levels at Folsom Reservoir be stabilized during the warmwater fish spawning season (April-June) to improve spawning success.

2. Artificial shelters such as clumps of large trees and brush bundles be chained and anchored to the bottom of Folsom Reservoir to provide fish rearing habitat lost from the impact to the littoral zone from lower reservoir water levels.

3. To mitigate the loss of the coldwater trout fishery, 30,000 rainbow trout (1/2 pounders) be planted in Folsom Reservoir during the winter and spring months to mitigate the loss of the coldwater trout fishery in the reservoir.

4. To mitigate the adverse impacts of the project on naturally spawning chinook salmon (critical period November), the following minimum flows be provided. Between October-December 31 in normal years 1,750 cfs and dry years 1,250 cfs, January-June 30 in normal years 1,250 cfs, in dry years 1,250 cfs.

5. To provide adequate water temperature for salmon rearing and smolt emigration (spring-summer), a block of water (60,000 acre-feet) be reserved for discretionary release by the Department of Fish and Game. This would mitigate for increases in April temperatures during the salmon rearing and smolt emigration period.

6. To mitigate the loss of spawning gravels from increased flows (115,000 to 180,000 cfs), 4,500 cubic yards of gravels (1/2- to 3-inch diameter) be placed at Sailor Bar whenever downstream water releases have exceeded 115,000 cfs.

7. To mitigate the loss of wildlife habitat values in the lower American River, 1,439 acres in the Lower American River floodway be acquired and developed for management as a wetland/upland complex achieving open water, emergent marsh, and riparian forest habitats. The FWS identified mitigation sites at the Sacramento Bar area.

Project Mitigation Plan. This mitigation information is tentative in nature and represents preliminary measures for comparison with the selected plan. If the 150-year alternative was ultimately selected, agency negotiations regarding the selection of the final mitigation requirements would take place in the advance planing phase. Mitigation measures found justifiable would be included in the recommended project. Potential mitigation measures could include acquiring 1,439 acres in the Parkway, vegetation planting, monitoring and fisheries rehabilitation programs. However, the design of a successful fishery mitigation plan is not certain and would necessitate extensive long-term studies before developing a final mitigation plan. The mitigation measures would be chosen to best mitigate the affected resources to a less than significant level within the Corps of Engineers planning and procedure guidelines.

However, it should be noted that many of the recommendations outlined in the FWS mitigation plan relate to water operations at Folsom Reservoir. The Corps has no authority over water operations at Folsom Reservoir other than for flood control. The USBR has operational authority for Folsom Reservoir as established by Congressional authorization and legally binding agreements between the fishery agencies, water contractors, and the USBR. The recommendations suggested by the FWS impact these legally binding agreements. Modification of these legal agreements to meet various provisions entail significant impacts in and of themselves which may require separate EIS/EIR documentation. Such documentation may require a full analysis of CVP operations.

Upper American River. In the Upper American River area, the 150-year alternative would generate no project related impacts and no mitigation would be required.

Indirect Impacts

Natomas and Lower American. Mitigation would be the same as described for the selected plan.

Upper American River. In the upper American River area, the 150-year alternative would generate no project related impacts and no mitigation would be required.

100-YEAR (FEMA) ALTERNATIVES

The FWS analysis included in the CAR was focused on the 150-year alternative presuming that it would be the logical next choice if neither the selected plan or the 400-year plan was chosen as the construction alternative. Therefore, the only mitigation recommendations received from the FWS was for the 150-year plan. If the one of the 100-year (FEMA) alternatives was ultimately selected for construction, mitigation planning and coordination with the appropriate agencies would take place in the advance planning and design phase of the project. Mitigation measures and studies needed to design and implement the mitigation plan would be similar to those discussed in the 150-year plan.

CHAPTER 8

ENDANGERED SPECIES

The Federal Endangered Species Act of 1973 (FESA) (50 CFR 17) provides legal protection for plant and animal species in danger of extinction and requires identification of critical habitat and development of recovery plans for such species. California has a parallel mandate embodied in the California Endangered Species Act of 1984 and the California Native Plant Protection Act of 1977 (CESA). The plant and animal species protected under FESA and CESA are listed as endangered, threatened, or, in the case of plants, rare.

Before any Federal agency can undertake an action involving modification of the environment, FESA requires that a finding be reached by U. S. Fish and Wildlife Service (FWS) concerning the potential of that action to jeopardize the continued existence of any listed species. Unless they are also listed under FESA, species listed by the State are not protected under the Federal endangered species act. Under CESA, however, the California Department of Fish and Game (DFG) is empowered to review projects for potential impacts to State-listed species and their habitats.

In addition to formal endangered and threatened listings by Federal and State Governments, many other species are of special interest because of their limited distribution, declining populations, diminishing habitat, or unusual scientific, recreational, or educational value. These species are not afforded the same legal protection as listed species, but may be added to official lists in the future. There are two general categories of special interest species:

- Those species that are candidates for official Federal or State listing as threatened or endangered;

- Those species which are not candidates, but which have been unofficially identified as a species of special interest by private conservation organizations or local governmental agencies.

Federal candidate species are assigned to one of two categories depending upon the state of the information base concerning the biological appropriateness for listing those species. Federal Category 1 (FC1) includes species for which the FWS has compiled substantial information indicating that, in terms of biological vulnerability and magnitude of threat, endangered or threatened status may be warranted. Federal Category 2 (FC2) includes species for which the existing base of information is incomplete, but which appear, based on the information that is available, to warrant continued consideration for listed status.

The State also maintains lists for Candidate-Endangered Species (SCE) and State Candidate-Threatened Species (SCT).

This chapter discusses State and Federally listed rare, threatened, and endangered species which may be affected by the American River Water Shed Investigation. The species likely to occur within the project area (Table 8-1) were identified during consultation with the FWS Endangered Species Office and the DFG.

For the Federally listed species, the Corps will prepare a Biological Data Report for submission to FWS. Based on information contained in that report and other information, FWS will issue a determination of jeopardy or nonjeopardy for each species and issue a formal Biological Opinion. If a finding of jeopardy is reached, FWS will identify reasonable and prudent measures to avoid jeopardy, and, based upon this information, appropriate mitigation measures will be developed and implemented.

In a preliminary draft Biological Opinion issued by the DFG on July 2, 1990 (Appendix P), three State-listed species known to occur in Natomas were identified. These were the Swainson's hawk, the giant garter snake, and the Sacramento River winter-run chinook salmon. The DFG's findings concerning the potential impacts of the American River Water Shed Investigation on these species were as follows:

- The project is not likely to result in any impacts to the winter-run chinook salmon because all levee work would be on the landward side of the levee for all project alternatives. Since this finding was issued, however, waterside levee work was added to the project, and potential impacts resulting from the re-operation of Folsom Reservoir were identified. The implications of these changes are discussed below.

- The project could potentially entail a significant reduction in Swainson's hawk nesting and/or foraging habitat due to the development that could occur following the provision of increased flood protection. Pending completion of studies leading to the development of a recovery plan, the DFG recommended that all existing foraging habitat within the vicinity of existing nest sites be preserved or compensated for within the project area.

- DFG also concluded that the present system of irrigation ditches and small canals in Natomas is essential to the continued existence of the giant garter snake and that, concurrent with development, an active mitigation program must be in place to preserve the snake's habitat in Natomas.

EXISTING CONDITIONS

Based on the species lists provided by the FWS and the DFG, several studies were initiated to determine if endangered, threatened, or rare species occurred in the project area. Bald eagle and avian surveys were conducted over the entire project area (USACE, 1991), field surveys for endangered plants were conducted in the upper American River and in Natomas (Drost and Woodward, 1990), and nesting surveys of Swainson's hawk along the Sacramento River and at its confluence with the American River were conducted in conjunction with the Corps' Sacramento River Urban Levee and Reconstruction Project. The results of the surveys are contained in Appendix P.

Six of the threatened or endangered species listed in Table 8-1 could potentially be affected by the project. These include Swainson's hawk (ST/FC2), which occurs along the Sacramento River; giant garter snake (ST/FC2), which is found in Natomas and below Meadowview Road; valley elderberry longhorn beetle (FT), which inhabits elderberry plants along the upper and lower American River; the bald eagle, which inhabits the American River basin and forages in Folsom Reservoir; the winter-run chinook salmon, which uses the Sacramento River during spawning runs; and the delta smelt, which inhabits the Sacramento-San Joaquin River delta. The occurrences of the Swainson's hawk, the valley elderberry longhorn beetle, and the giant garter snake were confirmed by field surveys. Detailed information on the biology of these species is contained in Appendix P, Endangered Species.

TABLE 8-1. The Federally-Listed and State-Listed and Candidate Species Identified By FWS and DFG as Potentially Occurring in the American River Watershed Investigation Project Area

LISTED SPECIES	FEDERAL STATUS	STATE STATUS
Bald Eagle	FT	SE
Peregrine Falcon	FE	SE
Winter-Run Chinook Salmon	FT	SE
Valley Elderberry Longhorn Beetle	FT	
Palmate (Ferris) Bird's Beak	FE	SE
Swainson's Hawk	FC2	ST
Western Yellow-Billed Cuckoo	FC2	ST
Greater Sandhill Crane		ST
Bank Swallow		ST
Giant Garter Snake	FC2	ST
Bogg's Lake Hedge-hyssop	FC2	SE
California Hibiscus		SR
El Dorado Bedstraw	FC2	SR
Pine Hill Flannel Bush	FC2	SR
Pine Hill Ceanothus	FC2	SR
Layne's Butterweed	FC2	SR
Sacramento Orcutt Grass	FC1	SE
Slender Orcutt Grass	FC1	SE
Stebbin's Morning Glory	FC2	SE
FEDERAL CANDIDATE SPECIES		
Delta Smelt	FC1	
White-faced Ibis	FC2	
Snowy Plover	FC2	
Tri-colored Blackbird	FC2	
California Tiger Salamander	FC2	
Red Legged Frog	FC2	
Sacramento Splittail	FC2	

TABLE 8-1. The Federally-Listed and State-Listed and Candidate Species Identified By FWS and DFG as Potentially Occurring in the American River Watershed Investigation Project Area, continued

Sacramento Valley Tiger Beetle	FC2	
Sacramento Anthicid Beetle	FC2	
Spiny Rhyacophilan Caddisfly	FC2	
Yate's Snail	FC2	
Bisbee Peak Rush-rose	FC2	
California Hibiscus	FC2	
Delta Tule Pea	FC2	
Dwarf Downingia	FC3	
El Dorado County Mule Ear	FC2	
Greene's Legenere	FC2	
Hispid Bird's-beak	FC2	
Mason's Lilaeopsis	FC2	
Nissenan Manzanita	FC3	
Pleasant Valley Mariposa	FC1	
Red Hill Soaproot	FC2	
Saw-toothed Lewisia	FC2	
Stebbin's Phacelia	FC2	
Valley Sagittaria	FC2	

FE = Federally listed endangered
FT = Federally listed threatened
FC1 or FC2 = Federal candidate
SE = State-listed endangered
SR = State-listed rare
ST = State-listed threatened

IMPACTS

SIGNIFICANCE CRITERIA

For purposes of this chapter, any action undertaken directly in connection with, or indirectly caused by, the project which would affect the continued existence of a threatened or endangered species is considered a significant adverse impact. For the six threatened and endangered species potentially affected by the American River Watershed Investigation, a significant impact would occur if:

Giant garter snake: the project directly or indirectly (1) destroys or disturbs any habitat utilized by the snake for nesting or breeding purposes or (2) results in any substantial loss of foraging habitat within the study area.

Swainson's hawk and bald eagle: the project directly or indirectly (1) disturbs an occupied nest or destroys an identified nest site in or near the project area or (2) results in any substantial loss of foraging habitat within the project area.

Bald eagle: the project directly or indirectly reduces the size of the eagle's foraging habitat

Valley elderberry longhorn beetle: the project directly or indirectly results in the partial or complete destruction of any elderberry shrubs in the project area.

Winter-run chinook salmon: the project directly or indirectly results in a decrease in either the size of the spawning run or the number of viable smolts produced.

Delta smelt: the project directly or indirectly results in (1) a loss or degradation of habitat or (2) a decrease in the size of the breeding population.

These significance threshold criteria are consistent with the appropriate provisions of the Endangered Species Act of 1973, as amended (Public Law 93-205; 16 USC 1451, et seq.), and the Bald Eagle Act (16 USC 668).

The likelihood is that one or more of the flood control alternatives will adversely affect the threatened or endangered species which FWS and DFG have identified as potentially present in the project area, or potentially affected by the project.

Field surveys have verified that three of the species in this group--the Swainson's hawk, the giant garter snake, and the valley elderberry longhorn beetle--do, in fact, inhabit the project area. The status of the remaining three species is as follows:

- o The bald eagle was not sighted during field surveys.
- o Sacramento River winter-run chinook salmon runs are carefully monitored, and the presence of this species in the project area (the Sacramento River and, occasionally, some project area creeks) is established.
- o Although known not to occur in the project area, the delta smelt could potentially be affected by changes in the flow regime of the Sacramento River. These changes would result from changes in the operation of the Central Valley Project to compensate for lost water and power production at Folsom Reservoir. Water and power production would be lost due to the provision of greater flood storage space in the reservoir as called for under the 150-year alternative, the 100-year (FEMA) storage alternative, and the 100-year (FEMA) levee/storage and spillway alternative.

Species likely to be adversely affected by one or more project alternative will be discussed in detail in subsequent sections (a separate section is devoted to the impacts of each individual project alternative). Species not likely to sustain adverse impacts will receive no further discussion. All identified direct and indirect impacts to Federally and State-listed species are summarized by alternative in Tables 8-5 and 8-6 at the end of this chapter.

BALD EAGLE

The bald eagle (Haliaeetus leucocephalus) is a Federally listed threatened species and a State-listed endangered species. Based on reviews of pertinent literature and consultation with local experts, it was determined that Folsom Reservoir is the only site within the project area that has any appreciable bald eagle use. This was substantiated during extensive ground and aerial surveys in 1989 and 1990 in the upper American River area, at Folsom Reservoir, along the lower American River, in Natomas, and within the Yolo Bypass. No bald eagles were detected within the project area (USACE, 1991).

It was concluded that only those alternatives affecting Folsom Reservoir would be likely to have any potential impacts on the species. The degree of the impact on the eagle will depend on the impact of flood control reoperation on the reservoir's fishery, which serves as the food base for the eagle. Any diminution of the reservoir fishery could be offset by a fish planting program.

WINTER-RUN CHINOOK SALMON

The winter run chinook salmon (Oncorhynchus tshawytscha) is a Federally listed threatened species and a State-listed endangered species. Based on coordination with the National Marine Fisheries Service and the DFG, no significant impacts are expected to result under the selected plan, the 400-year alternative, or the 100-year (FEMA) levee alternative because these alternatives would have no impact on flows in the Sacramento River. However, significant adverse impacts to this species could result under the 150-year alternative, the 100-year (FEMA) storage alternative, and the 100-year (FEMA) levee/storage and spillway alternative if the increased flood storage space required under these alternatives at Folsom Reservoir triggers adjustments in overall CVP operations, including altered flows in the Sacramento River. Waterside levee work would take place along the NCC and the NEMDC, where irregular runs of the endangered chinook salmon sometimes occur as the salmon are en route to Dry Creek, Pleasant Grove Creek, and the Auburn Ravine. Because these small runs occur only during high-flow periods when construction would have been suspended, no impacts are expected.

DELTA SMELT

The delta smelt (Hypomesus transpacificus) has been proposed for inclusion on the Federal threatened species list. The delta smelt, which occurs only in Suisun Bay and the Sacramento-San Joaquin estuary (the delta), has declined 90 percent over the last 20 years. It is primarily threatened by exports of freshwater from the delta to urban and agricultural users. No direct impacts to the delta smelt from the proposed selected plan are expected. The 150-year alternative and two of the three 100-year (FEMA) alternatives could adversely affect the delta smelt due to the altered flow regimes associated with the reoperation of Folsom Reservoir.

VALLEY ELDERBERRY LONGHORN BEETLE

The valley elderberry longhorn beetle (Desmocerus californicus dimorphus) (VELB) is a Federally listed threatened species which inhabits riparian zones along the upper and lower American River. No direct or indirect impacts to the beetle are expected in Natomas; however, routine levee maintenance procedures such as mowing and shrub removal could affect recruitment of future elderberry plants.

Direct impacts to beetle habitat in the upper American River could result under the 200-year and 400-year alternatives due to inundation of elderberry shrubs and resident beetles which are known to occur in the inundation zone behind the flood control dam. If implemented, the 150-year alternative, and any of the 100-year (FEMA) alternatives, would also affect beetles occupying the riparian corridor in the lower American River, including the levees on both sides of the channel. Changes in the flow regime of the river (higher fall releases and lower spring releases) due to reoperation of Folsom could adversely affect some elderberry shrubs within the American River Parkway, and bank protection and levee work along the lower river could also cause the removal or modification of beetle habitat. The extent of the impact on elderberry plants attributable to the above causes is not known. For purposes of this analysis, however, it is assumed that any loss of habitat occupied by the beetle would be significant.

SWAINSON'S HAWK

Swainson's hawk (Buteo swainsoni) has been listed by the State as a threatened species because of its precipitous decline from an estimated historic population of 17,000 breeding pairs in California (Bloom, 1980) to approximately 550 breeding pairs in 1990 (DFG, 1990a).

Many factors have been postulated as potential causes of the population decline, including incompatible vegetative cover for the production and/or capture of prey (Bloom 1980); grazing pressure (Detrich 1986); predation by great horned owls and crows (FWS, 1986); depredation by humans on wintering grounds (Bloom, 1980); pesticide use (Bloom, 1986; Detrich, 1986), and loss of breeding and foraging habitat through land use conversions (DFG, 1990a). Habitat loss and pesticide residues have recently been identified as plausible explanations of the population decline; however, Risebrough et al. (1989) have concluded that as yet unidentified local factor(s) are probably the principal cause of the decline.

Swainson's hawk is a migratory bird which spends roughly 5 months of the year (mid-March through mid-August) in the western United States and Canada and about the same amount of time (mid-September through mid-February) in the Pampas region of South America. Breeding occurs during the first 2 to 3 months of the North American season, with fledglings spending the remainder of the season achieving the maturity needed to fly south for the winter.

Swainson's hawk requires two habitat components to assure successful breeding--nesting trees and adequate foraging habitat nearby. In California, the Swainson's hawk nests throughout the Central Valley in solitary trees, small groves, or shrubs adjacent to open grasslands or agricultural fields (Dunkel, 1977; Bloom, 1980; Woodbridge, 1983; Schlorff and Bloom, 1984; and Estep, 1989). As many as 82 percent of the reported Swainson's hawk nests have been located in or within 1 mile of riparian forests (Schlorff and Bloom, 1984; Estep, 1989).

Forage during the breeding/fledgling cycle consists primarily of small mammals. This prey inhabits native grasslands, lightly grazed pastures, alfalfa and other hay crops, tomatoes, beets, and a combination of row crops. Telemetry studies in the mid-valley area indicate that the feeding habitat of Swainson's hawk was, in order of preference, alfalfa, disked fields, fallow fields, dryland pastures, beets, tomatoes, irrigated pasture, grains, other row crops, and other agricultural lands (Estep, 1989). Unsuitable foraging habitat includes rice fields, orchards, vineyards, and cotton crops. These crop types result in either low prey production or relatively heavy vegetative cover which prevents the hawk from effectively seeing and capturing its prey (DFG, 1990a).

Studies of the size of foraging range vary considerably. Craighead and Craighead (1956) reported maximum foraging areas in Wyoming between 180 and 1,056 acres. Newton (1979) compiled data on separate studies conducted in Utah (Smith and Murphy 1973) and Wyoming (Dunkle, 1977; Craighead and Craighead, 1956) and reported that home ranges averaged between 1,200 and 1,600 acres. Bechard (1982) found Swainson's hawk home ranges were between 1,500 and 3,600 acres in Washington State, while Estep (1989) reported home ranges between 30 and 16,000 acres.

Because not all the causes of the hawk's decline are understood, it was necessary to assume, for the purposes of this analysis, that any substantial decline in the amount of foraging habitat available to the Swainson's hawk in the project area would jeopardize the continued existence of the hawk population in the Sacramento region.

GIANT GARTER SNAKE

The giant garter snake (Thamnophis Couchi Gigas) is listed as a threatened species by the State and an FC2 species by the Federal Government. Increasing urbanization and agriculture and the introduction of predatory and/or competitive species are the three primary threats to giant garter snake populations (Ellis, 1987). Urban development has dramatically changed the snake's habitats through pollution, destruction of prey availability, and conversion of preferred native vegetation to exotic landscapes. Wetlands have been drained, and streams have been rerouted through culverts and concrete channels in order to prepare sites for urban development and agriculture.

Giant garter snakes are also lost as a direct result of farming operations. Livestock grazing has depleted protective plant cover and compacted the soil, resulting in the destruction of underground retreats. Giant garter snake populations have also declined as a result of the introduction into almost all permanent freshwater environments of large predatory fish species which prey on young snakes and compete for smaller forage fish (Ellis 1987).

Historically, the reported range of the giant garter snake included the Central Valley from the vicinity of Sacramento and Antioch southward to Buena Vista Lake near Bakersfield in Kern County (Hansen and Brode 1980). The present known distribution extends from just south of Chico in Butte County southward to the vicinity of Burrel in Fresno County (Ellis, 1987).

Although the size of the Natomas giant garter snake population is unknown, DFG, in cooperation with Caltrans, is currently conducting a study in order to develop an estimate (John Brode, DFG, pers. comm., 1991). It is likely that most or all interior drainage canals in this area are frequented by the giant garter snake, as these waterways provide important physical links between northern and southern populations inhabiting the basin.

The giant garter snake has not been reported in the foothills of the Sierra Nevada (Basey and Sinclair, 1980; Hansen and Brode, 1980) and is not likely to be found in the upper American River because of the absence of required habitat. Nor has the giant garter snake been reported in the American River Parkway

(DFG, 1991; Sanders et. al., 1985; Hansen and Brode, 1980; Brode, pers. comm. 1991; Sorenson, pers. comm. 1991). Outside of the Natomas area, the snake occurs only in the southern portion of the lower American River area in the vicinity of Morrison, Laguna, and Elk Grove Creeks and Stone and Beach Lakes (Brode, pers. comm. 1991; Sorenson, pers. comm. 1991). Hansen and Brode (1980) reported five observations of the giant garter snake in these areas. Hansen (1982) observed the giant garter snake along Elk Grove and Laguna Creeks. Hansen (1982) noted that the giant garter snake is uncommon in this area relative to other areas in Sacramento County. He attributed these low densities to the effects of winter flooding and heavy grazing.

The giant garter snake typically inhabits sloughs, marshes, and drainage canals characterized by slow flowing or standing water, permanent summer water, mud bottoms, earthen banks, and an abundance of preferred forage species. The giant garter snake is highly aquatic, but avoids areas of dense riparian overstory, preferring instead emergent aquatic vegetation, such as tules and cattails, and herbaceous terrestrial cover composed of annual and perennial grasses, blackberry, and mustard (CNDD, 1989). This vegetation, along with burrows, undercut banks, and large rocks, provides escape cover (J. Brode pers. comm., 1990). Because the snake must bask in the sun in order to thermoregulate, areas devoid of overstory shading are also necessary.

Rice farming plays an important role in sustaining the existing giant garter snake populations in the Natomas basin (see Brode and Hansen, August 1991, in Appendix P). The snakes use the irrigation canals which serve the rice fields for year-round habitat and movement between major population centers. Many of these ditches are ideal for the snake; the ditches are too small to support large predatory fish, but are large enough to provide snake populations with adequate food and cover. The flooded rice fields are important as late summer habitat, providing large numbers of mosquito fish (*Gambusia affinis*), Pacific treefrogs (*Hyla regilla*), and other forage. It is also believed that females use rice fields as nursery areas in mid-summer (J. Brode, pers. comm., 1990).

Elevated topographic features are necessary for refuge in areas subject to winter flooding (DFG, 1990a). The giant garter snake is generally absent from areas occupied by large, exotic predatory fish, such as black bass and striped bass. Giant garter snakes also avoid larger bodies of open water and areas where the banks are only lightly vegetated (DFG, 1990a).

Giant garter snakes rely on canals and ditches as movement corridors. These movement corridors are vital to migration patterns and, most importantly, for continuing genetic exchange between subpopulations. Although it is unknown how far giant garter snakes travel in a given timeframe, they have been observed in small irrigation ditches, suggesting that they have traveled a significant distance from the main canals (J. Brode, pers. comm., 1991).

Giant garter snakes are active between early April to mid-October. After the first part of October, giant garter snake begin to search for suitable winter retreats, where they remain all winter (J. Brode, pers. comm., 1990).

The giant garter snake is an aquatic feeder that specializes in ambushing fish underwater. It generally feeds on small carp (Cyprinus carpio), bullhead (Ictalurus sp.), mosquitofish (Gambusia affinis), and minnows. It will also feed on bullfrog (Rana catesbeiana), Pacific treefrog (Hyla regilla), and tadpoles (Hansen, 1982).

In the absence of empirical data regarding the population size and distribution of the giant garter snake in Natomas, this analysis will assume that any substantial loss of existing habitat capable of supporting the giant garter snake would constitute a significant impact.

NO-ACTION ALTERNATIVE

Flood-Related Damage

Under the no-action alternative, no Federal or State action would be undertaken to modify the existing flood control system. Thus, Sacramento would be exposed to a significant long-term risk of flooding from the American River. Inundation of the Natomas basin and other portions of the flood plain could imperil threatened or endangered species which are susceptible to flooding. These include the giant garter snake and valley elderberry longhorn beetle.

The giant garter snake inhabits sloughs and other small waterways within the flood plain. The snake may be vulnerable to flooding in three ways:

- During the snake's active season, flooding can inundate escape cover, leaving it vulnerable to predation.

- o The snake is potentially subject to harm if its refuges are flooded during its hibernation period.

- o Snakes that are unable to find high ground during flooding can be washed away. The flood of 1986 apparently displaced some populations in the Sacramento area.

The valley elderberry longhorn beetle, which inhabits elderberry shrubs commonly found in riparian corridors, would be affected during a 200-year flood event if the flood were of sufficient duration to drown the beetle or destroy the elderberry shrubs. The relationship between inundation duration and mortality for the beetle is not known.

Growth and Development

Natomas. The no-action alternative could result in the loss of Swainson's hawk breeding and foraging habitat in two ways (availability of habitat is assumed in this analysis to be the limiting factor in hawk survival): (1) urbanization allowable under flood plain guidelines and (2) production of crops incompatible with the foraging requirements of the Swainson's hawk.

Consistent with the no-action land use projections discussed in Chapter 4, it is assumed that stringent local and Federal flood plain management regulations would make it infeasible to convert agricultural lands to urban uses after November 7, 1992, when the current moratorium on the use of updated base flood elevations expires. Therefore, loss of foraging habitat due to urbanization would not be a significant impact under this alternative.

In the absence of urban encroachment, the amount of foraging habitat available to the Swainson's hawk in Natomas is directly related to cropping patterns. Changing cropping patterns could significantly increase or decrease the extent of suitable foraging habitat. Because decisions on crop production are made by private landowners based on regulatory policy and market factors, reliable predictions concerning the expansion or contraction of Swainson's hawk foraging habitat over the assumed 100-year life of the project are not possible.

Rice fields, for example, which are generally inundated during the residency of the Swainson's hawk in Sacramento, provide few foraging opportunities for the hawk. If, at some future time, producing rice became economically infeasible, conversion to alternative crops would be likely. The production of suitable crops could potentially increase the foraging habitat by up to 25,000 acres--a significant increase in the regional Swainson's hawk population. If, on the other hand, new markets were opened up or demand were stimulated in existing markets, rice prices would rise, and lands currently compatible with Swainson's hawk foraging could be converted to rice production.

Coupled with these factors is the uncertainty concerning the precise cause(s) of the decline of the Swainson's hawk. It is possible that hawk populations could decrease even if sufficient suitable foraging habitat is preserved. As a result, any prediction of future without-project impacts on the Swainson's hawk is inherently speculative. Nevertheless, it was assumed for the purposes of this analysis that available habitat would be the limiting factor for the survival of the Swainson's hawk in the project area.

Given this assumption and the land use projections contained in Chapter 4 (Land Use), it is likely that little or no Swainson's hawk habitat will be lost to urbanization, but that fluctuating cropping patterns will cause corresponding fluctuations in the size of the Natomas Swainson's hawk population. Extirpation would only occur if unsuitable crops replaced a significant amount of suitable crops. A large-scale shift in historical cropping patterns that would work to the detriment of the hawk appears to be improbable, however, since, over the long run, the Natomas area is likely to support a varying mix of crops.

The reported causes of the decline in giant garter snake populations are urbanization, agricultural practices, predation, and competition. Without-project conditions would reduce urbanization, thereby reducing losses attributable to this cause in Natomas. Agricultural practices are most likely to continue fluctuating in response to market forces, causing corresponding fluctuations in the quality and quantity of giant garter snake habitat. A sufficient increase in demand for rice, for example, would increase the amount of land in Natomas devoted to rice production, and the amount of suitable giant garter snake habitat. Decreased demand for rice, brought on by such factors as reduced crop subsidies, could lead to the conversion of rice fields to other crops. This would decrease the amount of suitable giant garter snake habitat.

Rice farming plays an important role in sustaining the existing giant garter snake populations in the Natomas basin (see the giant garter snake discussion in the "Significance Criteria" section, above). Like the Swainson's hawk, therefore, it is expected that giant garter snake populations will fluctuate as cropping patterns change from year-to-year under without-project conditions.

Predation and competition would continue to have a relatively constant adverse impact on the giant garter snake.

Lower American River. The American River Parkway contains numerous areas that could provide potential nesting habitat for Swainson's hawk. Due to the high level of human disturbance and lack of nearby foraging opportunities, however, no nests have been identified in the parkway.

Outside the parkway, about 1,400 acres of vacant, undeveloped land within the 100-year flood plain south of Meadowview Road in south Sacramento provides foraging opportunities for Swainson's hawks nesting along the Sacramento River. Between river mile 47.2 and 52.7, a total of six Swainson's hawk nests have been identified (five on the Yolo County side of the Sacramento River and one on the Sacramento County side). Of the six nests, two successfully fledged young during the 1991 breeding season. Under without-project conditions, vacant land in the Meadowview area would not be developed and would therefore continue to provide foraging habitat for the Swainson's hawks nesting nearby. As a result, no impacts are expected under the no-action alternative.

As noted above, the giant garter snake is not known to occur within the levees of the lower American River, but small populations do occur in the 100-year flood plain of the American River near the southern Sacramento City limits. Any development affecting these areas under the no-action alternative could adversely affect these giant garter snake populations. Winter flooding, primarily from the Morrison Creek Stream Group, will also continue to affect these populations.

Upper American River. Swainson's hawk is not known to nest or forage within the impact zone of the proposed project. Similarly, the giant garter snake does not inhabit the Upper American River project area. Consequently, impacts to these species are not anticipated.

SELECTED PLAN

Direct Impacts

Natomas. Approximately 626 acres of existing levees and adjacent lands could be temporarily disturbed as a result of levee construction and borrow site activities required under the selected plan. This disruption would occur for one season. About 20 acres of open space would be permanently modified to accommodate construction of new levees along Dry and Arcade Creeks. This area currently provides limited opportunities for Swainson's hawk foraging. Because of the location, quality, and amount of the habitat involved, however, this permanent modification would not constitute a significant impact.

Construction activities for the selected plan are not expected to directly affect Swainson's hawk nesting habitat sites since all proposed construction sites are more than 0.5 mile from existing nest sites. Further, construction would not require the removal of potential nesting trees.

Operational impacts associated with the selected plan in Natomas involve maintenance activities during nonflooding periods and pumping activities during flood periods. Maintenance activities include inspection and repair of levees, and periodic removal of woody vegetation from the levee side slopes. Potential impacts on Swainson's hawk, either positive or negative, would depend on the timing and nature of the levee maintenance. For example, periodic mowing of the levee slopes would benefit Swainson's hawk by increasing the vulnerability of prey similar to the situation described by Estep (1989) in which Swainson's hawks were frequently observed following farming equipment that was exposing prey. Further, the removal of shrub vegetation would also benefit Swainson's hawk by increasing the amount of forage habitat. However, if mowing activities were conducted in the fall, after the departure of the species, no benefit would be derived.

Direct construction impacts to the giant garter snake are possible in areas where waterside levee modifications would take place. These areas include the Main Avenue bridge, sites along the NEMDC, and the site of the NEMDC pumping plant near the mouth of Dry Creek. The giant garter snake has been sighted in the NEMDC north of Elverta Road. Because similar habitat is also present south of that location, the giant garter snake can be assumed to be present there also (Wolff, pers. comm. 1991). Levee construction activity in these areas could disturb resident giant garter snake. This is considered to be a potentially significant impact.

Construction impacts associated with the relocation of toe drains along the Sankey Road portion of the NEMDC are also possible. These drains, which are located at the base of the levees, would be relocated to accommodate the raising of Sankey Road. Because toe drains are used for irrigation and drainage (J. Clifton, Reclamation District 1000, pers. comm., 1991), they hold summer water and may provide suitable habitat for giant garter snakes. Relocation of these drains would increase the scope of the disturbance to resident giant garter snakes.

Levee enlargement along Dry Creek and Arcade Creek could affect toe drains. Because these toe drains are not used to convey irrigation or agricultural drainage flows, however, they are unsuitable as giant garter snake habitat.

Operational impacts associated with the selected plan involve (1) maintenance activities during nonflooding periods and (2) pumping activities during flood periods. Maintenance activities include inspection and repair of levees and periodic removal of woody vegetation from levee side slopes. Neither activity is expected to affect the giant garter snake. Waters would be pumped over the floodgate on the NEMDC only during periods of flooding, and all flows would be confined to the channel. Because giant garter snakes are secure hibernating during the winter rainy season, no adverse impacts are expected. By reducing the risk of flooding during hibernation, the flood control project would benefit the giant garter snake. Dormant snakes are drowned if their burrows are inundated.

Lower American River. No project-related activities are anticipated along the lower American River under the selected plan.

Upper American River. Swainson's hawk is not expected to forage or nest within the impact zone of the proposed flood control dam, and no impacts are anticipated.

The giant garter snake does not occur in the upper American River project area.

The valley elderberry longhorn beetle is known to occur in the upper American River canyons within the inundation zone of the proposed flood control dam. Table 8-2 summarizes the results of habitat mapping done on elderberry shrubs in the upper American River canyons and reports the assumptions made concerning projected losses. Because inundation will be most frequent in the elderberry shrub's preferred habitat--immediately adjacent to the river--losses would be highest where shrub densities are also highest. Higher on the canyon walls, where shrub densities are lowest, inundation frequency and attendant shrub losses would also be low. There will be additional studies done of the valley elderberry longhorn beetle in the upper canyon.

TABLE 8-2. Elderberry Shrub Losses in the Upper American River Canyon

Shrub Density Per Acre	Number of Acres	Frequency Inundation	Assumed Losses Per Acre	Total Assumed Losses (No. of Shrubs)
5 or more	601	Most Frequent	5	3,005
1 to 5	1,739	Intermediate	3	5,217
less than 1	1,660	Least Frequent	1	1,660
TOTALS	4,000			9,882

Indirect Impacts

Natomas. There are currently 47,622 acres of agricultural and vacant land in the Natomas Basin. See Chapter 4, Land Use. Approved general plans covering the Natomas basin call for 7,913 acres of that land to be converted to urban uses by 2010. It is expected that the provision of increased flood protection will permit urbanization to proceed in accordance with these plans. As shown in Table 8-3, 38,989 acres of land is currently in cultivation in Natomas. Because it is not known how many of the 7,913 acres that will be converted will fall into the "agriculture" (as opposed to the "vacant") category, a straight proportion will be used to estimate that amount. Of the 47,622 total agricultural and vacant acres, 81.9 percent (38,989) is in agriculture. Applying this proportion to the 7,913 acres that will be converted from agricultural and vacant to urban uses yields 6,481 acres of lost agricultural lands.

Of the 38,989 cropped acres in Natomas, 12,616, or 32.4 percent, is suitable foraging habitat for the Swainson's hawk. The remainder are in crops that either do not produce adequate quantities of the rodents, birds, and insects on which the hawk feeds, or else produce too much vegetative cover to allow the hawk to hunt. (See Appendix P, Endangered Species.) Applying this proportion to the estimated loss of agricultural land derived above, and assuming that the ratio of suitable to unsuitable forage habitat remains constant, the total loss of suitable forage habitat due to the indirect impacts of the selected plan comes to 2,100 acres (32.4 percent of 6,481 acres). This loss would be significant and would require mitigation.

Table 8-3. Estimated Crop Acreage and Suitability Rating for Forage Cover for Swainson's Hawk in the Natomas Area

CROP	SACRAMENTO COUNTY[1]	SUTTER COUNTY[1]	TOTAL BY CROP	HABITAT RATING[2]
Alfalfa	830	152	982	1
Sugar Beets	2,510	1,099	3,609	5
Tomatoes	1,124	124	1,248	6
Wheat	3,056	1,268	4,324	8
Corn/Grain	1,995	458	2,453	8
Safflower	2,019	634	2,653	9
Rice	9,620	14,017	23,637	10
Orchard[3]	83		83	10
TOTAL	21,237	17,752	38,989	

[1]U.S. Fish and Wildlife Service, 1990
[2]Estep, 1989
[3]Sacramento County, September, 1990.

If the general plan modifications currently under consideration in Sacramento and Sutter Counties are approved, the size of this loss could be larger. See Chapters 4 (Land Use) and 18 (Growth-Inducing Impacts) for descriptions of these proposed plan changes.

Regardless of the growth scenario on which estimated Swainson's hawk impacts are based, the use of straight proportions in the estimation process (as was done above) will almost certainly result in an overestimate of habitat losses. The reason is that current growth plans and proposals will result in significantly greater losses to rice (a crop that creates unsuitable hawk foraging habitat) than it will to the alfalfa, sugar beet, tomato, and grain crops in which the hawk primarily forages. A casual examination of currently planned and proposed development maps (Sacramento County, September 1990; Planning Center 1991; City of Sacramento, May 1986, November 1988, and January 1988) and a map of current Natomas cropping patterns (see, for example, Department of Water Resources, 1984) will show that much of the best hawk foraging territory along the Sacramento River is not currently being considered for development. Most of the foreseeable development in the Natomas basin will be to the east of this area, where rice is the predominant crop.

Development facilitated by increased flood protection in Natomas could have significant adverse impacts on the giant garter snake. Lost habitat, particularly rice fields and their associated drainage canals, impeded movement corridors, pollutant-laden urban runoff, increased road kill, and other forms of human disturbance would all take a toll on the existing giant garter snake population. The critical variable affecting giant garter snake survival is the maintenance of suitable aquatic habitat and the ability to supply that habitat with sufficient summer flows.

Development in Natomas could also entail some loss of elderberry shrubs, which are habitat to the valley elderberry longhorn beetle.

Lower American River. Construction of the flood control dam would permit approximately 1,400 acres of vacant, undeveloped land south of Meadowview Road in south Sacramento to be converted to urban uses in accordance with existing local land use plans. Without the project, high base flood elevations would make development of this area infeasible. Most of this land supports forage for the Swainson's hawk. Accordingly, loss of this habitat would constitute a significant adverse impact.

Giant garter snakes have been sighted in the Meadowview area. However, this area is not believed to sustain a viable population of the species (Hanson, pers. comm., 1991). Accordingly, growth facilitated by the project would not result in any substantial loss of habitat used by the giant garter snake.

Upper American River. The Highway 49 replacement identified for the selected plan is not expected to alter local traffic patterns. Therefore, under this plan, the project would have no effect on growth in the foothills.

400-YEAR ALTERNATIVE

The direct and indirect impacts associated with this alternative would be the same as those described for the selected plan.

150-YEAR ALTERNATIVE

Direct Impacts

The direct impacts of the 150-year alternative in Natomas would be substantially the same as described under the selected plan.

In the lower American River area, construction activities involving Folsom Dam and the levee system would not affect Swainson's hawk because the affected construction areas provide little prey, and no hawks have been identified nesting in the area. However, 600 acres of grain crops now under cultivation in the Sacramento bypass would revert to grassland. This grassland should continue to produce forage for the Swainson's hawk in an amount comparable to that produced under the current cultivation regime.

The giant garter snake is not known to occur along the lower American River. (See the "significance criteria" section above). Construction activities involving Folsom Dam and the levee system along the lower American River would not, therefore, affect the giant garter snake.

Levee construction activities may result in a loss of elderberry shrubs serving as hosts for the valley elderberry longhorn beetle. This would constitute a significant impact.

Operational activities for this alternative would involve (1) an increase in the annual floodwater reservation in Folsom Reservoir during the flood season and (2) increased design flows in the lower American River during flood periods. Because these operational conditions would occur during the rainy season when the giant garter snake is secure in hibernation and the Swainson's hawk is wintering in South America, no direct operational impacts would result. However, changes in the river's flow regime could affect elderberry plants, with possible loss of plants and resident beetles.

The 150-year alternative would involve the reoperation of Folsom dam in order to increase the amount of flood storage space in the reservoir, resulting in reduced capacity for water and power production. That lost production could trigger adjustments in the operations of the CVP system--possibly at Shasta Reservoir. The resulting altered flow regimes could potentially affect the Sacramento River winter-run chinook salmon and the delta smelt. The likelihood and extent of these impacts is currently under study in connection with the Folsom reoperation project.

Reoperating Folsom could also adversely affect the bald eagle. The increased flood storage space at Folsom could decrease the size of reservoir's fishery, which is a food source for the eagle.

Because no project-related activities would take place in the upper American River canyons under this alternative, no threatened or endangered species in that area would be affected.

Indirect Impacts

The indirect impacts associated with the 150-year alternative in Natomas and the lower American River would be essentially the same as those described for the selected plan.

No indirect impacts would occur in the upper American River under this alternative.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Direct Impacts

Direct impacts in the Natomas area resulting from implementation of the 100-year (FEMA) alternative would be the same as those described under the selected plan. Direct impacts in the Lower American River and upper American River study areas under this alternative would be substantially the same as those associated with the 150-year alternative. No direct impacts would occur in the upper American River.

<u>Indirect Impacts</u>

Indirect impacts in the Natomas and lower American River areas resulting from implementation of the 100-year (FEMA) levee alternative would be the same as those described under the selected plan. No indirect impacts would occur in the upper American river.

100-YEAR (FEMA) STORAGE ALTERNATIVE

<u>Direct Impacts</u>

Direct impacts in the Natomas area resulting from implementation of the 100-year (FEMA) storage alternative would be the same as those described under the selected plan. Direct impacts in the lower American River areas under this alternative would be substantially the same as with the 150-year alternative. There would be no direct impacts in the upper American River area.

<u>Indirect Impacts</u>

Indirect impacts in the Natomas and lower American River areas resulting from implementation of the 100-year (FEMA) storage alternative would be the same as those described under the selected plan. There would be no indirect impacts in the upper American River area under this alternative.

100-YEAR LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

<u>Direct Impacts</u>

Direct impacts in the Natomas area resulting from implementation of the 100-year (FEMA) levee/storage and spillway alternative would be the same as those described under the selected plan. Direct impacts in the lower American River area would be substantially the same as those occurring under the 150-year alternative. There would be no direct impacts in the upper American River area.

Indirect Impacts

Indirect impacts in the Natomas and lower American River areas resulting from implementation of the 100-year (FEMA) levee/storage and spillway alternative would be the same as those described under the selected plan. There would be no indirect impacts in the upper American River.

MITIGATION

SELECTED PLAN

Impacts to the Federally listed valley elderberry longhorn beetle and to the State-listed Swainson's hawk and giant garter snake are expected under the selected plan. In order to avoid jeopardizing a Federally listed species, a mitigation plan must be developed. This plan must be based on recommendations contained in a Biological Opinion issued by the FWS. The DFG has stipulated that specific and legally enforceable mitigation assurances must be incorporated into the final project document before a finding of "no jeopardy" to State-listed species can be issued.

Direct Impacts

In order to mitigate for the loss of valley elderberry longhorn beetle habitat due to project construction and operation in both the upper and lower American river areas, elderberry shrubs will be replanted according to the loss-to-replacement ratios shown in Table 8-4. Losses in the lower American River under the 150-year and all three 100-year alternatives have not been estimated, but elderberry shrubs generally occur at a rate of 5 or more per acre along the lower American River. This would require that a 5:1 replacement ratio be used for most lower American River replants. Estimated losses in the upper American River under the selected plan and the 400-year alternative are shown in Table 8-2.

The following measures will be taken to offset the adverse impacts to the beetle and its habitat:

- o 2,700 acres will be planted with about 33,000 elderberry shrubs and managed for the valley elderberry longhorn beetle.

- o Maintenance and monitoring of the 2,700 acres for 3 years; 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.

- o Revegetation of areas behind the flood control dam as described in the Adaptive Management Plan.

TABLE 8-4. Elderberry Shrub Replacement Ratios

Shrub Density per Acre	Shrubs Affected	Replacememt Ratio	Replacement Shrubs
5 or more	3,005	5:1	15,025
1 to 5	5,217	3:1	15,651
less than 1	1,660	1:1	1,660
Total	9,882		32,336

Implementation of the following measures would reduce any significant direct impacts on the Swainson's hawk and the giant garter snake to a less than significant level.

- o DFG has stipulated that all Swainson's hawk foraging habitat that is temporarily disturbed by construction activities be reseeded/replanted with vegetation suitable for Swainson's hawk foraging.

- o Because all presently known construction sites are located a minimum of 1 mile from the site of active Swainson's hawk nests (the closest nest to proposed construction activity is at river mile 77.5R), potential disturbance to nesting hawks would be insignificant. However, in the event nest(s) are established at new sites within 1/2 mile of proposed construction sites, or if new construction sites are identified within 1/2 mile of currently known Swainson's hawk nests, such work will be deferred until after the departure of the hawks in the fall, unless it is determined by the DFG that proposed construction activities would not impose serious impacts to nesting hawks.

Direct construction and cperation impacts to the giant garter snake are possible due to (1) waterside levee modifications along the NEMDC, (2) the raising of the Main Avenue Bridge, and (3) the modification of toe drains along 3,000 feet of the NEMDC (at Sankey Road). The following measures would reduce this potentially significant impact to a less than significant level (see Brode and Hansen, 1991, in Appendix P; Brode, 1990; City of Sacramento, 1990):

- No grading, excavating, or filling may take place in or within 30 feet of existing giant garter snake habitat between October 1 and May 1 unless authorized by the DFG.

- Because newly created habitat takes several years to mature, lost habitat should be replaced at least at a 2 for 1 ratio. Replacement habitat is needed in this proportion in order to overcome interim population declines that are expected between the loss of the original habitat and the maturation of the replacement habitat (see Brode and Hansen, 1991, in Appendix P).

- Construction of replacement habitat should begin as soon as possible after the approval of a conservation plan. Delays in the construction of replacement habitat would exacerbate the habitat maturation problem discussed in the previous item.

- Water may be diverted as soon as the new habitat is completed, but placement of dams or other diversion structures in the existing habitat will require onsite observation and consultation with the DFG.

- The new habitat would be revegetated as directed by DFG or as stipulated in the environmental documents.

- Dewatering of the existing habitat may begin any time after November 1, but must begin by April 1.

- Any giant garter snake surveys required by DFG would be completed to the satisfaction of the department prior to dewatering.

- All water must be removed from the existing habitat by April 15, or as soon thereafter as weather permits, and the habitat must remain dry (no standing water) for 15 consecutive days after April 15 and prior to excavating or filling the dewatered habitat.

- o The DFG would be notified when dewatering began and when it was completed. The department would inspect the area to determine when the 15-day dry period may start.

- o Excavation should be confined to one side of a canal in a given year. When possible, avoid excavating the banks above the high-water level. One side of the canal--preferably the west or north side--should be left undisturbed indefinitely.

- o To the extent possible, vehicular traffic along the canals should be restricted to maintenance or other official vehicles.

__Indirect Impacts__

All future development in Natomas would be preceded by mandatory environmental review consistent with State law, local planning policies, and Federal law, where appropriate. To prevent development in Natomas from jeopardizing the continued existence of the Swainson's hawk population in the basin, the following measures could be adopted by the local agencies (City of Sacramento, County of Sacramento, and County of Sutter):

- o In conjunction with the Sacramento Urban Area Levee Reconstruction Project, the monitoring of the breeding activity of the Swainson's hawk in the vicinity of the project should be continued. In addition, monitoring efforts should be expanded to include investigation of the foraging habitats used by Swainson's hawk in Natomas.

- o In coordination with the DFG, local agencies should identify and inventory parcels of land that are currently suitable as Swainson's hawk foraging habitat, based on known habitat and cover crop preferences.

- o Local agencies should adopt the goal of taking prudent and reasonable measures to maintain existing stocks of breeding Swainson's hawks in Natomas. Possible means to accomplish this goal include:

    1. Preservation and maintenance of a 1-mile-wide habitat set-aside east of, and immediately adjacent to, the Sacramento River from the north side of the confluence of the Sacramento and American Rivers north to the south side of the NCC.

This habitat could be preserved by acquiring fee title or easements or zoning as a "Habitat Conservation Zone" or agricultural preserve. Steps would have to be taken to assure that these zoning designations could not be subsequently changed. Mechanisms, such as a transfer of development rights system, could be developed to implement a set-aside.

Such a program would require the eventual acquisition of up to about 10,900 acres. Most of the land in this buffer area is currently designated for agricultural use. Draft land use plans in the south Sutter County General Plan Amendment Initial Study (1990) indicate these lands would remain in agricultural use. The Open Space Element of Sacramento County's Draft General Plan (1990) indicates the Sacramento County portion would remain as Open-Space and designated as Airport Buffer Lands and/or Airport Approach Lands. As such, urbanization would be an inconsistent land use, whereas habitat preservation would be a compatible land use.

Adoption of this measure would result in consistent and conjunctive mitigation and distribute costs over an array of mitigation purposes, including habitat conservation, noise, open space, and agricultural preservation. In order to assure that this program is implemented, local agencies could make contractual commitments in the proposed memorandum of agreement and in the local cost-sharing agreement.

2. Establishment of a mitigation bank and assessment district for the replacement of lost Swainson's hawk foraging habitat on an acre-for-acre basis for individual projects. Under this scheme, the local agencies would, in consultation with the DFG, designate and zone large parcels of land suitable as Swainson's hawk foraging habitat. Each approved development would require the purchase of an equivalent acreage of foraging habitat within these designated habitat conservation areas on an acre-for-acre basis. If suitable foraging habitat was insufficient to accommodate planned development, previously unsuitable lands, such as rice fields, would be

converted into appropriate cover. In addition, a mitigation assessment district would be established to provide a source of continuous funding to maintain the mitigation lands.

3. To the extent feasible, preserve foraging habitat present within proposed developments.

4. Preserve all mature riparian woodland areas for Swainson's hawk nesting sites.

5. Rely solely on existing general plan status and agricultural zoning to preserve existing agricultural land uses.

Implementing the following measures would reduce significant indirect impacts on the giant garter snake to a less than significant level:

- The establishment or maintenance of core habitat areas within each of three designated subareas in the Natomas basin. (See Brode and Hansen, 1991, Appendix P.) These core areas would all be interconnected by a series of canals. The three areas are (1) west of SR 99/70 and north of I-5, (2) south and west of I-5 and north of I-80, and (3) east of SR 99/70 and I-5 and north of I-80.

- Channels with slow-moving water. DFG has recommended parallel channels separated by an 8- to 12-foot-wide upland berm. Channel edge habitat is essential.

- DFG is recommending a greater than 2:1 mitigation ratio for loss of canal/channel habitat. Replacement habitat is needed in this proportion in order to overcome interim population declines that are expected between the loss of the original habitat and the maturation of the replacement habitat. (See Brode and Hansen, 1991, Appendix P.)

- Construction of replacement habitat should begin as soon as possible after the approval of a conservation plan. Delays in the construction of replacement habitat would exacerbate the habitat maturation problem discussed in the previous item.

- Suitable upland refugia for basking, and winter hibernation above high water.

- o Maintenance of a reliable and abundant food supply.
- o Long-term maintenance and monitoring are essential for all mitigation areas.
- o Strict channel maintenance criteria for mowing, clearing, etc., is essential.
- o Compatibility with other uses.

The following two measures could also be taken for the giant garter snake:

- o Preserve and enhance earthen canals.
- o Provide buffer zones around habitat areas.

Development-caused impacts to elderberry shrubs, and the valley elderberry longhorn beetle for which they are habitat, would be mitigated as described in the "direct impacts" section.

400-YEAR ALTERNATIVE

Same as the selected plan.

150-YEAR ALTERNATIVE

Natomas

Same as the selected plan.

Lower American River

Mitigation for lost valley elderberry longhorn beetle habitat under this alternative would consist of the same measures as those described under the selected plan.

To assure that winter run chinook salmon and delta smelt populations remain at preproject levels, the project must not trigger changes in the Sacramento River flow regime that would adversely affect these species. If flows in the Sacramento River are to remain unaltered, the water and power that are lost to the Central Valley Project due to the reoperation of Folsom Reservoir would have to be purchased from sources outside of the Central

Valley Project. Such purchases would have to be arranged and funded under the American River Watershed Investigation.

An increased flood storage pool in Folsom Reservoir could cause a decrease in the size of the fishery. That decrease could adversely affect the bald eagles which use that fishery. This impact could be mitigated by planting enough fish in the reservoir to enable the eagle population to remain at preproject levels.

Upper American River

No mitigation would be required.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Mitigation for Natomas under this alternative would be the same as with the selected plan. In the lower American River, mitigation would be the same as with the 150-year plan. There would be no impacts to endangered species under this alternative in the upper American River; therefore, no mitigation is required.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Mitigation for Natomas under this alternative would be the same as with the selected plan. In the lower American River, mitigation would be the same as with the 150-year plan. There would be no impacts to endangered species under this alternative in the upper American River; therefore, no mitigation is required.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

Mitigation for Natomas with this alternative would be the same as with the selected plan. In the lower American River, mitigation would be the same as with the 150-year plan. There would be no impacts to endangered species under this alternative in the upper American River; therefore, no mitigation is required.

CHAPTER 9

CULTURAL AND PALEONTOLOGICAL RESOURCES

This chapter discusses cultural and paleontological resources within the study area for the selected plan and alternatives. Specific locations of cultural and paleontological resources have been omitted in accordance with Federal and State confidentiality requirements.

CULTURAL RESOURCES

POLICIES, LAWS, AND REGULATIONS

Cultural resources or historic properties are the finite, nonrenewable vestiges of our nation's prehistoric and historic past. As such, they are subject to Federal historic preservation policies, laws, and regulations which are based on the principles that:

- o Important historic properties cannot be replaced if they are destroyed.
- o Preservation of this irreplaceable heritage is in the public interest so that the cultural and historical foundations of the Nation will be maintained and enriched for future generations of Americans.
- o The Federal Government will provide leadership in the preservation of the prehistoric and historic resources of the United States.

Historic properties (buildings, structures, objects, sites, districts, archeological and submerged resources) must be considered during project planning and execution in accordance with the Section 106 review process of the National Historic Preservation Act of 1966, as amended (Public Law 95-515). Federal regulations issued by the Advisory Council on Historic Preservation, entitled "Protection of Historic Properties" (36 CFR 800), provide agencies with specific guidelines for implementing this review process.

The Section 106 review process requires the Federal agency responsible for the undertaking, in this case the Corps, to identify and evaluate historic properties that may be affected by its undertaking. Identification activities are undertaken to gather information about historic properties in an area in accordance with "Archeology and Historic Preservation: Secretary of the Interior's Standards and Guidelines" (Federal Register 48:190, September 29, 1983).

Consideration of these cultural resources is also required by the National Environmental Policy Act (Public Law 91-190); Archeological and Historic Preservation Act, as amended (Public Law 93-291); American Indian Religious Freedom Act (Public Law 95-341); Archaeological Resources Protection Act (Public Law 96-95); Abandoned Shipwreck Act of 1987 (Public Law 100-298); and Corps of Engineers planning guidance (Engineer Regulation 1105-2-100). In addition, the California Environmental Quality Act (CEQA; Public Resources Code 21000 et seq.) and Appendix K of the CEQA Guidelines require that project effects on historic and prehistoric archeological sites be addressed during preparation of an environmental impact report.

BACKGROUND

Prior to European contact, the Nisenan (Southern Maidu) Indians occupied the American River basin. Archeological excavations bear witness to their ancestry in this area for at least 4,000 to 5,000 years. The epidemics of 1833-36, and later the California gold rush of 1848, with its influx of settlers, were significant factors in the rapid demise of the Nisenan people. The Patwin Indians occupied portions of the study area within Yolo County. By the 1840's, Mexicans and Americans had overtaken their territory. Those who survived were either partially assimilated into the new American culture or were placed on small reservations by Act of Congress. Today, the archeological remnants of these Native American cultures include village and camp sites, rock art, seed- and acorn-grinding stations (bedrock mortars), hunting blinds, trails, and quarries (Johnson, 1978; Wilson and Towne, 1978).

One of the first Europeans to see the Central Valley was Pedro Fages on an expedition from Monterey in 1772. In 1827, Jedediah Smith is believed to have reached the American River, which he named "Wild River." Many other trappers, including several expeditions from the Hudson's Bay Company, explored the valley between the 1820's and 1840's. In 1837, California's

Spanish Governor Juan Bautista Alvarado gave the wild river its current name, "Rio de los Americanos"--American River. John Sutter settled in Sacramento in 1839 and established Sutter's Fort. Much of our knowledge of the Sacramento Valley in the 1840's comes from the journals of Army Corps of Engineers officer John C. Fremont and his cartographer Charles Pruess (Woodward and Smith, 1977).

The lower American River area was included in the Del Paso land grant in 1844. Originally deeded to Eliab Grimes, the grant came into the hands of James Ben Ali Haggin and Lloyd Tevis in 1862. Haggin became famous for his horse breeding on the rancho, but the bottom lands along the river were used only for grazing.

The Natomas area was not historically important until the Natomas Consolidated Dredging Company reclaimed the area known as the American Basin (now called Natomas), east of the Sacramento River between the American and Feather Rivers. Agriculture became the dominant industry in the area after the reclamation effort in 1913 (McGowan, 1961).

The upper American River area experienced significant and rapid development as an outgrowth of the gold rush. Remnants of extensive mining activities still exist in the river canyons, in gulches, and along many gravel bars. The American River and other streams in the area were subjected to many reclamation and development projects after the gold rush (Kyle, 1990).

Unlike the Sacramento River, traffic up the American was usually limited to high-flow periods when steamers and other vessels could navigate a few miles upstream. To a lesser extent, lumbering, ranching, and limestone quarrying occurred. The Great Depression witnessed a resurgence of gold mining and dredging. These later occupants of the 1930's often settled in structures or campsites originally constructed by the gold rush argonauts.

EXISTING CONDITIONS

General

Cultural resources surveys have been conducted along the Sacramento and American Rivers, including Folsom Lake, prior to the current study. These have resulted in the identification of a number of prehistoric sites within the study area; however, the entire area has not been systematically investigated. Many of the surveys date to the 1950's or earlier, and the data from them are not considered reliable in accordance with current standards.

With the exception of Folsom Lake and the upper American River, little attention has been paid to historic structures, historic archeological sites, and navigational features such as landings, piers, and moorings. Future work must include an evaluation of the historic sites, in accordance with Federal law, and is expected to increase the known inventory of cultural resources within the study area.

Natomas

Archival records reveal that seven prehistoric archeological sites and the former ethnographic village of Wijuna exist within the Natomas portion of the study area. One of the archeological sites, CA-Sac-164, has been evaluated and found to be eligible for the National Register of Historic Places. Another site, CA-Sac-16, has been removed from the National Register due to physical damage to its integrity. None of the other sites have been evaluated.

The structures of the Natomas East Main Drainage Canal, Natomas Cross Canal, and Pleasant Grove Creek Canal are greater than 50 years old. These will be evaluated for National Register eligibility during future project studies.

The Dry Creek portion of the study area also includes eight prehistoric sites. A more detailed discussion of these can be found in the draft EIS for the Corps' interim flood control investigation at Dry Creek (Roseville) (USACE, 1988, 1990). No sites in Dry Creek have been evaluated for the National Register.

Previously unsurveyed tracts of land along the Sacramento River are considered to have high potential for the discovery of additional cultural resources. For instance, historic research for the Corps' Sacramento River Bank Protection Project Phase III Study in August 1991 documented 35 potential historic site locations within 1 mile of the Sacramento River in Natomas (Jones, 1991). These locations have not yet been verified in the field, but will be checked during future project studies.

Lower American River

Within the study area, there are 13 known prehistoric sites on the north bank of the lower American River and 7 on the south bank. At least 20 Nisenan Maidu villages have been described by researchers, some of which are at the same locations as the prehistoric sites (Peak and Associates, 1978). Existing records show no recorded historic archeological sites in this portion of the study area.

The National Register lists two historic truss bridges and a vertical lift bridge across the lower river. Two of these, the Tower Bridge and the I Street Bridge, are also Historic Civil Engineering Landmarks. Because the Sacramento Weir is eligible for the National Register, any impacts to it also must be considered during future project planning. The system of weirs, levees, and floodways of the Sacramento and American Rivers are recognized as Historic Civil Engineering Landmarks.

Two prehistoric sites are known to exist within the Yolo Bypass south of the Sacramento Bypass. One of these sites was recently located during an archeological survey of 3,915 acres within the Yolo Bypass for the Corps' proposed Yolo Basin wetlands modification of the Sacramento River Flood Control Project (Bouey, 1991). Archeological surveys of the levees on both the east and west sides of the Yolo Bypass have been completed from the Sacramento Bypass south to the south fork of Putah Creek as part of the Corps' Sacramento Metropolitan Area Study. No prehistoric or historic sites were found here, and the potential for future impacts along the levees is minimal (Glover and Bouey, 1990). Additional studies are currently under way as part of the Corps' Yolo Bypass Flood Control Study, which also includes areas south of Putah Creek, Liberty Island, and New Holland Tract (Osborn, 1991).

Many cultural resources exist in the Folsom Reservoir area. Documentation prepared for the Corps' current Folsom Dam and Reservoir Reoperation Study indicates 55 prehistoric and 26 recorded historic resources below gross pool (Barrett, 1989). An archeological survey of 1,000 acres below gross pool at Folsom Reservoir is being undertaken as part of the reoperation study. The results of the archeological investigation will be available in February 1992.

Primary archival and secondary sources suggest that more than 200 other potential sites or features may exist in the reservoir (Peak and Associates, 1990). These have not been verified in the field because of their inaccessibility below the reservoir pool. The Folsom Powerhouse received National Register listing in 1973, but no archeological sites within Folsom Lake State Historic Park have been evaluated, declared eligible, or listed. The number of potential sites in these categories will not be known until the completion of a more reliable inventory.

Upper American River

Studies prepared by the University of California, Davis, for the USBR's authorized multipurpose dam project document a total of 1,589 historic and 125 prehistoric sites in the Auburn area (True, 1980). These prehistoric sites include villages and camps, food-processing stations (bedrock mortars), quarry sites, artifact scatters, and isolated artifacts. At least 14 known ethnographic sites also occur here.

Both the North and South Forks of the American River offer testimony to a profusion of historic activity stimulated by the gold rush. Identified historic features include settlements, structures, mines, mined areas, gravel bars, ditchline segments and remnants, isolated pits or trenches, isolated shafts and tunnels, check dams, trails, roads, bridges, wells, and unidentified ground disturbances (McCarthy, 1989).

The North Fork Dam, located 5 miles above Auburn on the North Fork of the American River, was built by the Corps in 1938 to provide containment of hydraulic mining debris. This dam, of single-arch design, stands 155 feet high and is 620 feet in length (Hagwood, 1981). Now over 50 years old, the dam must be evaluated for National Register eligibility.

The Highway 49 replacement would be in close proximity to the concrete arch bridge at Auburn, known locally as Mountain Quarries bridge, or the "No Hands" bridge. The bridge was constructed in 1911 just below the confluence of the North and Middle Forks of the American River. The bridge has been designated a Civil Engineering Landmark and is considered to be historically significant by numerous groups and individuals. However, as of August 1991 the State Historic Preservation Office (SHPO) had no record of a request for determination of National Register eligibility or a completed nomination form for the bridge. Five recorded archeological sites are also in the vicinity of the highway replacement.

A National Register nomination form was submitted to the SHPO in July 1991 for that portion of the Western States Trail from Michigan Bluffs to Last Chance (Kreutzberg, pers. comm., July 1991). SHPO staff has not yet reviewed the nomination form; therefore, the current status of the trail is pending. The reach of trail included in the nomination form is entirely outside of the Corps study area.

IMPACTS

General

It is the policy of the Federal Government to use those measures, including financial and technical, which foster conditions under which modern society can coexist in productive harmony with its archeological and historic resources. Since the nation's historic properties are known to be destroyed or substantially altered with increasing frequency, avoidance and preservation of cultural resources, to the extent feasible, is almost always the preferable alternative to mitigation. Likewise, CEQA guidelines direct public agencies to avoid damaging effects on archeological resources whenever possible.

Consideration will be given to measures that would avoid impacts to and preserve cultural resources within the area of potential effect. These measures could include relocation of roads and borrow sites, stabilization of banks with a potential for sloughing, and covering sites with protective caps or fill.

In those cases where avoidance and preservation are not possible, impacts to cultural resources are determined under the "criteria of effect" as defined in 36 CFR 800.9, "Protection of Historic Properties." These are the regulations implementing Section 106 of the National Historic Preservation Act. An "adverse effect" is one which diminishes the integrity of the property's location, design, setting, materials, workmanship, feeling, or association. Adverse effects include, but are not limited to:

- Physical destruction, damage, or alteration of all or part of the property.
- Isolation of the property from or alteration of the character of the property's setting when that character contributes to the property's qualifications for the National Register.
- Introduction of visual, audible, or atmospheric elements that are out of character with the property or alter its setting.
- Neglect of a property, resulting in its deterioration or destruction.
- Transfer, lease, or sale of the property.

Significance Criteria

All five criteria of adverse effect could be applied to some of the cultural resources within the project area. For purposes of the EIS/EIR, these adverse effects, or impacts, are considered significant if the affected property is a site, building, structure, or object which is recognized as culturally or historically significant based on the following institutional, public, or technical criteria.

Institutional Recognition of Cultural Resources. National Historic Landmarks and the National Register of Historic Places are the primary forms of institutional recognition of cultural resources used by Federal agencies. These are a reflection of a number of Federal historic preservation laws which are grounded in the early 20th century concepts of conserving cultural resources for the benefit of future generations. With the passage of The Historic Sites Act of 1935, Congress established a national policy to preserve for public use historic sites, buildings, and objects of significance for the inspiration and benefit of the people of the United States. The National Historic Preservation Act of 1966, as amended in 1980, forms the underlying structural basis of a national program to coordinate and support public and private efforts to identify, evaluate, and protect our historic and archeological resources (USDI, 1990).

National Historic Landmarks. A National Historic Landmark is a district, site, building, structure, or object that the Secretary of the Interior has determined possesses exceptional value in commemorating or illustrating the history of the United States and which has been so designated under the authority of The Historic Sites Act of 1935 (16 USC 461). Acts of Congress and Executive orders may also create historic areas of the National Park System, all or portions of which may be determined to be of historic significance consistent with the intent of Congress (USDI, 1990). There are no National Historic Landmarks or National Parks within the study area.

National Register of Historic Places. The National Historic Preservation Act of 1966 (16 USC 470), as amended, authorizes the Secretary of Interior to expand and maintain a National Register of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, engineering, and culture. The National Register is an authoritative guide to be used by Federal, State, and local governments, private groups, and citizens to identify the Nation's cultural resources and to indicate what properties should be considered for protection from destruction or impairment (36 CFR Part 60).

The National Register was designed to be and is administered as 36 CFR 60.4 Criteria for Evaluation. There are four criteria applied to evaluate properties for the National Register of Historic Places. These criteria are worded in a manner to provide for a wide diversity of resources. The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association and

- That are associated with events that have made a significant contribution to the broad patterns of our history; or
- That are associated with the lives of persons significant in the past; or
- That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinctive entity whose components may lack individual distinction; or
- That have yielded or may be likely to yield information important in prehistory or history.

Several sites within the area of potential effect are listed or eligible for the National Register. No sites within the study area were evaluated by the Corps, nor were any sites evaluated by the USBR as part of its multipurpose dam project. Evaluation by the Corps will be accomplished in the continued planning and engineering phase of the investigation following submittal of the feasibility report and EIS/EIR for Washington-level review and authorization of the proposed project by Congress.

The historic cultural resources associated with 19th century mining in the upper American River are likely to be determined eligible for the National Register of Historic Places as a district. A district is a geographically definable area possessing a significant concentration, linkage, or continuity of sites, buildings, structures, or objects united by past events or esthetically by plan or physical development.

State Historic Landmarks. Historic landmarks are sites, buildings, or features which are considered important enough to deserve landmark status. To be designated a State Historic Landmark, a site must be of statewide significance and have anthropological, cultural, military, political, architectural, economic, scientific or technical, religious, experimental, or other value. Landmarks are officially designated by the California State Historical Resources Commission. The nine-member commission is appointed by the Governor (Office of Historic Preservation, 1990).

Points of Historical Interest. These are sites of local interest. They may be registered as a point of historical interest if so recommended by a county board of supervisors and approved by the State Historical Resources Commission (Office of Historic Preservation, 1990).

Significance Based on Public Recognition. The American Society of Civil Engineers established a national committee in 1964 in order to recognize and identify the Nation's significant civil engineering works. Projects which represent a significant facet of civil engineering and which are also of historic engineering interest may be nominated as national or local Historic Civil Engineering Landmarks. Several of these projects are within the study area, including the Auburn concrete arch bridge (Mountain Quarries/No Hands bridge); I Street and Tower Bridges in Sacramento; Sacramento Weir; and entire system of levees, weirs, and floodways along the Sacramento and American Rivers (American Society of Civil Engineers, 1976).

Other private organizations also recognize and mark historic sites in California. These include the Native Daughters of the Golden West, Native Sons of the Golden West, Daughters of the American Revolution, and E. Clampus Vitus (Kyle, 1990).

Numerous public comments on the draft EIS expressed concern over the loss of historic mining resources, portions of the Western States Trail and other historic roads or trails, inundation of the Mountain Quarries/No Hands bridge, and impacts to Native American sites. Studies have demonstrated that there is almost universal respect attributed by humans to cherished places such as historic sites (Hiss, 1990).

Popular literature is also a source of public recognition. "Historic Spots in California" (Kyle, 1990) was first published in 1932 as an effort to commemorate and preserve California history. Now in its fourth edition, the book continues to reflect the public's interest in sites designated by Federal, State, or local governments and private organizations. The history of specific locations within the study area can also be found in published accounts such as "California Place Names" (Gudde, 1960), "Ghost Towns and Mining Camps of California" (Nadeau, 1965), and "Gold Districts of California" (Clark, 1970).

Significance Based on Technical Recognition. Archeological resources are the prehistoric and historic material remains of past human life or activities. They are nonrenewable resources; that is, the cultural practices of the ethnic groups or societies with whom the resources are associated usually no longer exist. Resources are of archeological interest when they are capable of providing scientific or humanistic understandings of past human behavior, cultural adaptation, and related topics through the application of scientific or scholarly techniques such as controlled observation, contextual measurement, controlled collection, analysis, interpretation, and explanation. Preservation of archeological resources is important because no one can predict future technology for the study of these sites or determine what research questions will be important.

Federal land managers are required to provide protection to archeological resources located on public lands and Indian lands of the United States in accordance with provisions of the Archaeological Resources Protection Act of 1979 (16 USC 470aa-11), as amended. Protection must be afforded to these resources regardless of whether they have been listed or determined eligible for the National Register.

No-Action Alternative

Impacts to certain cultural resources would occur even without a flood control project. Urban expansion and agricultural practices would continue to destroy prehistoric and historic sites. Flooding in excess of the current level of protection could cause significant damage to some cultural resources in both Natomas and the lower river. Natural processes such as erosion, root and rodent intrusion, and grazing are known to affect archeological sites. Vandalism, through deliberate looting and collecting, is a national problem and is expected to continue.

Sites below gross pool at Folsom Reservoir are currently affected by fluctuations in the reservoir pool during normal reservoir operations, significant levels of vandalism, and off-highway vehicle (OHV) use. Impacts to sites in the upper American River include ongoing destruction by OHV's; illegal looting by bottle collectors, persons using metal detectors, and other artifact hunters; construction of fire access roads; and natural causes such as mudslides, fires, erosion, and periodic flooding.

Selected Plan

The following section describes, in broad terms, the types and relative degrees of impacts caused by the selected plan.

Direct Impacts.

Natomas. Direct impacts in Natomas would be substantially the same for all the alternatives. Construction activities during the raising of existing levees could adversely affect prehistoric and historic sites. Several prehistoric sites in the Natomas area are known to extend beneath the levees to both the land and water sides. These impacts would be significant if the affected property met any of the institutional, public, or technical criteria outlined above.

Impacts are most likely to occur as a result of activities related to levee construction along Dry and Arcade Creeks where sites are already known to exist. Impacts are least likely to occur in the detention basin, NEMDC, NCC, and Pleasant Grove Creek Canal components, with the exception of direct impacts to these historic flood control structures. If necessary, the borrow site for levee construction would be relocated to avoid impacts to cultural resources.

Any historic buildings or structures identified in proximity to the levees may also be affected by levee expansion. Examples include historic piers, docks, moorings, and small agricultural outbuildings which may require removal during construction.

Impacts to sites could be avoided during construction of access roads or selection of borrow areas; however, avoidance is not usually possible for the actual levee construction or enlargement. A National Register of Historic Places evaluation of the levee system, already designated as a Historic Civil Engineering Landmark, will be required during future planning studies.

Lower American River. No direct impacts to cultural resources are expected to occur in the lower American River area because the selected plan does not include any features there.

Upper American River. The flood control dam would be built near the site of the USBR's authorized multipurpose dam.

Because the damsite has already been extensively modified by construction, no further impacts to cultural resources are expected. However, disturbance of significant sites could occur as a result of construction activities in project areas away from the damsite.

The 545,000-acre-foot detention zone would intermittently impound water to a maximum elevation of 868.5 feet and could result in impacts to 17 prehistoric and 163 historic sites. (See Table 9-1.) Most of the 17 prehistoric sites consist of bedrock mortars, although a rockshelter, lithic scatter, and housepit could also be affected. Among the 163 historic sites are settlements, mining complexes (with evidence of machinery and structures), mined areas (mainly tailings, trenches, pits, and shafts), areas of structural development, bridges, check dams, ditch remnants, and miscellaneous areas such as roads, trails, and trash dumps. The mined areas are believed to be among the least likely to suffer major impacts (McCarthy, 1989).

TABLE 9-1. Archeological Site Impact Summary for the Selected Plan: Upper American River

Site Type	Below Confluence	North Fork	Middle Fork	Total
Historic	10	79	74	163
Prehistoric	2	8	7	17
TOTAL	12	87	81	180

Data recovery efforts undertaken to document these sites would not be significantly affected because there would be no permanent impoundment of water behind the dam. However, periodic, temporary inundation of the canyon area could cause substantial site disturbance. Impacts from temporary inundation can include, but are not limited to, physical destruction by waves at varying elevations, bank slumping, and development of a new zone of frequent wet-dry cycling which enhances deterioration of some materials. The architectural and historic integrity of the North Fork Dam and the Mountain Quarries/No Hands bridge could be affected by periodic inundation as could the historic Western States Trail.

The Highway 49 replacement alignment would be in proximity to five archeological sites and near the historic Mountain Quarries/No Hands bridge. The Ponderosa Way bridge is greater than 50 years old, and it will be evaluated to determine eligibility for National Register listing. However, it is possible that the new high bridge and the highway replacement could be constructed without any direct impacts to historic, prehistoric, or submerged resources by designing the alignment to avoid these. Impacts from visual intrusion to the Mountain Quarries/No Hands bridge would be unavoidable.

Indirect Impacts. Archeological sites and historic structures in the Natomas area may be adversely affected by urban expansion. The areas of impact would generally be those covered by the South and North Natomas community plans. For the lower American River, the Meadowview area is affected. Based on the Highway 49 replacement identified by the Corps, the selected plan would not have any indirect impacts in the upper American River area.

Two unavoidable significant impacts would also occur which cannot be fully mitigated. There is a high potential for the loss of a number of historic sites during periodic inundation of the area behind the flood control dam. Sloughing due to soil instability would cause total or partial site destruction, including loss of integrity of location and displacement of stratigraphic context. The respect humans attribute to cherished places of their physical surroundings such as historic sites, open space, and the natural environment is considered to be almost universal (Hiss, 1990). Construction of a dam would intrude upon the quality of the historical setting and would detract from the public's visual and esthetic experience; however, the dam would not be visible from most areas.

Impacts from temporary inundation, including bank sloughing, wave action, and a new zone of wet-dry cycling, could be reduced by data recovery, documentation, and structural protection, but not to a less than significant level. Visual impacts of the dam and Highway 49 replacement could be significant and unavoidable.

400-Year Alternative

The impacts to cultural resources caused by the 400-year alternative would be the same as for the selected plan in the Natomas and lower American River areas. In the upper American River area, however, the design of the dam included in the alternative would create a larger inundation zone and thus increase the number of resources that could be affected by the project. The 894,000-acre-foot detention zone could temporarily impound water to a elevation of 942 feet and affect 23 prehistoric and 268 historic sites. (See Table 9-2.) Impacts to the North Fork Dam and Mountain Quarries/No Hands bridge and from the replacement of Highway 49 are the same as for the selected plan.

TABLE 9-2. Archeological Site Impact Summary for the 400-Year Alternative

Site Type	Below Confluence	North Fork	Middle Fork	Total
Historic	12	157	99	268
Prehistoric	2	13	8	23
TOTAL	14	170	107	291

150-Year Alternative

Direct Impacts. Impacts to cultural resources in Natomas would be the same as for the selected plan.

Construction activities during any modifications of the American River levees and increased flows in the channel could affect prehistoric sites near the river. Historic sites are less likely to occur in these locations, although construction on the water side of these levees could affect submerged resources. The Howe Avenue bridge is ineligible for National Register consideration. No prehistoric or historic sites are recorded near the bridge abutments. The Sacramento Weir has been determined eligible for the National Register. Modifications to the weir, such as lengthening it by 3,600 feet, would compromise its architectural and historical integrity. Impacts within the Yolo Bypass are expected to be minimal.

Permanently increasing Folsom Reservoir's seasonal flood storage to 650,000 acre-feet would result in a pool at or below an elevation of 395 feet during prescribed periods. Between the 395- to 466-foot (gross pool) elevation are 32 prehistoric and 13 historic sites. The 150-year plan would increase the disturbance already experienced by these sites as a result of reservoir fluctuation, erosion, intentional vandalism, and other factors and for longer periods of time due to reoperation. A total of 55 prehistoric and 26 historic recorded archeological sites would be affected, using the historic low elevation of 347 feet. A recent overview noted more than 200 other potential historic site locations. Numbers of both prehistoric and historic sites are expected to increase substantially after an extensive field survey and additional archival studies. An archeological survey of 1,000 acres below gross pool is expected to be completed for the Corps by January 1992. Lowering the spillway or adding new gates is expected to have no impacts on cultural resources other than those described above.

This alternative involves no construction at the Auburn damsite and therefore has no impacts in the upper American River.

Indirect Impacts. Same as the selected plan.

100-Year (FEMA) Levee Alternative

Raising and building levees in Natomas would have the same impacts as the selected plan. In the lower American River, impacts from levee modifications, including Yolo Bypass, and the Sacramento Weir (lengthening 1,400 feet) are similar to impacts of the 150-year alternative. Increasing flows in the lower American River to 145,000 cfs are also similar to, but probably less than, the 150-year alternative due to the smaller volume of water. This alternative involves no construction at the Auburn damsite and therefore has no impacts in the upper American River. Indirect impacts are the same as for the selected plan.

100-Year (FEMA) Storage Alternative

Raising and building levees in Natomas would have the same impacts as for the selected plan. No channel work below Folsom Dam would be done under this alternative; therefore, no impacts would occur in that reach of the lower American River.

Increasing Folsom flood storage to 590,000 acre-feet would result in a reservoir pool at elevation 404 feet or below during prescribed periods. Between elevations 404 and 466 feet, some 25 prehistoric and 10 historic sites exist. These would continue to be affected by reservoir fluctuation, erosion, intentional vandalism, and other factors and for longer periods of time due to reoperation. For impacts to sites below elevation 404 feet, see the discussion for the 150-year alternative.

This alternative would not result in impacts in the upper American River area. Indirect impacts in Natomas and lower

American River would be the same as described for the selected plan. There would be no indirect impacts in the upper American River.

100-Year (FEMA) Levee/Storage and Spillway Alternative

Raising and building new levees in Natomas would have the same impacts for this alternative as for the selected plan. Impacts from levee modifications in the lower American River are similar to the impacts of the 150-year alternative. Increasing flows in the lower American River to 130,000 cfs could affect known prehistoric archeological sites, depending upon the amount of erosion, if any, that could occur. Impacts to historic sites have yet to be specifically determined. The level of impact is likely to be less than for the 100-year (FEMA) levee alternative.

Increasing Folsom storage to 470,000 acre-feet would result in a reservoir pool at elevation 419 feet or below during prescribed periods. Between elevations 419 and 466 feet, some 23 prehistoric and 9 historic sites exist. These would be affected by reservoir fluctuation, erosion, increased intentional vandalism, and other factors. Additional information is provided in the discussion of the 150-year alternative.

This alternative involves no construction at the Auburn damsite and therefore has no impacts. Indirect impacts in the Natomas area and lower American River would be the same as described for the selected plan. There would be no indirect impacts in the upper American River area.

MITIGATION

A cultural resources Programmatic Agreement will be used to complete Section 106 responsibilities for the wide range of related Federal actions and secondary impacts anticipated for the selected plan. The agreement includes procedures for treatment of indirect impacts of later non-Federal approvals for developments in Natomas as well as direct impacts of the construction of the dam and levee improvements. The agreement was prepared in consultation with the State Historic Preservation Officer and the Advisory Council on Historic Preservation. A Programmatic Agreement is appropriate, in accordance with 36 CFR 800.13, when the effects on cultural resources cannot be fully determined prior to project approval.

Both Section 106 of the National Historic Preservation Act of 1966 and NEPA require the consideration of historic properties (buildings, structures, objects, sites, districts, and archeological and submerged resources) during project planning and execution. In this case, identification of all of these properties within the study area will not be completed before issuance of the final EIS/EIR. Instead, in consultation with the State Historic Preservation Officer, the Corps determined that sufficient evidence already exists to conclude that the proposed undertaking would adversely affect at least some historic properties.

Based on this appraisal and previous investigations, a Programmatic Agreement between the Corps, USBR, SHPO, and Advisory Council on Historic Preservation has been drafted. The non-Federal sponsor, the State of California, is a concurring party to the agreement. Under this agreement, the inventory and evaluation of historic properties for the National Register of Historic Places would take place as outlined in a mutually agreeable management plan developed during planning and engineering studies following the feasibility stage of the investigation while consideration is being given to authorization of the proposed project.

Mitigation costs up to 1 percent of the total amount authorized to be appropriated will be borne by the Federal Government in accordance with Section 7 of the Archeological and Historic Preservation Act of 1974. If mitigation costs exceed 1 percent, a waiver request shall be submitted in accordance with Section 208 of the National Historic Preservation Act Amendments of 1980. This waiver would be submitted through channels to the Chief of Engineers for approval. The waiver must then be forwarded to the Secretary of the Interior for concurrence and congressional notification. Any additional costs above the 1 percent will be cost shared between the Corps and the non-Federal sponsor in the same ratio as flood control costs.

Specific mitigation measures may include, but not be limited to, the following standards and guidelines promulgated by the Secretary of the Interior (FR 48:190):

- Archeological Documentation - Consisting of such activities as archival research, observation and recording of above-ground remains, and observation (directly, through excavation, or indirectly, through remote sensing) of below-ground remains. Archeological documentation is employed for the purpose of gathering information on individual archeological sites or groups of sites. It is guided by a scientific and theoretical framework of objectives and research methods. These mitigation measures would apply to both historic and prehistoric archeological sites.

- o Architectural and Engineering Documentation - Usually consisting of measured drawings, photographs, and written data. These are used to preserve information about a historic building, site, structure, or object that may be demolished or subject to loss of historical integrity. Documentation may be included in the Historic American Buildings Survey and the Historic American Engineering Record Collections in the Library of Congress. Documentation must adequately explicate and illustrate what is significant or valuable about the resource being recorded.

- o Historical Documentation - Includes a variety of techniques to document historic values and information about a property. It can be used in conjunction with archeological and architectural/engineering documentation or can be used as a final treatment in cases of threatened property destruction. It is undertaken to make a detailed record of the significance of a property within defined research objectives.

Mitigation measures such as historical, archeological, architectural, and engineering documentation are expected to be beneficial to the overall understanding of past lifeways during this historic time period. The mitigation measures will substantively enrich our knowledge of such topics as regional historic settlement patterns, evolution of certain types of mining technology, and the relationships between different ethnic populations involved in this extractive economy. However, data recovery itself is a destructive mechanism, which, while providing otherwise unattainable scientific information, also destroys that portion of the site being investigated.

An "adverse effect" can be reduced to a "no adverse effect" when the property is determined to be of value only for its potential contribution to archeological, historical, or architectural research, and when such value can be substantially preserved through the conduct of appropriate research, and such research is conducted in accordance with applicable professional standards and guidelines. It is expected that a number of sites within the project area will fall into this category.

With regard to long-term management of the resources after construction, Section 110 of the National Historic Preservation Act and implementing guidelines (FR 53:31, February 17, 1988) require that the heads of all Federal agencies shall assume responsibility for the preservation of historic properties which are owned or controlled by such agencies. The intent of Section 110 is to ensure that historic preservation is fully integrated into ongoing programs and missions of Federal agencies. The regulations suggest that Federal agencies seek opportunities for cooperative efforts with State and local agencies, Indian tribes, and the private sector in the preservation and use of historic properties.

PALEONTOLOGICAL RESOURCES

BACKGROUND

Paleontology is the study of fossils and the fossil record. The recording and interpretation of paleontological remains help scientists characterize past environments, geographic relationships, changes in the earth's climate and surface, and the evolution of biological species. Fossils are the remains of ancient plant and animal life. They are primarily found in sedimentary rocks. Fossils can also be preserved in igneous and metamorphic rocks when volcanic ash, lava flows, or other geologic occurrences form molds around the organism.

Section 102(2)(A) of the National Environmental Policy Act of 1969, as amended, requires agencies to comply with the mandate to utilize a systematic, interdisciplinary approach which will ensure the integrated use of the natural and social sciences and the environmental design arts in planning and in decision-making which may have an impact on the human environment. The 40 CFR 1508.27 requires considerations of the degree to which the action of an agency may cause loss or destruction of significant scientific, cultural, or historical resources.

Construction, use, and maintenance activities associated with the flood control alternatives may result in adverse impact on paleontological resources. The resources of concern are fossils expected to occur in various sedimentary geologic units that may be disturbed as a result of project activities. A review of the geological/paleontological literature and fossil locality records of the State Museum of Paleontology, University of California, Berkeley (UCMP), is summarized in this chapter for the area addressed in the ARWI.

The geological/paleontological setting is summarized for the upper American River area and for the Natomas and lower American River areas. Based on known fossil localities, potential adverse impact on paleontological resources is evaluated for each area. Recommendations are suggested for mitigation of the potential adverse impacts.

EXISTING CONDITIONS

Natomas and Lower American River

Geology. Downstream from Folsom Dam, the American River flows across alluvial sediments of the Central Valley. There are isolated patches of Tertiary deposits north of the American River and a larger body of the Tertiary Laguna Formation south of the river. Many of the latter deposits have been highly disturbed by dredging activity. Tertiary fossils have not been recorded from this area, but the Mehrten Formation is fossiliferous elsewhere, and all three formations (Table 9-3) exhibit sedimentary characteristics suitable for fossil preservation. Most of the deposits in the lower American River and Natomas areas are of Quaternary age. The Turlock Lake Formation is known to be fossiliferous, but no records are available from within the study area. Both the Riverbank Formation and the various younger, unnamed Quaternary alluvial sediments have produced fossils in the study area.

Table 9-3. Cenozoic Sedimentary Units Exposed Within 5 Kilometers of the Natomas-Lower American River Valley Area

++	Unnamed Quaternary deposits
++	Riverbank Formation (Quaternary)
+	Turlock Lake Formation (Quaternary)
	Laguna Formation (Pliocene)
+	Mehrten Formation (Miocene-Pliocene)
	Ione Formation (Eocene)

++ fossils recorded from unit within area
\+ fossils recorded from unit

Paleontology. The Teichert Gravel Pit East 1-2 local biota (UCMP localities V69129 and V75126; Harris, 1985; Jefferson, in press-a; Jefferson in press-b) was recovered from the Riverbank

Formation and has been dated at 103,000 years before present (Hansen and Begg, 1970). This locality has indicated that both plant and animal fossils can be recovered together from the Riverbank Formation, which is important for increasing understanding of ancient environments. There are several records of isolated large vertebrate specimens from alluvium within the Sacramento area. These occurrences have not been placed accurately within the Quaternary stratigraphic framework of the region.

Upper American River

Geology. Upstream from Folsom Dam, in the Sierra Nevada foothills, the American River flows mostly through metamorphic and igneous units that do not usually contain fossils. However, there are discontinuous occurrences of four Tertiary sedimentary formations on the uplands northwest of the river valley between Folsom and Auburn and along both sides of the Middle Fork (Table 9-4). These units are shown as undifferentiated Tertiary in this report. The Mehrten Formation and the "Auriferous Gravels" have yielded fossils (outside the study area) that provide important biostratigraphic and paleoenvironmental information. No reference to fossils from the Valley Springs Formation or Ione Formation was found, but both units include lithologies suitable for fossil preservation.

Table 9-4. Cenozoic Sedimentary Units Exposed Within 5 Kilometers of the Upper American River Area

++	Unnamed Quaternary deposits
+	Mehrten Formation (Miocene-Pliocene)
	Valley Springs Formation (Oligocene-Miocene)
	"Auferous" Gravels (Eocene-?Oligocene)
	Ione Formation (Eocene)

++ fossils recorded from witin area
\+ fossils recorded from unit

Paleontology. Fossils are often recovered from unnamed Quaternary sediments that are not distributed widely enough to appear on geologic maps. Two local faunas are known from such deposits within the upper American River. Hawver Cave (UCMP locality 1069; Miller, 1911; Stock, 1918; Hay, 1927; Miller and DeMay, 1942; Brattstrom, 1954, Kurten and Anderson, 1980; Lundelius et al., 1983; Jefferson, in press-a; Jefferson, in press-b) was about 8 kilometers east of Auburn (in a location since completely quarried out). It is the most diverse Quaternary faunal sample from the Sacramento region and includes the type specimens of one bird and two mammal taxa. Cool Quarry (UCMP V48005; Jefferson, in press-a; Jefferson, in press-b) yielded a much smaller sample, but includes three mammal species not reported from Hawver Cave.

IMPACTS

General

Impacts to paleontological resources include physical destruction due to construction activities, displacement of fossils from their stratigraphic context, vandalism, and unauthorized collecting. Construction impacts are difficult to avoid because the precise location of fossils often cannot be determined before they are unearthed by heavy equipment.

Natomas and Lower American River

In these two areas, there is some potential for disturbance of fossiliferous sediments during levee, weir, and channel modifications, as well as construction of pumping plants. Due to the very low relief and lack of outcrops on these flood plain areas, it is not practical to perform more than a cursory field inspection before construction commences.

Upper American River

Construction for the flood control dam and related activities, such as the Highway 49 replacement, may have an impact on paleontological resources. Potentially fossiliferous Tertiary units and Quaternary cave and fissure fills may be affected if these deposits are used as borrow sites for construction material or by placing access roads and storage areas within these units. After project completion, there is a potential for the temporary impoundment of storm runoff to submerge and erode fossiliferous sediments.

MITIGATION RECOMMENDATIONS

Involvement of a paleontological resource management team during the planning phase of this project may help avoid or reduce any adverse impacts. A field survey should be undertaken to determine if potentially fossiliferous sediments can be avoided by project activities. If potentially fossiliferous sediments will be disturbed, a mitigation plan should be implemented to salvage and interpret representative samples from affected units.

Natomas and Lower American River

Construction crews should be made aware of the possibility of uncovering fossils. Full-time monitoring of construction is not warranted in these areas, but periodic inspection of spoil piles by qualified paleontologists while work progresses may ensure that important, small fossils are not overlooked. If fossils are discovered, they will be collected and documented.

Upper American River

Occurrences of potentially fossiliferous Tertiary units and Quaternary cave and fissure fills are discrete, and it may be possible to minimize disturbance by not utilizing these deposits as borrow sites for construction material or placing access roads and storage areas within these units. If it is not feasible to avoid these units, construction activities should be monitored for potential salvage of fossils. The field survey could lead to a proactive plan to identify and recover representative samples before temporary impoundment occurs.

CHAPTER 10

AGRICULTURE/PRIME AND UNIQUE FARMLANDS

INTRODUCTION

AGRICULTURE

Historically, agriculture has played an important role in the development of the greater Sacramento area. During the late 19th and early 20th centuries, dryland farming allowed production of crops like wheat, hay, and some wine grapes. By the 1920's, gas engines and electric motors made it possible to pump ground water for irrigation, thereby increasing the amount of irrigated croplands. Technological improvements after World War II led to the conversion of large areas of land into irrigated pastures and fields for rice, corn, sorghum, strawberries, and grapes.

More recently, urbanization of the Sacramento metropolitan area has led to the loss of thousands of acres of productive agricultural land. This loss has generated substantial local concern, and agricultural preservation is an objective embraced in the general plans of all of the local agencies controlling land use in the area. However, Sacramento remains subject to intense regional growth pressures, and the desire of the local land use agencies to respond constructively to these pressures forces agricultural preservation to compete with a host of other planning objectives related to urban development.

PRIME AND UNIQUE FARMLAND

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

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

The Soil Conservation Service developed the following definitions of important farmlands, as modified for California:

"Prime Farmland" is land with the best combination of physical and chemical characteristics for the production of crops. It has the soil quality, growing season, and moisture regime needed to produce sustained high yields of crops when treated and managed, including water management, according to current farming methods. Prime farmland must have been used for the production of irrigated crops within the last 3 years. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use.

"Farmland of Statewide Importance" is land other than prime farmland with a good combination of physical and chemical characteristics for the production of crops. Like prime farmland, it must have been used for the production of irrigated crops within the last 3 years. It also does not include publicly owned lands for which there is an adopted policy preventing agricultural use. Furthermore, farmland of statewide importance must meet criteria similar to that of prime farmlands, with minor differences in acid-alkali balance, soil sodium content, and erodibility.

"Unique Farmland" is land that does not meet the criteria for the preceding categories, but is currently used for the production of specific high economic value crops. It has the special combination of soil quality, location, growing season, and moisture supply needed to produce sustained high quality or high yields of a specific crop when treated and managed according to current farming methods. It does not include publicly owned lands for which there is an adopted policy preventing agricultural use.

EXISTING CONDITIONS

NATOMAS

Land use planning in the 55,000-acre Natomas basin demonstrates the ongoing tension between preserving agricultural land and responding to regional growth pressures. Natomas was reclaimed from the flood plain in 1914 by a system of perimeter levees and canals designed to contain floodwaters in the Sacramento and American Rivers and their tributaries east of the basin. These improvements, combined with an extensive system of interior drainage canals, transformed Natomas into a highly productive agricultural area. In the last 20 years, however, urban development has begun to encroach into the basin.

Sacramento Metropolitan Airport, which is owned by Sacramento County, now occupies approximately 2,800 acres in the western portion of the basin. An additional 2,900 acres of residential and commercial development exists in the southern portion of the basin where the City of Sacramento has adopted a growth management strategy designed to take advantage of Natomas' central regional location in order to avoid a pattern of dispersed suburban development which could exacerbate regional air quality problems. The City's adopted general plan envisions an additional 6,000 acres of development by the year 2010. Meanwhile, Sutter County is contemplating nearly twice that amount of growth in the south Sutter County portion of Natomas by the year 2030, and Sacramento County could add anywhere from 1,200 to 6,800 acres of new development to the basin by the year 2040. (See discussion in Chapter 18, Growth-Inducing Impacts.)

As of 1990, about 47,700 acres remained undeveloped in Natomas. Of these, about 39,000 were under cultivation. The majority of this land is in rice. Other important crops include wheat, sugar beets, safflower, corn, and tomatoes. Table 10-1 presents these crop acreages based on information provided by the FWS.

Table 10-2 indicates the acreage in each county which is considered prime, unique, or of statewide importance.

TABLE 10-1. Existing Agricultural Acreages in the Natomas Area

CROP	SACRAMENTO COUNTY[1]	SUTTER COUNTY[1]	TOTAL BY CROP
Alfalfa	830	152	982
Sugar Beets	2,510	1,099	3,609
Tomatoes	1,124	124	1,248
Wheat	3,056	1,268	4,324
Corn/Grain	1,995	458	2,453
Safflower	2,019	634	2,653
Rice	9,620	14,017	23,637
Orchard[2]	83		83
TOTAL	21,237	17,752	38,989

[1]U.S. Fish and Wildlife Service, 1990
[2]County of Sacramento, 1990

TABLE 10-2. Prime and Unique Farmlands in Natomas

County	Prime	Statewide Importance	Unique
Sutter	8,020	3,554	577
Sacramento	20,343	4,684	1,057

LOWER AMERICAN RIVER

No significant agricultural land remains in the flood plain portion of the lower American River area. However, agriculture predominates in the areas of the Sacramento and Yolo Bypasses which would be directly affected by levee construction under the 150-year alternative and two of the 100-year (FEMA) alternatives. Three main types of soil dominate this portion of the study area--the Rincon-Marvin-Tehama association, Sycamore-Tyndall association, and Capay-Sacramento association. These diverse soils support irrigated orchards, irrigated row crops, and field crops, among others. Tomatoes, corn, and rice are the major irrigated crops in Yolo County.

UPPER AMERICAN RIVER

The upper American River area includes some agricultural lands, mostly irrigated pasture, orchards, and abandoned orchards. These lands cover some 600 scattered acres in the Cool, Pilot Hill, Lotus, Green Valley, and Greenwood areas. Also, a small plot of Christmas trees is commercially grown along Highway 49 near Cool.

IMPACTS

SIGNIFICANCE CRITERIA

No Federal, State, or local threshold has been established for determining the significance of converting agricultural lands to other uses. The CEQA guidelines--Appendix G(y)--list those environmental effects considered significant and note that a "project will normally have a significant effect on the environment" if it will ". . . convert prime agricultural land to nonagricultural or impair the agricultural productivity of prime agricultural land."

For purposes of this analysis, any substantial long-term disruption of an existing or reasonably foreseeable agricultural land use is considered to be a significant impact.

NO-ACTION ALTERNATIVE

The impacts on agricultural lands under the no-action alternative are those related to flooding and growth in Natomas. With the existing level of flood protection, virtually the entire Natomas basin would be inundated by flood events exceeding about a 70-year frequency. This could disrupt agricultural operations on a short-term basis. However, substantial crop damage would be unlikely since large floods would occur only during the winter season when the potential for such damage is minimal. Furthermore, it is unlikely that such flooding would result in any long-term degradation of soils. Thus, the impacts of flooding on agriculture would not be significant.

With respect to growth under the no-action alternative, no agricultural land would be converted to urban use in Natomas after November 7, 1992. On that date, the Federal legislation restricting the use of post-1986 base flood elevations to manage development in the American River flood plain would expire. FEMA would then be authorized to promulgate new flood insurance rate maps for Sacramento indicating the new base flood elevations. These elevations combined with stringent local and Federal flood plain management regulations would make development in Natomas infeasible. (See Chapter 4, Land Use.)

In the lower American River area, about 80 percent of the land within the 100-year flood plain is already developed. Most of the remaining vacant land is expected to develop for urban uses even without the project. The southern portion of the Meadowview area of the City (approximately 1,400 acres) would remain undeveloped as a result of prohibitive base flood elevations. However, the open space remaining there is not agriculturally significant.

SELECTED PLAN

Direct Impacts

Natomas. Levee alignments for the Dry Creek north and south levees would permanently disrupt use of a few acres of prime agricultural land used for grazing. The remaining levee construction activities associated with the selected plan in Natomas would not disrupt any existing or reasonably foreseeable agricultural land use. Levees along the NEMDC, NCC, and Pleasant Grove Creek Canal would be raised. The required channel at Sankey Road would be excavated in an area covered by ruderal grass. The Main Avenue bridge would be replaced along the existing alignment. Construction of the levee encircling the detention basin would result in some loss of prime farmlands. However, this loss would be less than 1 percent of the total acreage of prime farmlands in Natomas. Thus, none of these activities would result in significant impacts to agriculture.

Construction activities may temporarily disrupt agricultural use of lands adjacent to improvement sites, such as along the Dry Creek north and south levees where adjacent lands are used for grazing, at the Pleasant Grove Creek Canal and Sankey Road improvement site, at the Pleasant Grove Creek Canal at Fifield Road improvement site, and at the Natomas Cross Canal improvement site where adjacent lands are in agricultural production. These impacts are adverse; however, they are not considered significant.

Use of the borrow site south of the airport, however, would substantially disrupt existing agricultural land use by removing 71 acres of topsoil from the site. The affected land is believed to be prime or unique farmland. This would be a significant impact.

Lower American River. The selected plan would not result in any direct impacts in the lower American area.

Upper American River. Construction and operation of the flood control dam would have no effect on agricultural land. However, construction activities required to replace Highway 49 would disrupt use of some grazing lands along the alignment identified by the Corps as part of the selected plan. Since this would be a short-term impact, it is not considered significant.

Indirect Impacts

Natomas. Protection of Natomas from floods up to a 200-year frequency would allow development in Natomas in accordance with the adopted general plans of the City of Sacramento and Sacramento and Sutter Counties. These plans generally forecast development through the year 2010. Based on these plans, growth facilitated by the project would result in a cumulative loss of 7,913 acres, 80 percent of which is being cultivated. The remaining 20 percent is either fallow farmland or land which is unsuited for agriculture. Most of the affected land, whether cultivated or fallow, would qualify as prime or unique or statewide important farmland. Conversion of this land to urban uses would be a significant impact.

Lower American River. Given the absence of cultivated land in the lower American River area, no significant indirect impacts are anticipated in this area.

Upper American River. Based on the alignment for Highway 49 identified by the Corps for the selected plan, the project would not affect growth in the foothill region, and no indirect impacts to agriculture would occur.

400-YEAR ALTERNATIVE

The 400-year alternative would produce the same agricultural impacts as the selected plan in the Natomas and lower and upper American River areas.

150-YEAR ALTERNATIVE

Direct impacts in Natomas would be the same as those described for the selected plan.

Lengthening the Sacramento Weir and widening the Sacramento Bypass could permanently disrupt agricultural production on lands lying just north of the bypass. These lands, amounting to approximately 785 acres, would be made a part of the bypass by moving the north levee 3,600 feet to the north. This could present a land use conflict since the bypass is currently designated a wildlife area. In addition, the new levee would restrict access to the additional bypass lands, possibly prohibiting their continued use for agriculture. Loss of these 785 acres of prime farmland would be a significant impact.

There would be no direct impacts in the upper American River area. Indirect impacts in all areas would be the same as for the selected plan.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Direct and indirect impacts would be the same as those described for the selected plan in Natomas. Direct impacts in the lower American River would be substantially the same as impacts in the 150-year alternative except that the affected acreage would total approximately 315 acres. There would be no significant impacts to agriculture in the upper American River area.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Direct and indirect impacts would be the same as those described for the selected plan in Natomas. There would be no significant impacts to agriculture in the lower or upper American River areas.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

Direct and indirect impacts would be the same as those described for the selected plan in Natomas. Direct impacts in the lower American River area would be substantially the same as impacts in the 150-year alternative except that the affected acreage would be about 110 acres. There would be no significant impacts to agriculture in the upper American River.

MITIGATION

DIRECT IMPACTS

Long-term disruptions of agricultural use of the levee improvement borrow site could be mitigated to a less than significant level by the following measure:

- Develop a reclamation/restoration plan for the borrow site prior to construction. The plan should include provisions to remove and replace topsoil so as not to preclude the future agricultural productivity of the site.

INDIRECT IMPACTS

The cumulative impact of converting thousands of acres of agricultural land to urban use in Natomas could be reduced, but not to a less than significant level, by the following measure:

- Plan for higher density uses in more compact clusters of development capable of accommodating anticipated population increases with less overall loss of agricultural land.

CHAPTER 11

TRANSPORTATION

This chapter describes the existing transportation system and traffic conditions in the American River Watershed Investigation study area, identifies impacts of the alternatives on traffic and transportation resources, and suggests mitigation measures for these impacts.

EXISTING CONDITIONS

Figure 11-1 presents regional transportation facilities (public roads) and daily traffic volumes for the study area. These facilities include Interstate 80 (I-80), Interstate 5 (I-5), U.S. Highway 50 (U.S. 50), State Route 99 (SR 99), and Business 80 (B-80). Traversing the study area, I-80 provides an important transportation link between the San Francisco Bay area and Reno and other points east. U.S. 50 is an important commuter and recreational route between Sacramento and South Lake Tahoe and other points east.

Both I-5 and SR 99 serve as vital north-south transportation spines for the State. The original I-80 route, B-80, passes through the central city area of Sacramento. Highway 49, from Oakhurst to Vinton, is a two-lane highway connecting the Auburn and Placerville vicinities in the upper American River portion of the study area. These highways connect residential locations with regional employment, commerce, and recreation areas. The central city area and the U.S. 50 and I-80 corridors are the primary employment centers. Many workers from throughout the region, including Placer and El Dorado Counties, travel to these centers during peak-commute periods, typically 7-9 a.m. and 4-6 p.m. weekdays.

NATOMAS

For planning purposes, traffic volumes are quantified in the form of vehicle-to-roadway capacity (V/C) ratios based on the number of lanes in the roadway. These ratios are in turn translated into level-of-service (LOS) ratings. V/C ratios of 60 percent or less are designated LOS "A"; 60 to 70 percent is

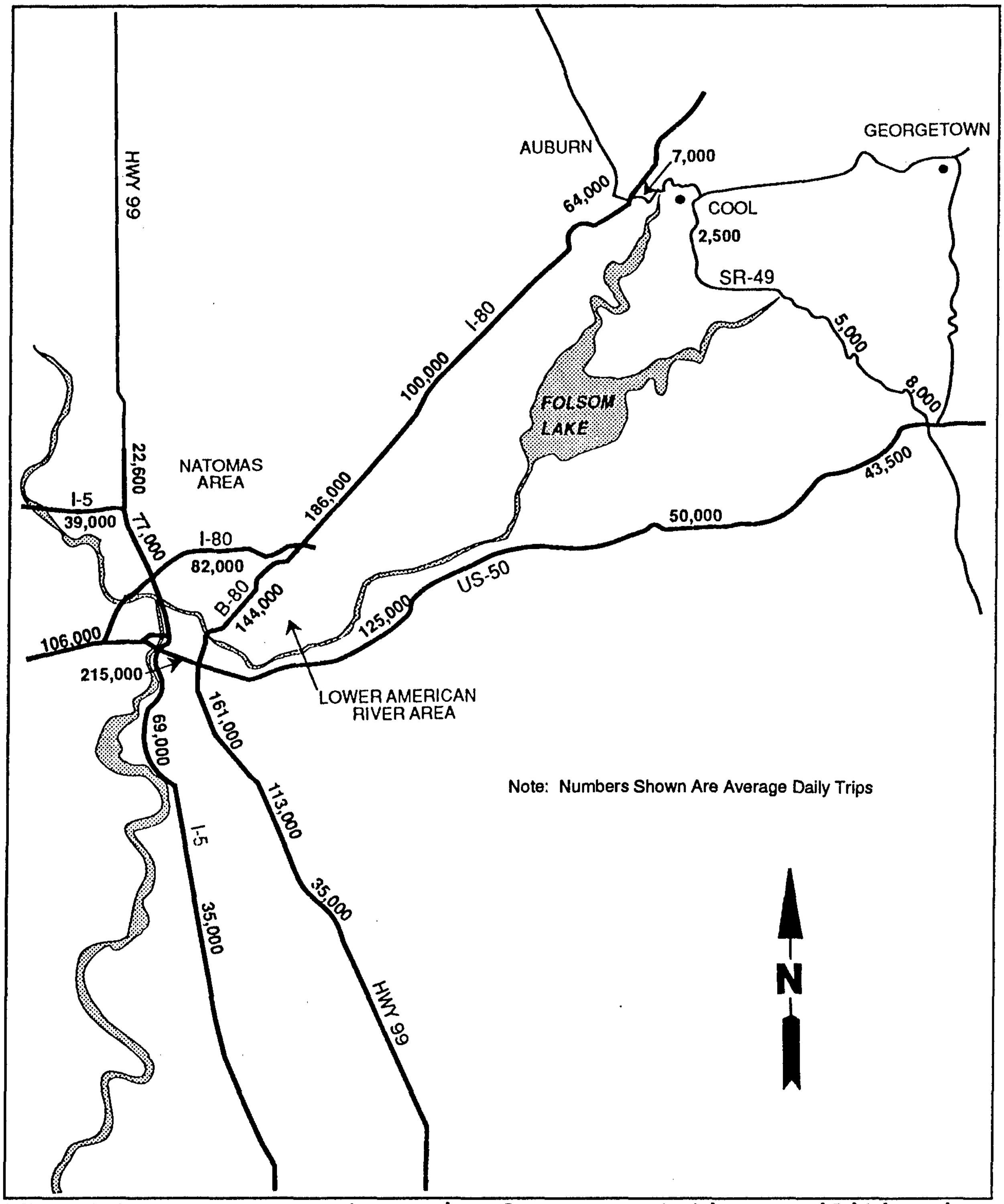


FIGURE 11-1. Sacramento Regional Transportation Facilities in the Study Area and Existing Traffic Volumes

considered LOS "B"; 70 to 80 percent is LOS "C"; 80 to 90 percent is LOS "D"; and 90 percent or greater is LOS "E/F." Ratios of 80 percent or more (LOS "D" or worse) are considered to reflect "significant" congestion. (See discussion below.)

The Natomas area is served by two major freeways and numerous arterial roadways and collector streets. The major freeways are I-5, the primary north-south freeway serving the western sections of the Sacramento metropolitan area, and I-80, which provides important east-west access along the northern sections of the metropolitan area. SR 99, traveling north from its interchange with I-5, connects the Natomas basin with northern Sutter County.

The quality and character of the local Natomas area circulation system varies. The undeveloped northern portions of the basin are served primarily by rural, two-lane blacktop facilities which are compatible with existing agricultural land uses. The urbanized southern portion of the basin contains a developing local roadway system that includes three major arterials, several minor arterials, and a series of local interchanges which provide access to I-5 and I-80.

The major streets serving the North and South Natomas community plan areas are shown in Figure 11-2. These roads are Elkhorn Boulevard, East Levee Road, Del Paso Road, San Juan Road, Northgate Boulevard, El Centro Road, West El Camino Avenue, Garden Highway, West Silver Eagle Road, and Truxel Road. Secondary roads providing important local circulation are North Market Boulevard and Azevedo Drive.

The existing major roadways in the Natomas/North Sacramento area that would serve project-generated traffic include Main Avenue, Northgate Boulevard, East Levee Road, Norwood Avenue, Rio Linda Boulevard, Arcade Boulevard, and Marysville Boulevard. These roadways and their existing traffic volumes are shown in Figure 11-3. A general description of each follows.

Main Avenue

Main Avenue is a two- to four-lane arterial that connects Rio Linda Boulevard to North Market Boulevard. On the west side of North Market, Main Avenue turns into Del Paso Road and continues across the width of the basin to the Garden Highway. This interregional arterial provides access to growing industrial/commercial/residential areas in North Natomas and North Sacramento. The Arco Arena is accessible from this road. Del Paso Road has an interchange with I-5.

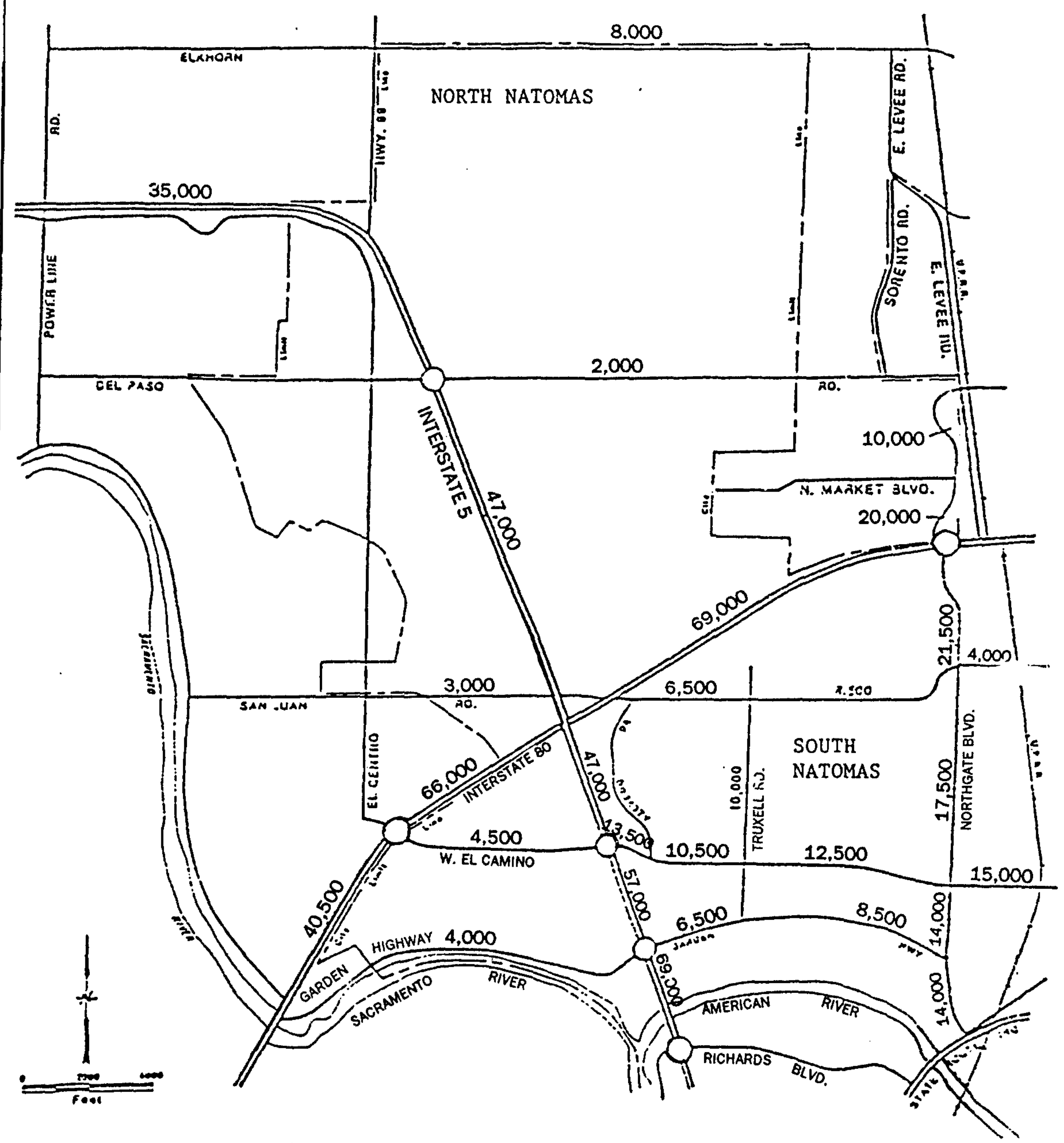
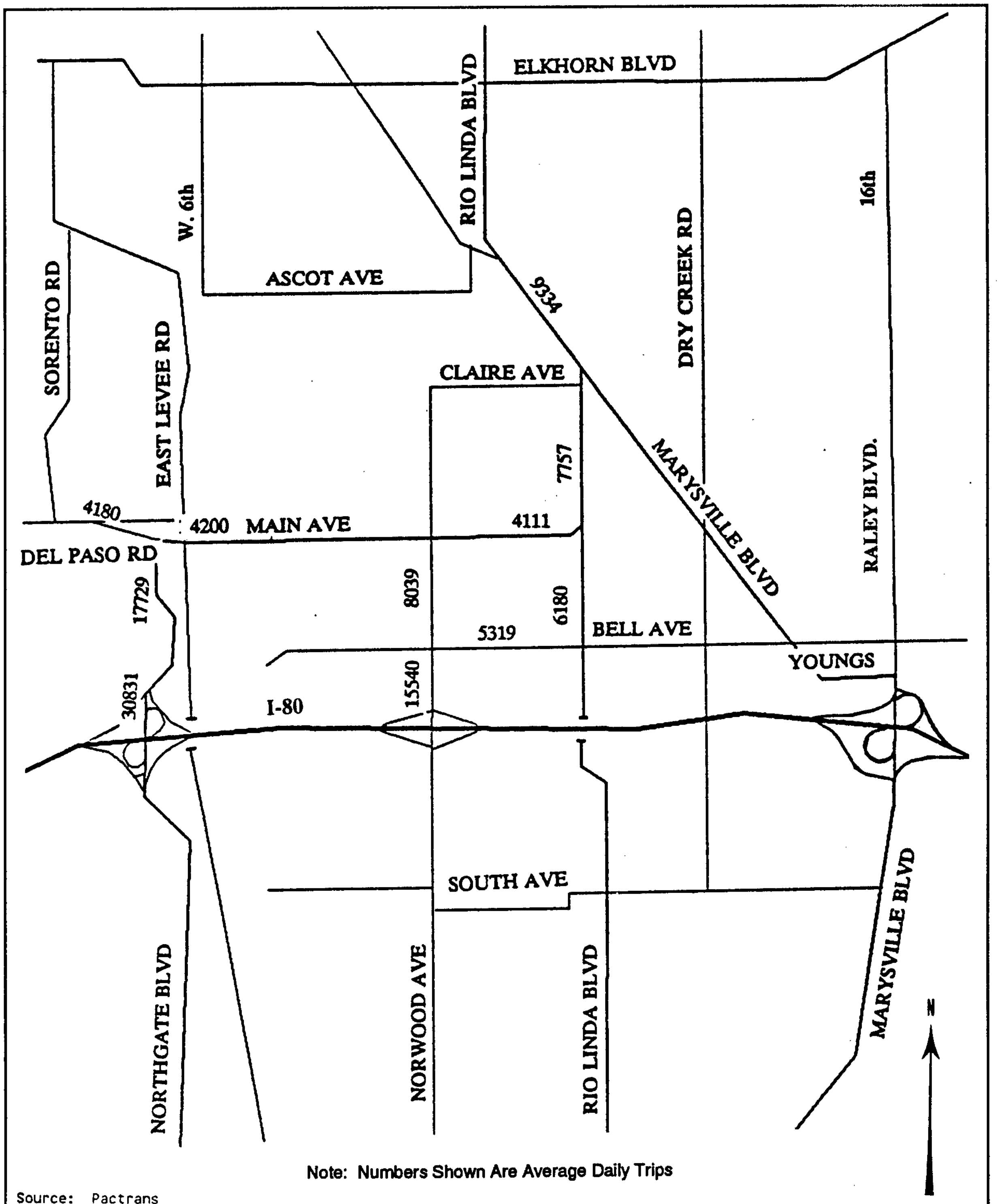


FIGURE 11-2. **Existing Roadways and Traffic Volumes in North Natomas and South Natomas**



Source: Pactrans

FIGURE 11-3. Existing Daily Traffic Volumes for Roadways in Natomas and North Sacramento

Main Avenue Bridge

The existing two-lane Main Avenue bridge traverses the NEMDC. This bridge is adequate for current traffic levels; however, traffic is subject to interruption by rail traffic on the Union Pacific Railroad tracks adjacent to the NEMDC. The current structure also does not meet FEMA 100-year flood standards and may not be available as an evacuation route during periods of flooding.

Northgate Boulevard

This two- to four-lane north-south roadway is one of the major arterials in the Natomas area. It connects growing areas of industrial/office land use in North Natomas with the residential/commercial areas of South Natomas. It provides a route to downtown Sacramento via Highway 160. Access to Highway 160 is provided via a partial interchange and a full interchange with I-80.

East Levee Road

This facility is a two-lane rural road that follows the NEMDC from Northgate Boulevard to Howsley Road in Sutter County. The road is narrow (20 to 24 feet) and ends at Main Avenue just east of Northgate Boulevard.

Norwood Avenue

This facility is a major two- to four-lane roadway that provides connections from North Sacramento to the north and Del Paso Heights to the south. Access to I-80 is available via an interchange.

Rio Linda Boulevard

This two- to four-lane arterial connects downtown Sacramento (via Del Paso Boulevard and Highway 160) and the community of Rio Linda. It provides access to areas of commercial, residential, and industrial land use.

Marysville Boulevard

This two- to four-lane arterial connects downtown Sacramento (via Del Paso Boulevard and Highway 160) and the community of Rio Linda. There is a break in the route north of I-80 as Marysville Boulevard splits from Raley Boulevard via Young Avenue. It provides access to areas of commercial, residential, and industrial land use. It has an interchange with I-80.

Arcade Boulevard

This two-lane residential roadway parallels Arcade Creek. There is a break in the route between Altos Avenue and Rio Linda Boulevard. Between Marysville Boulevard and Rio Linda Boulevard, Arcade Boulevard has a posted speed limit of 15 miles per hour and has undulations located in the street.

Table 11-1 shows the assumed capacity for various types of arterial roadways. Existing traffic operating conditions at the study area critical roadways have been estimated using daily (24-hour) traffic counts conducted by Metro Design and Tech. Based on the capacities shown on Table 11-1 and the volumes shown in Figure 11-3, the only roadway segment currently operating at an unacceptable level of service (LOS "D" or worse) is the link of Northgate Boulevard between I-80 and North Market Boulevard.

TABLE 11-1. Relationship of Peak-Hour Traffic to Levels of Service for Surface Streets

ROADWAY	LEVEL OF SERVICE				
	Level of Service A v/c=0.00 to 0.60	Level of Service B v/c=0.61 to 0.70	Level of Service C v/c=0.71 to 0.80	Level of Service D v/c=0.81 to 0.90	Level of Service E v/c=0.91 to 1.00
Two lanes	0 to 9,150	9,150 to 10,500	10,501 to 12,000	12,001 to 13,500	13,501 to 15,000
Four lanes	0 to 18,300	18,301 to 21,000	21,001 to 24,000	24,001 to 27,000	27,001 to 30,000
Six lanes	0 to 27,000	27,501 to 31,500	31,501 to 36,000	36,001 to 40,500	40,501 to 45,000

Source: Highway Capacity Manual, Special Report 209, Transportation Research Board, 1985.
Note: Apply Level of Service F when V/C>1.00.

LOWER AMERICAN RIVER

The transportation network serving the lower American River area is radial with its major streets starting at, and then radiating outward from, the City's central business district. In the downtown area, the surface streets are laid out in a grid format. The most traveled corridors are served by one-way facilities. The areas away from downtown exhibit typical suburban roadway design with major arterials serving commercial-office-industrial corridors and providing access to the regional freeway network. A system of collector streets provides access from local residential areas to the arterial system.

The regional freeway network is dominated by four major systems: the I-5/SR 99 system (north-south), the SR 99/B-80 system (northeast-south), the B-80/SR 99/U.S. 50 system (east-west), and the I-80 system (northeast-west). These freeways exhibit typical urban freeway characteristics, ranging from 4 to 10 lanes, with many segments elevated or depressed within the City. Certain portions of B-80 between the Cal Expo interchange and I-80 are considered substandard for Federal highway designation due to inadequate width and design.

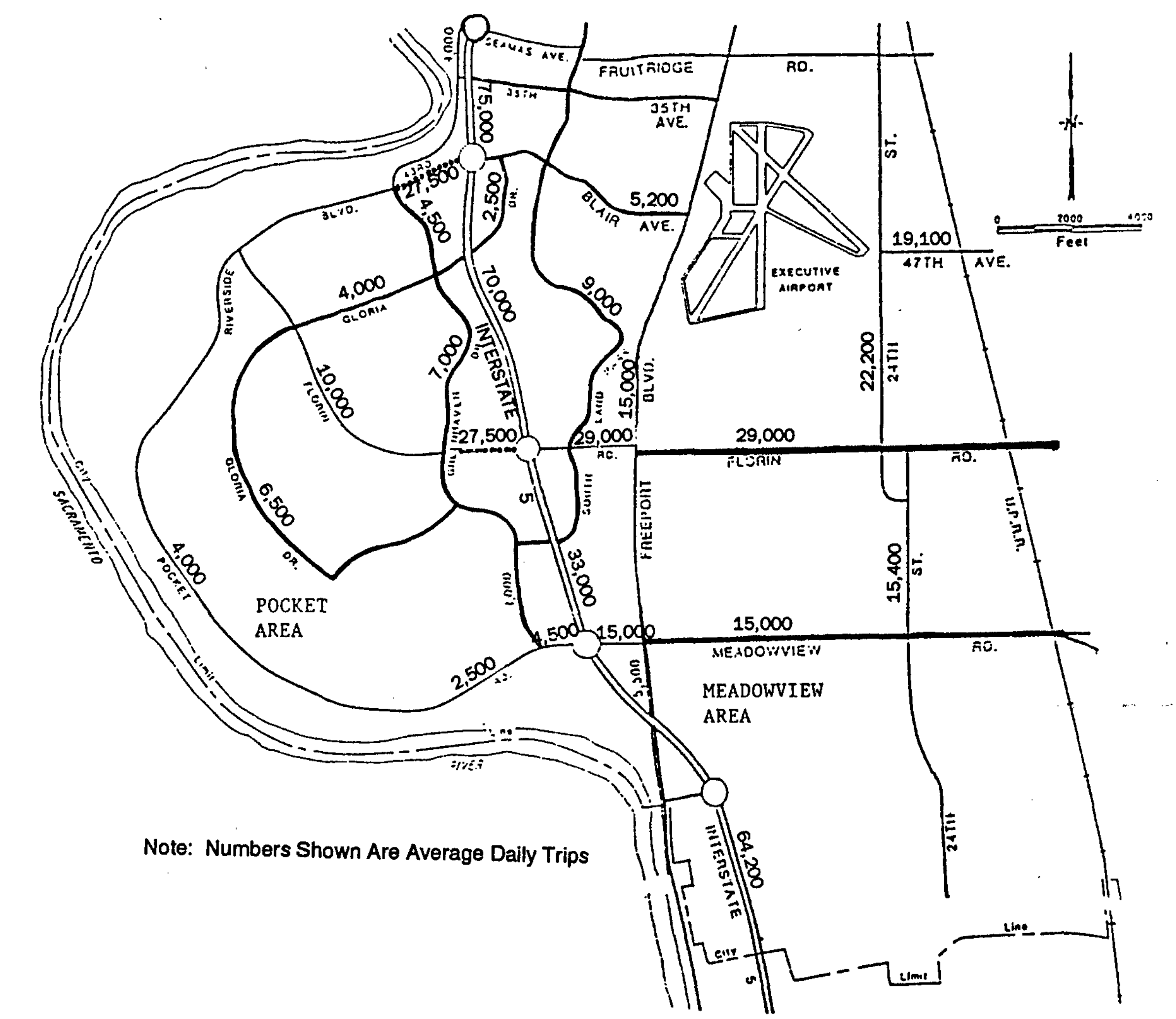
The major streets in the Airport/Meadowview section of the City are Freeport Boulevard, 24th Street, Meadowview Road, and Florin Road. North-south freeway service is provided by I-5, located immediately west of the community with access at Meadowview Road, Florin Road, and Blair Street/43rd Avenue. The major streets in the Pocket area are Florin Road, Riverside Boulevard, Pocket Road, and 43rd Avenue. Secondary roads that provide important circulation include South Land Park Drive, Gloria Drive, and Greenhaven Drive. North-south freeway service is provided by I-5 with interchanges at Florin Road, Pocket/Meadowview, and 43rd Avenue. These roadways and their existing volumes are shown in Figure 11-4.

UPPER AMERICAN RIVER

The Auburn area is partially urbanized with heavy traffic volumes passing along I-80 and north to Grass Valley and Nevada City by way of Highway 49, which conveys about 7,000 vehicles daily through the study area. The principal roadways in the area are shown in Figure 11-5.

Old Cool Quarry is located approximately 4 miles east of the City of Auburn and can be accessed via Highway 49 on the south end and an Auburn State Recreation Area unimproved dirt road from the north. (See Figure 11-5.) The currently operating portion of Old Cool Quarry is approximately 800 vertical feet above the Middle Fork American River streambed. Movement of processed material to the damsite would be accomplished primarily via an extensive temporary conveyor system. This conveyance system would minimize use of the area's existing road network.

The damsite location is shown in Figure 11-5. Access to the damsite is available from numerous dirt roads constructed to accommodate reconnaissance investigations for the previously authorized USBR Auburn Dam project. These roads are gated, unimproved, and infrequently used and carry correspondingly low traffic volumes.



Note: Numbers Shown Are Average Daily Trips

LEGEND

▪▪▪▪▪▪▪▪▪▪▪▪	Segments with V/C greater than 0.80 that cannot be mitigated without displacing existing uses
▬ ▬ ▬ ▬ ▬	Segments with V/C greater than 0.80 that can be mitigated to a less than siginificant level (none on this page)
────────	Segments with less-than-significant impacts

FIGURE 11-4. Pocket and Meadowview Existing Roadways and Traffic Volumes

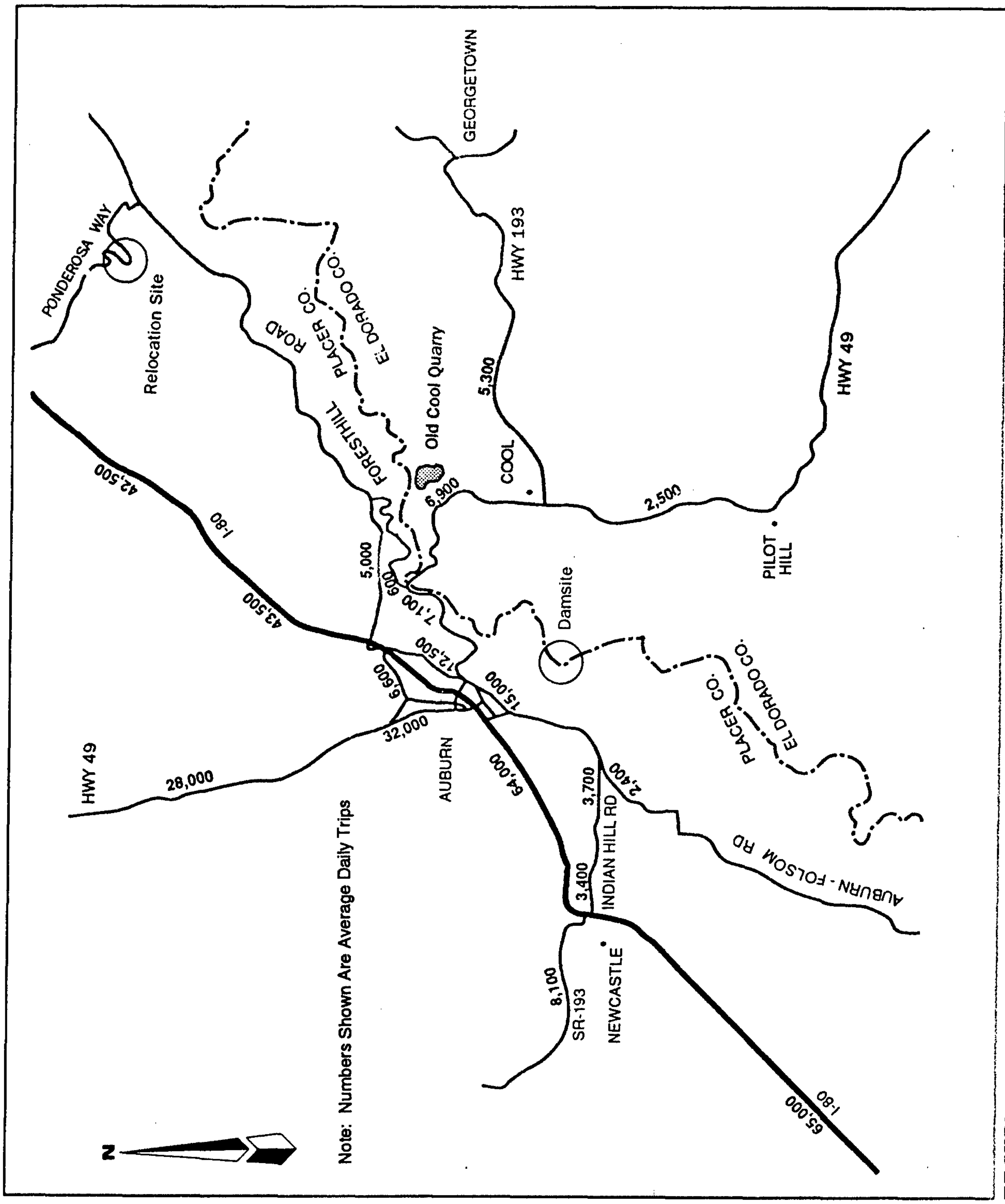


FIGURE 11-5. Auburn-Cool Area Transportation Facilities and Existing Traffic Volumes

Highway 49 descends and ascends the North Fork canyon by a slow, circuitous route. The highway is occasionally subject to closure by winter weather. Recreation-related traffic causes congestion in summer and winter.

The I-80/Foresthill interchange cannot handle the current recreation-related travel demand. Recognizing this, Placer County has included this interchange in its Regional Transportation Improvement Program for study by Caltrans and possible right-of-way purchase.

Ponderosa Way is a two- and sometimes one-lane dirt/gravel county road connecting Foresthill Road with I-80 at Weimar approximately 11 miles north of Auburn. (See Figure 11-5.) Ponderosa Way crosses the North Fork American River approximately 2 miles southwest of Big Bend.

Caltrans completed a relocation study for Highway 49 across the North Fork of the American River as part of the original USBR Auburn Dam project. The route proposed for that realignment would have passed across the top of the dam. The realignment proposed as a part of the American River Watershed Investigation project is shown on Plate 22 in the feasibility report. This alignment represents an in-kind, in-place replacement of Highway 49 at river mile 23.0. A more detailed discussion of other possible alignments identified in the Caltrans relocation study is provided in Chapter 17, Cumulative Impacts.

IMPACTS

SIGNIFICANCE CRITERIA

To determine if project-generated traffic and transportation impacts would be significant, three significance criteria were used: (1) predicted change in roadway level of service or elimination of existing primary roadway access points, (2) safety considerations, and (3) roadway transportation index (TI) rating.

According to CEQA, Appendix G(l), "A project will normally have a significant impact if it causes an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system." To apply this significance criteria, where specific project detail was available, the type and amount of project-generated traffic was estimated and a trip generation and distribution analysis performed. Existing and project-added volume-to-capacity ratios were then calculated and an existing and existing-plus-project roadway level of service determined. Transportation impacts are considered significant if project-added traffic volumes contribute to or degrade any existing peak hour intersection level of service to LOS "D" or below. These criteria were used to analyze the project's potential traffic impacts in the Natomas area. In situations where project information was less detailed, best efforts were applied to estimate the project-generated change in level of service and associated traffic impacts.

Safety issues were assessed based on the traveled roadway width, size of project vehicles, potential impacts of large slow-moving vehicles given existing roadway volumes, and adequacy of line of sight. In instances where project traffic would create a substantial safety risk, impacts were considered significant. In addition, potential impacts to the structural integrity of a roadway resulting from flooding is also considered significant.

Roadway TI rating impacts, or the potential for damage to roadway surfaces resulting from the operation of heavy-duty vehicles, were assessed based on an evaluation of the engineering standards for project-traveled roadways. In instances where project vehicle weight could exceed roadbed design standards, potential impacts to road surfaces were considered significant.

NO-ACTION ALTERNATIVE

Flood-Related Damage

With this alternative, no Federal action would be undertaken to modify the existing flood control system along the American River. As a result, developed portions of the American River flood plain would remain exposed to a significant risk of flooding from the American River and the tributary streams east of Natomas. The existing flood control system can safely contain flows from storms up to about a 70-year frequency. Larger, less frequent events could inundate substantial portions of the flood plain, causing ponding to depths in excess of 5 feet in many areas, up to 15 feet in the Pocket area, and over 20 feet in the developed portions of Natomas. Flooding to these depths could significantly damage many local roadways and transportation facilities, including Sacramento Metropolitan Airport, and could impair use of these facilities for a considerable period of time.

Growth and Development

Without a Federal effort to increase the existing level of flood protection, the undeveloped portions of the Natomas basin would remain in agriculture, and existing vacant lands in the Pocket and Meadowview areas would remain partially undeveloped. Existing roadways in these areas would maintain their present levels of service. However, since the growth constrained by inadequate flood protection would likely be absorbed elsewhere in the region, the effect of the no-action alternative on regional traffic and associated impacts would be minimal.

In the upper American River area, traffic-related impacts associated with constructing a flood control dam at Auburn would be avoided. Growth would proceed as anticipated under California State Department of Finance population projections and adopted local plans. Any replacement of Highway 49 would be tied to the development needs of the area.

SELECTED PLAN

Direct Impacts

Construction activities required in the selected plan would generate significant transportation-related impacts. While construction-related impacts are usually considered insubstantial because the activity is temporary and of short duration, work on this project could span 2 to 3 years at some locations, with many oversized vehicles transporting materials throughout the region.

Construction in areas like the northern Natomas basin, where the sites are farther from existing development, would have less impact on traffic than construction in the South Natomas and Dry or Arcade Creek areas. Construction of new levees would have slightly prolonged traffic impacts compared to levee raising operations. Table 11-2 summarizes construction-related transportation impacts and mitigation measures. A more detailed discussion is presented below.

Natomas Area. The majority of transportation impacts resulting from proposed Natomas-area flood control improvements would result from construction activities. Once completed, these improvements would not result in long-term impacts to transportation facilities. Consequently, the Natomas area traffic analysis generally focuses on short-term construction impacts to existing traffic flows and the effects of increased

TABLE 11-2. General Direct Construction-Related Traffic Impacts

CAPACITY IMPACTS	
Impact:	Extra-large construction vehicles (legal and permit loads) on public roadways could cause capacity problems with existing traffic activity. This could result in increased delay at major intersections and along major arterials. The extent of impact depends on the timing of when extra-large construction vehicles will be on the roadway and whether or not such activity will coincide with peak commute weekday traffic periods.
Mitigation:	Contractor will be required to stay off major transportation facilities (freeways and major arterials in urbanized areas) during peak commute periods of 6:30 - 9:30 a.m. and 3:30 - 6:30 p.m. on weekdays.
INADEQUATE TURNING RADIUS	
Impact:	Construction site access requires adequate turning radius at major intersections. As some freeway ramp-intersections access primarily residential areas, intersection turning radii may not be adequate for extra-large legal and permit truck loads.
Mitigation:	During construction planning, construction site access will be identified and intersection turning radii analyzed. Where inadequate turning radii is identified, an appropriate alternate route will be chosen. If no alternate route is available, intersection geometrics must be improved by the contractor to accommodate requirements for extra-large construction vehicles.
ROADBED IMPACTS	
Impact:	Extensive construction-related vehicle activity reduces the useful life of roadway facilities. Extra-large construction vehicles damage roadbeds not designed for this type of vehicle activity. While freeways and major arterials are typically designed and maintained to withstand heavy truck vehicle loads, collectors and local roadways are not. Some local roadways are also not wide enough to handle this type of traffic activity as well as on-street parking.
Mitigation:	Collector and local roads will be monitored during construction. Any damage during the construction period will be corrected by the contractor to standards. Where construction site access is via local road, residents should be informed, and truck vehicle activity will be monitored to minimize safety problems or neighborhood nuisance.

truck traffic on existing roadway operating conditions and roadway pavement. The only exception to this short-term focus is the replacement of the Main Avenue/NEMDC bridge, which would result in the long-term improved operation of this facility by eliminating the existing at-grade railroad crossing.

The Natomas area transportation impact analysis below is presented in two parts: (1) levee and related improvement construction impacts and (2) impacts resulting from the temporary closure of the Main Avenue bridge.

The traffic impacts from each of the levee improvement sites have been evaluated separately because overall project implementation requires that certain projects be implemented before starting others. As a result, the timing of some construction activities may overlap slightly; however, it is not likely that this would occur for any significant length of time. Furthermore, because construction impacts would be short term, they have been evaluated for the existing and existing with-project conditions only.

The Natomas area transportation impact analysis is based on construction equipment lists and trip generation rates compiled for each improvement site. These data were assembled in consultation with engineers familiar with the project. The analysis is based on the worst-case construction phase traffic generation at each improvement site. For example, while the levee-raising phase may produce the greatest average daily trips at one improvement site, depending on the extent of improvements, asphalt paving may produce the highest trip generation rate at another improvement site. The construction phase and associated trip volumes for each improvement site are presented in Table 11-3.

After most severe trip generation rates were identified for each improvement site, construction trips were distributed onto the surrounding road network based on the likely origins and destinations for the individual trip types. Fill import haul route information was provided by the Corps.

The project's traffic impacts on critical roadways was then assessed based on the information presented in Tables 11-1 and 11-3. Tables 11-4 through 11-7 show the results of the LOS analysis for improvement sites located in the more urbanized areas of Natomas. Review of Tables 11-4 through 11-7 shows that, in general, construction-related traffic volumes would not have a significant impact on study area road segments. One roadway segment, Northgate Boulevard, between North Market Boulevard and I-80, is currently operating at LOS "F" during peak hour traffic conditions (4 to 6 p.m.) even without the addition of project-generated traffic. To avoid worsening this condition, it is recommended that the project trips through this road segment end prior to 4 p.m.

The project would also generate a significant amount of truck traffic on the segment of Del Paso Road between I-5 and the proposed borrow site. The total number of truck trips expected on this road segment is 13,270. This number of truck trips is unlikely to have a significant impact on the level of service along this section of road as the road is a low-volume facility.

However, this number of trucks may have a potentially significant impact on the condition of the pavement due to the weight of full dump trucks and the low TI rating of this roadway. As a result, impacts to the roadway surface are considered potentially significant and subject to mitigation.

TABLE 11-3. Most Severe Construction-Related Trip Generation - Natomas

SITE NO.	LOCATION	TYPE OF ACTIVITY	DAILY TRAFFIC VOLUMES		
			TOTAL	TRUCKS	AUTOS
1	NEMDC	LEVEE RAISING	112	68	44
2	MAIN AVENUE BRIDGE	ASPHALT PAVING	92	80	12
3	PUMPING STATION	CONCRETE BYPASS CHANNEL	50	36	14
4	NATOMAS CROSS CANAL	LEVEE RAISING	64	40	24
5	PLEASANT GROVE CREEK CANAL	ASPHALT PAVING	20	6	14
6	SANKEY ROAD	LEVEE RAISING	76	42	34
7	DRY CREEK-NORTH	LEVEE RAISING	54	37	17
8	ARCADE CREEK	LEVEE RAISING	45	33	12
9	DETENTION BASIN	LEVEE CONSTRUCTION	56	32	24

Source: Parsons Brinckerhoff.
Notes: NEMDC = Natomas East Main Drainage Canal.

TABLE 11-4. Natomas East Main Drainage Canal; Level of Service on Critical Roadways in the Study Area: Existing With-Project Condition

ROADWAY	NUMBER OF LANES	LOCATION	EXISTING CONDITION		EXISTING WITH PROJECT	
			DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**	DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**
Northgate Blvd.	4	I-80 to Market	35,000	F	35,092	F
Northgate Blvd.	4	Market to Main	21,900	A	21,992	A
Del Paso Road	2	I-5 to Northgate	4,200	A	4,200	A
Main Ave.	2	Northgate to Norwood	0	A	0	A
Main Ave.	2	Norwood to Rio Linda	4,100	A	4,100	A
Norwood Ave.	4	Main to Bell	12,100	A	12,100	A
Norwood Ave.	4	Bell to I-80	14,600	A	14,600	A
Rio Linda Blvd.	2	Main to Ascot	6,200	A	6,200	A
Rio Linda Blvd.	2	Marysville to Main	7,760	A	7,760	A

* Volumes are Total Daily Traffic, both directions.
** See Table 11-1 for Level of Service criteria.

TABLE 11-5. Pumping Station; Level of Service on Critical Roadways in the Study Area: Existing With-Project Condition

ROADWAY	NUMBER OF LANES	LOCATION	EXISTING CONDITION		EXISTING WITH PROJECT	
			DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**	DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**
Northgate Blvd.	4	I-80 to Market	30,800	F	30,850	F
Northgate Blvd.	4	Market to Main	17,700	A	17,750	A
Del Paso Road	2	I-5 to Northgate	4,200	A	4,200	A
Main Ave.	2	Northgate to Norwood	4,200	A	4,200	A
Main Ave.	2	Norwood to Rio Linda	4,100	A	4,100	A
Norwood Ave.	4	Main to Bell	8,000	A	8,000	A
Norwood Ave.	4	Bell to I-80	15,500	A	15,500	A
Rio Linda Blvd.	2	Main to Ascot	6,200	A	6,200	A
Rio Linda Blvd.	2	Marysville to Main	7,760	A	7,760	A

* Volumes are Total Daily Traffic, both directions.
** See Table 11-1 for Level of Service criteria.

TABLE 11-6. Dry Creek; Level of Service on Critical Roadways in the Study Area: Existing With-Project Condition

ROADWAY	NUMBER OF LANES	LOCATION	EXISTING CONDITION		EXISTING WITH PROJECT	
			DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**	DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**
Northgate Blvd.	4	I-80 to Market	30,800	F	30,800	F
Northgate Blvd.	4	Market to Main	17,700	A	17,700	A
Del Paso Road	2	I-5 to Northgate	4,200	A	4,226	A
Main Ave.	2	Northgate to Norwood	4,200	A	4,211	A
Main Ave.	2	Norwood to Rio Linda	4,100	A	4,137	A
Norwood Ave.	4	Main to Bell	8,000	A	8,037	A
Norwood Ave.	4	Bell to I-80	15,500	A	15,500	A
Rio Linda Blvd.	2	Main to Ascot	6,200	A	6,200	A
Rio Linda Blvd.	2	Marysville to Main	7,760	A	7,760	A

* Volumes are Total Daily Traffic, both directions.
** See Table 11-1 for Level of Service criteria.

TABLE 11-7. Arcade Creek; Level of Service on Critical Roadways in the Study Area: Existing With-Project Condition

ROADWAY	NUMBER OF LANES	LOCATION	EXISTING CONDITION		EXISTING WITH PROJECT	
			DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**	DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**
Northgate Blvd.	4	I-80 to Market	30,800	F	30,844	F
Northgate Blvd.	4	Market to Main	17,700	A	17,744	A
Del Paso Road	2	I-5 to Northgate	4,200	A	4,268	A
Main Ave.	2	Northgate to Norwood	4,200	A	4,312	A
Main Ave.	2	Norwood to Rio Linda	4,100	A	4,100	A
Norwood Ave.	4	Main to Bell	8,000	A	8,000	A
Norwood Ave.	4	Bell to I-80	15,500	A	15,500	A
Rio Linda Blvd.	2	Main to Ascot	6,200	A	6,200	A
Rio Linda Blvd.	2	Marysville to Main	7,760	A	7,760	A

* Volumes are Total Daily Traffic, both directions.
** See Table 11-1 for Level of Service criteria.

In addition to the LOS analysis, each proposed haul route was evaluated for potential safety impacts. It was determined that safety impacts would occur along one haul route road segment during the fill material import phase of construction. The road segment affected is East Levee Road between Sotnip Road and the proposed NEMDC pumping station site. This road segment is located atop the NEMDC west levee and is relatively narrow (20-24 feet) with no shoulder. This roadway also curves sharply in two nearby locations: one along the affected section described above and one just north of the proposed pumping station site. Of particular concern is the East Levee Road curve located just north of the proposed pumping station. It is proposed that loaded fill import trucks would leave East Levee Road at the pumping station via a dirt road to access the NEMDC pumping station and north Dry Creek levee construction sites. Trucks exiting East Levee Road at this location would require a larger turning radius than presently exists. This would require dump trucks to use a portion of the southbound lane to negotiate the right turn off East Levee Road. The factors of narrow roadway width and inadequate turning radius, combined with impaired line of sight for vehicles traveling southbound on East Levee Road through the curve mentioned above, would result in significant safety impacts. To reduce safety impacts to less than significant, East Levee Road between Sotnip Road and the NEMDC pumping station site should be closed to through traffic during construction. Local traffic could be detoured around this road segment via Sorento Road and Del Paso Road.

The greatest disruption to existing traffic circulation would occur as a result of reconstruction of the Main Avenue Bridge. Following reconstruction, the proposed high bridge would accommodate existing and future traffic volumes at an adequate level of service, would be grade separated from the Union Pacific Railroad tracks, and would meet FEMA 100-year flood standards. However, the construction of the bridge would eliminate the existing access to land uses along Main Avenue between Pell Drive and Northgate Boulevard and would close East Levee Road at Main Avenue. According to the significance criteria, loss of a primary access point is considered a significant transportation impact. To mitigate access impacts, new frontage roads would need to be constructed which would allow access to the affected businesses from Northgate Boulevard and Pell Drive. East Levee Road could also be permanently closed at Del Paso Boulevard/Main Avenue due to bridge construction. To mitigate this impact, traffic using East Levee Road could be rerouted onto another roadway. It is recommended that the traffic be rerouted onto Sorento Road.

During construction of the new bridge, estimated to last approximately 1 year, traffic currently using the Main Avenue bridge over the NEMDC would be detoured onto Norwood Avenue, I-80, and Northgate Boulevard. This detour route is shown on Figure 11-6. The amount of daily traffic expected to use the detour is 4,200 vehicles per day. (See Figure 11-6.) Table 11-8 presents the results of the roadway link level-of-service analysis under existing and detour traffic conditions. Northgate Boulevard between I-80 and North Market Boulevard is the only roadway link projected to be operating at an unacceptable LOS during the year the new bridge is under construction. This segment of Northgate Boulevard, however, currently operates at LOS "F," and the additional traffic would therefore add to this condition. However, based on the significance criteria established for this project, detour-added traffic volumes would significantly affect Northgate Boulevard between I-80 and North Market Boulevard on a short-term basis. Since this is an existing condition and the project impacts to this condition would be only temporary, no physical improvement mitigation is recommended. However, impacts could be reduced by an effective ad campaign similar to that used for the construction on the I-5/American River bridge and Sunrise Boulevard/American River bridge in the summer of 1991 advising motorists of alternative routes around the construction and promoting use of alternative modes.

Lower American River. The selected plan would not require any construction or result in any construction-related impacts in the lower American River area.

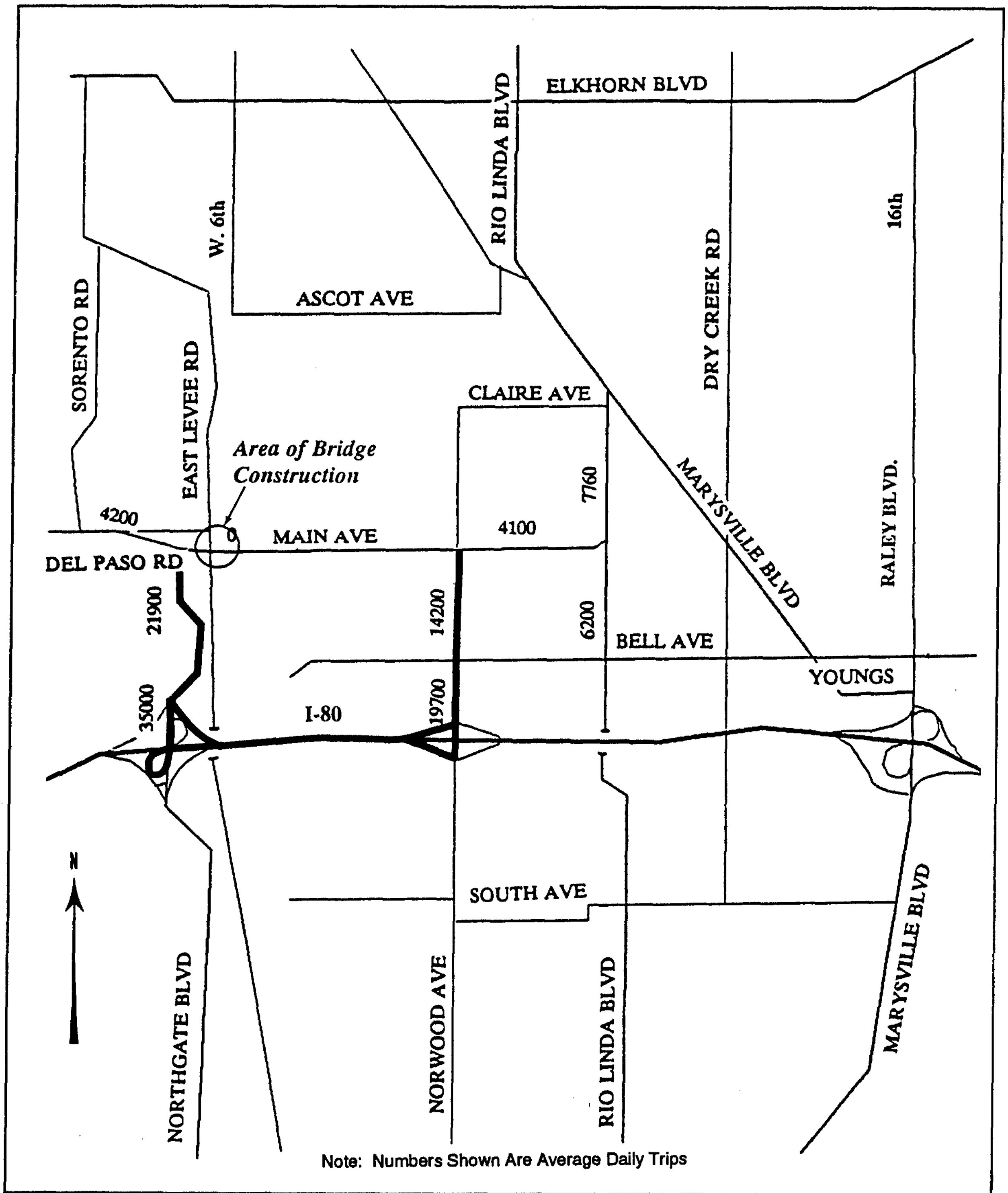


FIGURE 11-6. Daily Traffic Volumes: Existing With-Project Condition - Detour Plan

TABLE 11-8. Level of Service on Critical Roadways in the Study Area: Bridge Construction Detour Condition

ROADWAY	NUMBER OF LANES	LOCATION	EXISTING CONDITION		EXISTING WITH PROJECT	
			DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**	DAILY VOLUME (VEH/DAY)*	LEVEL OF SERVICE**
Northgate Blvd.	4	I-80 to Market	30,800	F	35,000	F
Northgate Blvd.	4	Market to Main Ave	17,700	A	21,900	C
Del Paso Road	2	I-5 to Northgate	4,200	A	4,200	A
Main Ave.	2	Northgate to Norwood	4,200	A	0	A
Main Ave.	2	Norwood to Rio Linda	4,100	A	4,100	A
Norwood Ave.	4	Bell to I-80	15,500	A	19,700	B
Norwood Ave.	4	I-80 to Bell	8,000	A	14,200	A
Rio Linda Blvd.	2	Main to Ascot	6,200	A	6,200	A
Rio Linda Blvd.	2	Marysville to Main	7,760	A	7,760	A

* Volumes are Total Daily Traffic, both directions.
** See Table 11-1 for Level of Service criteria.

<u>Upper American River</u>. Transportation impacts in the Auburn area would be related to the construction aspects of the dam, including concrete placement, spoils disposal, and the Highway 49 and Ponderosa Way bridge replacements. Dam construction and spoils disposal activities are expected primarily at the damsite and in the Middle Fork canyon along the proposed conveyor route. Aggregate would be mined at the Old Cool Quarry and transported via a temporary conveyor belt to the damsite. Depending on positioning of mining and processing facilities, the distance from the quarry downstream to the damsite is about 5 miles. The conveyor alignment would be on the south side of the American River canyon away from the river. It would follow, to the extent possible, existing minor roads and trails and cross Highway 49. It would continue to the temporary concrete plant which would be constructed at the damsite. This conveyance system would avoid any significant impact on existing local roads, including Highway 49.

Some materials other than aggregate would have to be transported to the damsite over public roads. The use of large slow-moving trucks could cause significant capacity-related conflicts, particularly if construction vehicle operation occurs during peak traffic periods. In addition, some construction vehicle routes may lack adequate turning radii, and heavy equipment could cause damage to road surfaces. These transportation impacts are considered potentially significant and subject to mitigation.

Spoils material would be moved to the proposed disposal sites over existing dirt access roads. Spoils-related traffic would not use local roadways and thus would not affect local roadways except during transport of required equipment to the project site.

Likewise, construction of a new Highway 49 bridge would create additional construction-related vehicle trips along the existing roadway and in the Auburn area. Under the selected plan, this bridge would be placed at river mile 23, a location which retains, to the extent feasible, the existing alignment of the highway while ensuring that the roadway is high enough to satisfy State gradient requirements and permit clearance of the maximum inundation level of the flood control dam. During construction, access would continue to be provided via a detour along the existing alignment; however, some delays beyond those currently experienced would occur at the spot where the new alignment departs the existing alignment. These delays, however, would occur over the short term and be intermittent and of short duration. Consequently, impacts to transportation are considered less than significant.

As explained in the chapter on cumulative impacts, the selected plan alignment has been selected as in-kind replacement for the Highway 49 bridge. The State of California has indicated it will accomplish route adoption studies. These studies may lead to the selection of an alternative alignment based on the long-term transportation needs of the area independent of the flood control project.

Indirect Impacts

Natomas. The selected plan would provide increased flood protection to the Natomas basin, thus permitting the City to complete its development of the South Natomas and North Natomas community plan areas. The City anticipates that by 2010 development of these areas in accordance with adopted plans would cause several local roadway segments and intersections and many freeway segments and interchanges to operate at LOS "D" or worse during peak hours, thereby significantly affecting the local circulation system. Similar, though less frequent, adverse impacts could result from the operation of the proposed stadium in North Natomas.

The local roadways, intersections, freeways, and interchanges affected are listed in Table 11-9 at the end of this chapter, along with the mitigation measures which the City has adopted and an estimate of the effect of these measures.

Figure 11-7 shows the affected roadway and freeway segments and future traffic volumes.

The scope of the indirect traffic impacts associated with the selected plan would broaden if the general plan modifications being considered by Sacramento and Sutter Counties are implemented. A discussion of these proposed modifications and their effect on the environment is in Chapter 18.

Lower American River. Construction of the project would permit the City to complete development of the Pocket and Airport/Meadowview sections of the city. This development would cause Florin Road and Meadowview Road to operate at LOS "D" or worse during peak hours, thereby significantly affecting the local circulation system.

Upper American River. Implementation of an in-kind replacement of Highway 49 at river mile 23.0, as proposed in the selected plan, would not significantly alter traffic patterns in the area and would not, therefore, result in any indirect traffic impacts. However, it is reasonably foreseeable that the State route adoption process will result in selection of a high bridge alignment as the preferred relocation. Such an alignment would shorten commute times between residences in western El Dorado County and job centers along the I-80 corridor and would thus contribute to regional growth pressures and associated growth-related impacts, including transportation impacts. The State route adoption process and potential high bridge alignments are discussed in Chapter 17, Cumulative Impacts. The growth-related impacts likely to result from such an alignment are discussed in Chapter 18, Growth-Inducing Impacts.

The abandoned section of Highway 49 will either be removed from the project area by the non-Federal sponsor, or the non-Federal sponsor will be responsible for its operation and maintenance for other incidental public uses. At this time it is proposed that this segment be turned over to either Placer or El Dorado County. This section of roadway may be left open to the public for recreational use to allow continued river access in the area during nonflood periods. Occasional flooding, however, could cause roadbed damage. If this roadway section is left open for recreational use following a flood, it may be unsafe for public use. This would be considered a potentially significant impact. Designation of a government agency to be responsible for the continued maintenance of the abandoned section of Highway 49 or closing this section of the roadway to public use following a flood would reduce this potential impact to less than significant.

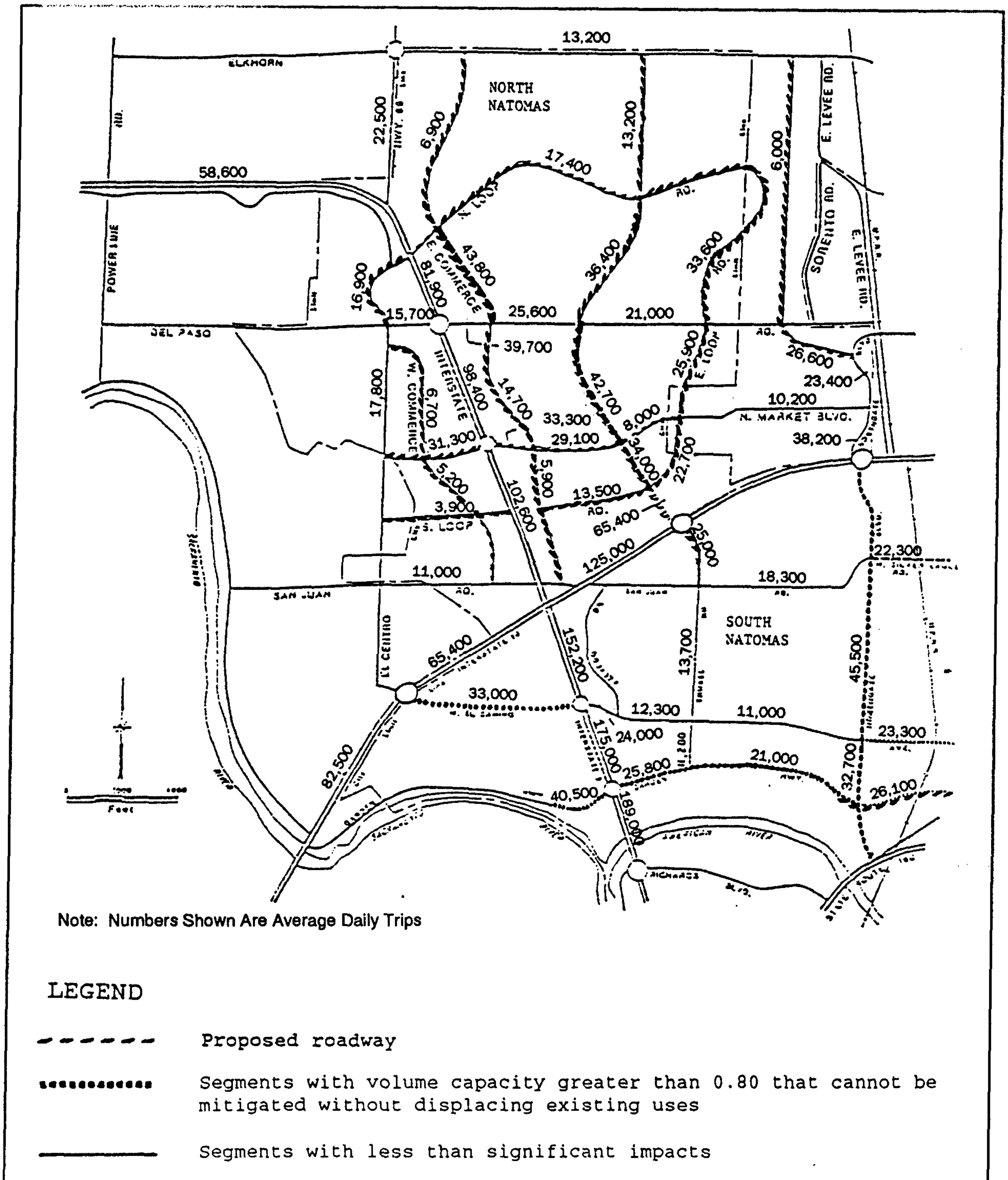


FIGURE 11-7. North and South Natomas: Planned Roadways/ Anticipated Traffic Volumes (2010)

400-YEAR ALTERNATIVE

The 400-year alternative would produce the same traffic impacts as the selected plan in the Natomas and lower American River areas. The impacts associated with dam construction in the upper American River would occur over a slightly extended period but would be substantially the same as with the selected plan.

150-YEAR ALTERNATIVE

In the Natomas area, the direct and indirect traffic impacts associated with the 150-year alternative would be the same as for the selected plan.

In the lower American River area, however, construction-related traffic impacts would be far more severe. Borrow materials for required levee improvements would be transported to various sites on existing public roads. Access would likely be via U.S. 50 to collector and local roads through residential neighborhoods and would create capacity conflicts and roadbed and neighborhood nuisance impacts. Some access roads may lack adequate turning radii for oversized vehicles. Closure of the road across Folsom Dam for construction vehicles would affect already congested peak-period commuter and local traffic. These impacts are considered potentially significant and subject to mitigation, but could be reduced by limiting access to nonpeak commute or recreational periods.

To accommodate the higher flows anticipated with this alternative, modifications to or replacement of the Howe Avenue bridge, H Street bridge, and the Union Pacific Railroad trestle near Highway 160 would be required. These improvements or modifications would require rerouting or delay of local traffic and would result in significant adverse unavoidable traffic impacts on H Street and Howe Avenue during the period of construction. These impacts would be particularly acute because the H Street and Howe Avenue bridges are two of only six American River crossings between Business 80 and Folsom Lake.

Indirect impacts in the lower American River area would be the same as for the selected plan. However, the 150-year alternative would avoid all project-related traffic impacts in the upper American River area.

100-YEAR (FEMA) LEVEE ALTERNATIVE

The direct traffic impacts associated with this alternative would be the same as for the selected plan in Natomas and substantially the same as for the 150-year alternative in the lower American River area. Indirect impacts would be the same as for the selected plan; however, this alternative would avoid all project-related traffic impacts in the upper American River area.

100-YEAR (FEMA) STORAGE ALTERNATIVE

The direct and indirect traffic impacts associated with this alternative in Natomas and the lower American River area would be the same as for the selected plan. However, this alternative would avoid all traffic impacts in the upper American River area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The direct traffic impacts associated with this alternative would be the same as for the selected plan in Natomas and substantially the same as for the 150-year alternative in the lower American River area. Indirect impacts would be the same as for the selected plan; however, this alternative would avoid all project-related traffic impacts in the upper American River area.

MITIGATION

DIRECT IMPACTS

To reduce the direct construction impacts associated with the various project alternatives in all project areas, the following measures shall be implemented:

- Contractors shall avoid public roads when hauling materials to construction sites. If this is not feasible, then contractors shall prepare a transportation plan with information on haul routes and the number of trucks per day, as well as a traffic engineering analysis indicating that potential affected intersections have adequate turning radii for oversized vehicles.

- Contractors shall avoid hauling on public roads during weekday peak traffic periods, such as 6:30-9:30 a.m. and 3:30-6:30 p.m., especially in developed areas. If this is not feasible, contractors shall prepare traffic engineering studies to include peak-hour capacity calculations at affected intersections along haul routes, demonstrating that acceptable levels of service will be maintained. These studies shall be prepared for the Corps and shall conform to appropriate local standards. Contractors shall also allow pertinent agencies and concerned neighborhoods to comment on the transportation plan and traffic engineering studies. Where construction access is by local roads, residents shall receive prior notification.

To reduce upper American River study area transportation impacts associated with dam construction, the following measure shall be implemented:

- In the Auburn area under alternatives involving dam construction, aggregate shall be transported to the damsite by conveyor belt, thereby avoiding public roads. Heavy construction materials such as cement and steel shall be transported to Auburn via rail (if feasible) and then to the damsite along an authorized haul route, according to an approved transportation plan.

The following measure will be accomplished to reduce traffic impacts to the upper American River study area resulting from Highway 49 and Ponderosa Way replacements:

- For the Highway 49 and Ponderosa Way replacements, construction vehicles shall avoid use of the local roadway network during peak commute hours (6:30 to 9:30 a.m. and 4:30 to 6:30 p.m.).

During the construction of the new Main Avenue bridge in Natomas, which is expected to take approximately 1 year, traffic currently using the Main Avenue bridge over the NEMDC would detour around the construction site primarily via Norwood Avenue, I-80, and Northgate Boulevard. The expected traffic increase would adversely affect roadways along the primary detour route; however, detour impacts were considered significant for Northgate Boulevard between I-80 and North Market Boulevard. This segment of Northgate Boulevard is currently operating at LOS "F," and the additional traffic would compound this condition. Since this is an existing condition and because the project impacts to this condition would be temporary, no physical improvement mitigation is recommended. However, to mitigate project-generated short-term impacts, the following measure is recommended:

- o An ad campaign shall be initiated by the project sponsor similar to that used for the construction on the I-5/ American River bridge and Sunrise Boulevard/American River bridge. The ads developed should advise motorists of alternative routes around the construction site and promote the use of alternative transportation to reduce short-term impacts.

Even with implementation of an ad campaign, residual impacts to Northgate Boulevard between I-80 and North Market Boulevard are expected to remain significant.

To mitigate safety impacts along the segment of East Levee Road between Sotnip Road and the proposed NEMDC pumping station site, the following measure is recommended:

- o East Levee Road between Sotnip Road and the NEMDC pumping station site shall be closed to through traffic during the fill import phase of construction. Local traffic, with the exception of residents who must access homes from East Levee Road, shall be detoured around this road segment via Sorento Road and Del Paso Road.

Reconstruction of the Main Avenue bridge would eliminate the existing access to land uses along Main Avenue between Pell Drive and Northgate Boulevard due to the required earthen approaches and associated retaining walls and would close East Levee Road at Main Avenue. To mitigate impacts related to access, the following measures are recommended:

- o Frontage roads with access off Northgate Boulevard and Pell Drive should be constructed on both the north and south sides of Main Avenue to service the affected land uses.

- o Traffic using East Levee Road shall be rerouted onto Sorento Road.

With implementation of the above measures, access impacts would be reduced to less than significant.

INDIRECT IMPACTS

It may be impossible to fully mitigate all of the significant traffic impacts associated with project-induced growth in the Natomas and lower American River areas. On a regionwide basis, the City has concluded that by 2010 virtually all freeway segments in Sacramento, with the exception of portions of I-80 between I-5 and Truxel Road and portions of I-5 between I-80 and Del Paso Road, will operate at LOS "D" or greater during peak hours. This level of service could be substantially improved if the existing freeway segments were widened to include additional travel lanes. However, the City has concluded that such an approach is infeasible because of the need to relocate existing development. Thus, the City has determined that to increase the operating capacity of the regional freeway system, major new facilities would have to be constructed.

In this regard, several regional facilities have been proposed for further analysis and consideration. These facilities include:

- Sacramento beltway - A proposed new freeway extending generally from SR 99 to Route 148, east and north through the communities of South Sacramento, Folsom, and Orangevale to a potential terminus at I-80 and the Route 65 Bypass.

- Elvas-Richards connector - A proposed facility that would link Elvas Avenue in East Sacramento to Richards Boulevard in the north central city area.

- Truxel Road bridge - A potential improvement to alleviate traffic on I-5 crossing the American River.

- Route 102 - A metropolitan bypass from I-5 near SR 99, passing near Lincoln and intersecting with I-80 northeast of Auburn.

In addition to these facilities which would expand regional operating capacity, a series of measures designed to permit the existing system to function more efficiently are being implemented. These measures include:

- High-occupancy vehicle lanes - These lanes are reserved for vehicles carrying a number of passengers, thereby reducing the commute time of those vehicles and encouraging their use.

- Public transit including light rail.

- Transportation systems management - The City adopted a transportation systems management ordinance, which has as its goal a 15-percent reduction in peak-hour vehicle trips.

Mitigation for local roadway segments generally consists of widening the affected roads to permit a smoother flow of traffic. As indicated by Table 11-9, the City has adopted several road-widening measures to relieve roadways in North Natomas. It is believed that these measures will substantially lessen, if not eliminate, identified impacts. In the South Natomas, Airport/Meadowview, and Pocket areas, the City has generally determined that widening of affected roadway segments is infeasible; therefore, development of these areas would produce significant and unavoidable traffic impacts.

With respect to affected local intersections in Natomas, the City has proposed to add a series of left- and right-turn lanes to facilitate a smoother flow of traffic. The City has further required developers in North Natomas to undertake a series of freeway improvements including:

- Construction of interchanges at Truxel Road/I-80 and North Market Boulevard/I-5.

- Construction of three overcrossings of I-5, one north of Del Paso Road and the remaining two between I-80 and Del Paso Road.

It is believed that these improvements would lessen impacts at some North Natomas intersections while leaving several others above the LOS "D" (80-percent capacity) threshold during peak hours.

Even with these improvements, impacts to segments of I-5 and I-80 in the Natomas area would remain unavoidable during peak hours as would the interchanges permitting access to these freeways. To relieve some of these impacts, the City proposes to initiate a study to evaluate the feasibility of improving the existing American River bridge or constructing a new bridge.

TABLE 11-9. Natomas Future (2010) Roadway Conditions and Adopted Mitigation Measures

IMPACT	ADOPTED MITIGATION MEASURES	STATUS OF IMPACT AFTER MITIGATION
Regional growth will cause the following regional roadway segments to operate at 80% of capacity or greater during peak hours:		
I-5 from I-80 to Business 80	Implement the City's Transportation Systems Management Program (applicable to all traffic and circulation impacts)	Impacts would remain significant (applies to all impacts)
I-80 from Business 80 to Greenback		
Business 80 from I-5 to I-80	Require dedication of right-of-way and extend light rail if determined feasible by SRTD (applicable to all traffic and circulation impacts)	
Highway 160 from Business 80 to American River		
SR 99 from Business 80 to south of Florin Rd.		
Implementing the North Natomas Community Plan will cause the following local roadway segments to operate at 80% of capacity or greater during peak hours:		
Truxel Rd. between I-80 and North Market St.	Construct Truxel Rd. as eight-lane limited access thoroughfare	Impact substantially lessened if not eliminated
I-5 from I-80 to Business 80	*Initiate study to evaluate feasibility of improving* existing American River bridges or constructing new bridge	*Impact remains significant*
Elkhorn Blvd. immediately east of East Levee Rd.	Widen Elkhorn to four-lane major thoroughfare from Northgate Blvd. to SR 99	Impact substantially lessened if not eliminated
Northgate Blvd. from I-80 to North Market St.	Construct Northgate extension as six-lane limited access thoroughfare	Impact substantially lessened if not eliminated
I-80 from I-5 to Norwood	None	Impact is significant and unavoidable
North Market from East L Loop to I-5	Widen North Market to six-lane limited access thoroughfare	Impact substantially lessened

TABLE 11-9. Natomas Future (2010) Roadway Conditions and Adopted Mitigation Measures

IMPACT	ADOPTED MITIGATION MEASURES	STATUS OF IMPACT AFTER MITIGATION
Implementing the South Natomas Community Plan will cause the following roadways and intersections to operate at 80% of capacity or greater during peak hours under cumulative impact, worst-case scenario:		
Roadways		
Truxel Rd. from South Loop Rd. to I-80	Widen road to eight lanes	Less than significant
Truxel Rd. from I-80 to San Juan Rd. (assuming six-lane alignment)	None (Widening to eight lanes found infeasible)	Impact remains significant
Northgate Blvd. from I-80 to Garden Hwy. (assuming four- and six-lane alignments)	None (Widening to eight lanes found infeasible)	Significant
Northgate Blvd. from Garden Hwy. to Highway 160 (assuming two-lane alignment)	Widen to four lanes	Significant
I-5/SR 99 from Market Blvd. to I-80 (assuming six-lane alignment)	None (Widening to eight lanes found infeasible)	Significant
I-5/SR 99 from I-80 to Garden Hwy. (assuming eight-lane alignment)	None	Significant
I-80 from West El Camino Ave. to Norwood Ave. (assuming six-lane alignment)	None	Significant
West El Camino Ave. between I-80 and I-5 (assuming six-lane alignment)	None (Widening to eight lanes found infeasible)	Significant
West El Camino Ave. from Northgate Blvd. to Norwood Ave. (assuming two-lane alignment)	None (Widening to four lanes found infeasible)	Significant
San Juan Rd. from Azevedo Dr. to Truxel Rd. (assuming four-lane alignment)	None (Widening to six lanes found infeasible)	Significant
San Juan Rd./West Silver Eagle from Northgate Blvd. to Norwood Ave. (assuming two-lane alignment)	None (Widening to six lanes found infeasible)	Significant
Garden Hwy. from Gateway Oaks Dr. to Northgate Blvd. (assuming four-lane alignment)	None (Widening to six lanes found infeasible)	Significant

TABLE 11-9. Natomas Future (2010) Roadway Conditions and Adopted Mitigation Measures

IMPACT	ADOPTED MITIGATION MEASURES	STATUS OF IMPACT AFTER MITIGATION
<u>Intersections</u>		
Northgate Blvd./I-80 westbound ramps	Provide two westbound right-turn lanes	Impacts remain significant
West El Camino Ave./Azevedo Dr.	Convert southbound right and through lane to exclusive right-turn lane. Convert northbound right and through lane to exclusive right-turn lane. Add one northbound left-turn lane	Significant
West El Camino Ave./Truxel Rd.	Convert southbound right and through lane to exclusive right-turn lane. Add one southbound left-turn lane. Add one northbound left-turn lane. Convert northbound right and through lane to exclusive right-turn lane	Significant
West El Camino Ave./Northgate Blvd.	None. (Proposed mitigation measures found infeasible)	Significant
Garden Hwy./Gateway Oaks Dr.	Convert westbound right and through lane to exclusive right-turn lane	Significant
Garden Hwy./I-5 southbound ramps	Add one eastbound left-turn lane	Significant
Garden Hwy./I-5 northbound ramps	Add one eastbound left-turn lane	Significant
Garden Hwy./Creekside Oaks Dr.	None	Significant
Garden Hwy./Truxel Rd.	None (Mitigation measures found infeasible)	Significant
Garden Hwy./Northgate Blvd.	Convert westbound right-turn and through lane to exclusive right-turn lane. Convert eastbound right-turn and through lane to exclusive right-turn lane. Convert southbound right-turn and through lane to exclusive right-turn lane. Add one eastbound left-turn lane.	Significant
Truxel Rd./I-80 westbound ramps	None (Mitigation measure found infeasible)	Significant
Truxel Rd./I-80 eastbound ramps	Add one southbound through lane. Provide two lanes on westbound on-ramp. Add one northbound through lane.	Significant
Truxel Rd./Rosin Rd.	None (No feasible mitigation measure identified)	Significant
Northgate Blvd./Rosin Rd.	None (Mitigation measure found infeasible)	Significant

CHAPTER 12

AIR QUALITY

This section addresses existing air pollution conditions in the study area, evaluates the region's conformance to applicable Federal and State air quality standards, identifies short- and long-term impacts to air quality that would result from each of the proposed alternatives, and suggests possible mitigation.

EXISTING CONDITIONS

The Sacramento Valley air basin is in the northern portion of the Great Valley and extends into the neighboring mountain ranges. It is bounded on the west by the Coast Range and on the north and east by the Cascade and the Sierra Nevada Ranges. To the south is the San Joaquin Valley air basin. The Sacramento basin covers a region which, because of similar meteorological and geographical conditions, shares the same air and hence the same air pollution problems as the San Joaquin Valley basin. The concept of air basins recognizes that winds carry air pollutants throughout large areas and that topography and temperature inversions influence such transport. An air basin is not a precise physical division like a watershed, but a political district established for dealing with air pollution that crosses municipal boundaries.

The principal air pollutant concern to the Sacramento basin is ozone, the main constituent of photochemical smog. Ozone is not released directly into the atmosphere, rather it is a secondary pollutant resulting from a complex series of photochemical reactions. These reactions occur when precursor compounds, such as hydrocarbons and nitrogen oxides (NO_X), are mixed by light winds and heated by the sun. Hydrocarbon emissions represent a compound of reactive organic gases (ROG's), which result from evaporation of petroleum products.

Nitrogen oxide emissions result from combustion of petroleum products. ROG's and NO_X, measured in tons per day, are emitted into the air from a variety of sources. These sources are generally grouped into two main categories: stationary and mobile. Stationary sources consist of major industrial, manufacturing, and processing plants (point sources) and commercial/industrial facilities which individually emit only small quantities of pollutants but collectively result in significant emissions (area sources). Mobile sources consist of on-road motor vehicles, including automobiles, trucks, and buses, and off-road vehicles such as construction equipment, farm tractors, trains, ships, and aircraft.

The health effects of ozone include respiratory illnesses, chronic heart and lung disorders, and some anemias. Concentrations of ozone found regularly in various parts of the State can also harm normal, healthy adults. The effects often include nausea, headaches, eye irritation, dizziness, throat pain, breathing difficulty, and coughing. The health effects caused by combined concentrations of certain sulfur oxides and ozone are more severe than those caused by greater concentrations of either pollutant alone.

Carbon monoxide (CO) is another, though less pervasive, pollutant emitted directly into the atmosphere and generally dispersed from the emission source and diluted through mixing. CO problems are usually localized and result from a combination of high traffic volumes and significant traffic congestion. CO pollution is most often a problem in winter months as a result of radiation inversion. This inversion occurs when air near the ground cools in the evening while the air aloft remains warm.

The inversions, coupled with calm conditions, cause "hot spots" near the emission source due to poor dispersion during winter nights. These inversions usually burn off in the morning. CO levels are a public health concern because the CO molecule has a greater affinity to bind with hemoglobin (HgB) than with oxygen (O_2) molecules, resulting in reduced oxygen in the blood. State and national standards were established to keep the CO-HgB concentration below levels that will harm cardiovascular and central nervous systems.

As mandated by the Clean Air Act of 1977 Amendments (Federal Act), the Environmental Protection Agency (EPA) established National Ambient Air Quality Standards (NAAQS) for a variety of pollutants, including ozone and CO. These standards are designed to protect people most susceptible to respiratory distress, such as the acutely and/or chronically ill, young children, the elderly, and persons engaged in strenuous work. The Federal Act requires each State to develop a State Implementation Plan (SIP) detailing the pollution control measures necessary to attain the standards. Areas that do not meet these standards for any or all constituents are designated as "nonattainment" areas.

State air quality standards have been established in California by the State Air Resources Board (ARB). As indicated in Table 12-1, these standards are generally more stringent than those established by EPA. Under the California Clean Air Act of 1988 (Sher bill), the ARB is required to establish criteria for identifying air basins which have not attained State air quality standards. Air basins which are designated as nonattainment areas and which, like the Sacramento basin, receive or contribute to transported air pollutants were required to submit to the ARB a plan for attaining State standards by June 30, 1991.

NATOMAS AND LOWER AMERICAN RIVER

This project area is located in the south-central portion of the Sacramento basin. Yolo County, Sacramento County, southwest Placer County, and northern Solano County currently comprise the Sacramento Metropolitan Air Quality Maintenance Area (SMAQMA) (Maintenance Area). As depicted in Figure 12-1, the Maintenance Area has been designated as a nonattainment area for ozone. In addition, a portion of the area lying within Sacramento County has been designated as a nonattainment area for CO.

In 1979, the Sacramento Area Council of Governments (SACOG) published the Air Quality Management Plan (1979 AQMP) for Sacramento. The 1979 AQMP constituted the SIP for the area, and, as required under the Federal Act, it was designed to permit the area to attain all the national standards by December 31, 1982. Three years later, when it was clear that attainment of these standards would not be achieved, SACOG promulgated a new SIP (1982 AQMP) designed to ensure attainment of Federal standards by the end of 1987. In February 1983, EPA proposed to disapprove the 1982 AQMP because the plan failed to demonstrate that attainment of all standards could be achieved within the required time frame. In July 1984, EPA approved the control measures set forth in the plan, but held the attainment issue open. By May 1987, it was clear that the Federal ozone standard would not be attained for some time in Sacramento. The Environmental Council of Sacramento (ECOS) and the Sierra Club sued EPA, claiming the agency had a mandatory duty under the Federal Act to disapprove the 1982 AQMP.

In response to this suit and in view of persistent violations of the ozone standard in Sacramento, EPA determined that the 1982 AQMP was substantially inadequate and required revision. In December 1988, pursuant to a settlement agreement between the Federal Government, ECOS, and the Sierra Club, EPA disapproved the 1982 plan due to its failure to attain the primary national ozone standard.

TABLE 12-1. State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards[1]		National Standards[2]		
		Concentration[3]	Method[4]	Primary[3,5]	Secondary[3,4,6]	Method[7]
Ozone	1 Hour	0.09 ppm (180 μg/m3)	Ultraviolet Photometry	0.12 ppm (235 μg/m3)	Same as Primary Std.	Ethylene Chemiluminescence
Carbon Monoxide	8 Hour	9.0 ppm (10 mg/m3)	Nondispersive infrared Spectroscopy (NDIR)	9.0 ppm (10 mg/m3)		Nondispersive infrared Spectroscopy (NDIR)
	1 Hour	20 ppm (23 mg/m3)		35 ppm (40 mg/m3)		
Nitrogen Dioxide	Annual Average	---	Gas Phase Chemiluminescence	0.053 ppm (100 μg/m3)	Same as Primary Std.	Gas Phase Chemiluminescence
	1 Hour	0.25 ppm (470 μg/m3)		---		
Sulfur Dioxide	Annual Average	---	Ultraviolet Fluorescence	80 μg/m3 (0.03 ppm)	---	Pararosoaniline
	24 Hour	0.05 ppm[8] (131 μg/m3)		365 μg/m3 (0.14 ppm)	---	
	3 Hour	---		---	1300 μg/m3 (0.5 ppm)	
	1 Hour	0.25 ppm (655 μg/m3)		---	---	
Suspended Particulate Matter (PM_{10})	Annual Geometric Mean	30 μg/m3	Size Selective Inlet High Volume Sampler and Gravimetric Analysis	---	---	---
	24 Hour	50 μg/m3		150 μg/m3	Same as Primary Stds.	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	---	---	50 μg/m3		
Sulfates	24 Hour	25 μg/m3	Turbidimetric Barium Sulfate	---	---	---
Lead	30 Day Average	1.5 μg/m3	Atomic Absorption	---	---	Atomic Absorption
	Calendar Quarter	---		1.5 μg/m3	Same as Primary Std.	
Hydrogen Sulfide	1 Hour	0.03 ppm (42 μg/m3)	Cadmium Hydroxide Stractan	---	---	---
Vinyl Chloride (chloroethane)	24 Hour	0.010 ppm (26 μg/m3)	Tedlar Bag Collection, Gas Chromatography	---	---	---
Visibility Reducing Particles[9]	8 Hour (10 a.m.-6 p.m. PST)	In sufficient amount to produce an extinction coefficient of 0.23 per kilometer due to particulates when the relative humidity is less than 70 percent. Measurement in accordance with ARB method V.		---	---	---

[FOOTNOTES ON NEXT PAGE]

NOTES:

1 California standards for ozone, carbon monoxide, sulfur dioxide (1 hour), nitrogen dioxide, suspended particulate matter - PM_{10} and visibility-reducing particulates are values not to be exceeded. The sulfur dioxide (24-hour), sulfates, lead, hydrogen sulfide, and vinyl chloride standards are not to be equaled or exceeded.

2 National standards, other than ozone and those based on annual averages or annual arithmetic means, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.

3 Concentration is expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25 °C and a reference pressure of 760 mm of mercury.

All measurements of air quality are to be corrected to a reference temperature of 25 °C and a reference pressure of 760 mm of mercury (1,013.2 millibar); ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

4 Any equivalent procedure which can be shown to the satisfaction of the ARB to give equivalent results at or near the level of the air quality standard may be used.

5 National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each State must attain the primary standards no later than 3 years after that State's implementation plan is approved by the EPA.

6 National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. Each State must attain the secondary standards within a "reasonable time" after the implementation plan is approved by the EPA.

7 Reference method as described by the EPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the EPA.

8 At locations where the State standards for ozone and/or total suspended particulate matter are violated. National standards apply elsewhere.

9 This standard is intended to limit the frequency and severity of visibility impairment due to regional haze and is equivalent to a 10-mile nominal visual range when relative humidity is less than 70 percent.

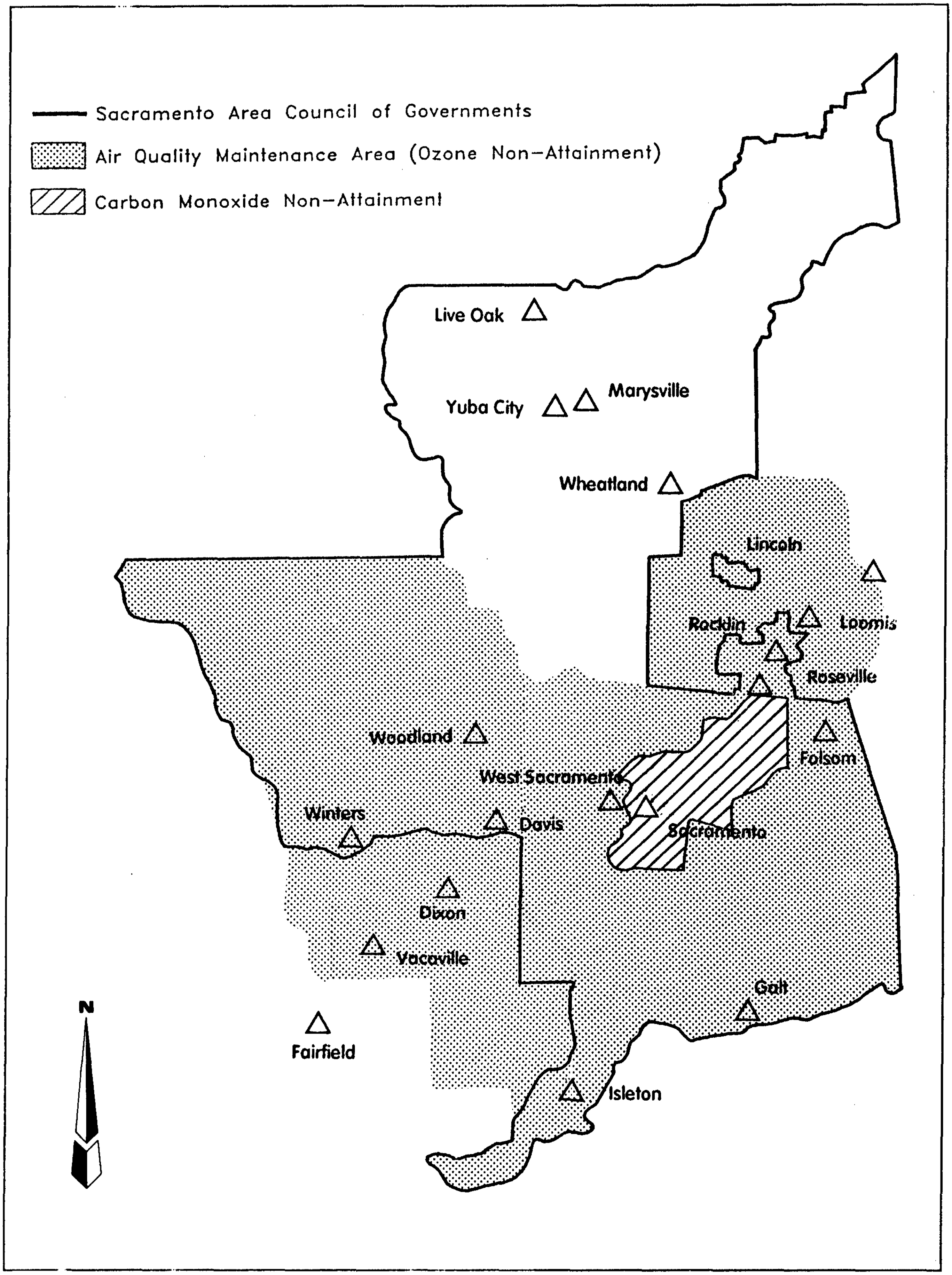


FIGURE 12-1. The Sacramento Air Quality Maintenance Area

The settlement agreement stipulated that EPA would promulgate a Federal Implementation Plan (FIP) in the event Sacramento fails to make reasonable progress toward the achievement of the Federal ozone standard. EPA's reasonable progress criteria are outlined in Table 12-2. These criteria require the ARB to submit a detailed schedule for development, adoption, and submittal of a new SIP and direct the Placer County Air Pollution Control District, the Yolo-Solano Air Pollution Control District, and the Sacramento District to adhere to the ARB's projected schedule.

No later than October 1, 1993, the ARB must submit a SIP which (1) sets forth the reductions necessary to attain the Federal ozone standard, (2) identifies the implementing agencies and the rules and regulations necessary to achieve attainment, and (3) demonstrates the sufficiency of the plan to achieve a minimum 3 percent annual reduction of emissions until attainment of the Federal standard is realized.

Under the settlement agreement, EPA is committed to sign a Notice of Proposed Rulemaking by June 26, 1991, setting forth either a proposed approval of the revised SIP or EPA's proposed FIP to attain the Federal ozone standard in Sacramento. EPA must sign a Notice of Final Rulemaking by February 26, 1992, setting forth either the approval of a SIP or EPA's final FIP.

EPA has identified three planning processes which may result in control measures and rules and regulations which the State may submit as additions and/or revisions to the existing SIP. These planning efforts include SACOG's program to develop a comprehensive air quality improvement plan for the region, the development of a regional air quality improvement strategy under the Sacramento Air Quality Act of 1988 (Connelly bill), and the development by each air pollution control district of new air quality plans as required under the Sher bill.

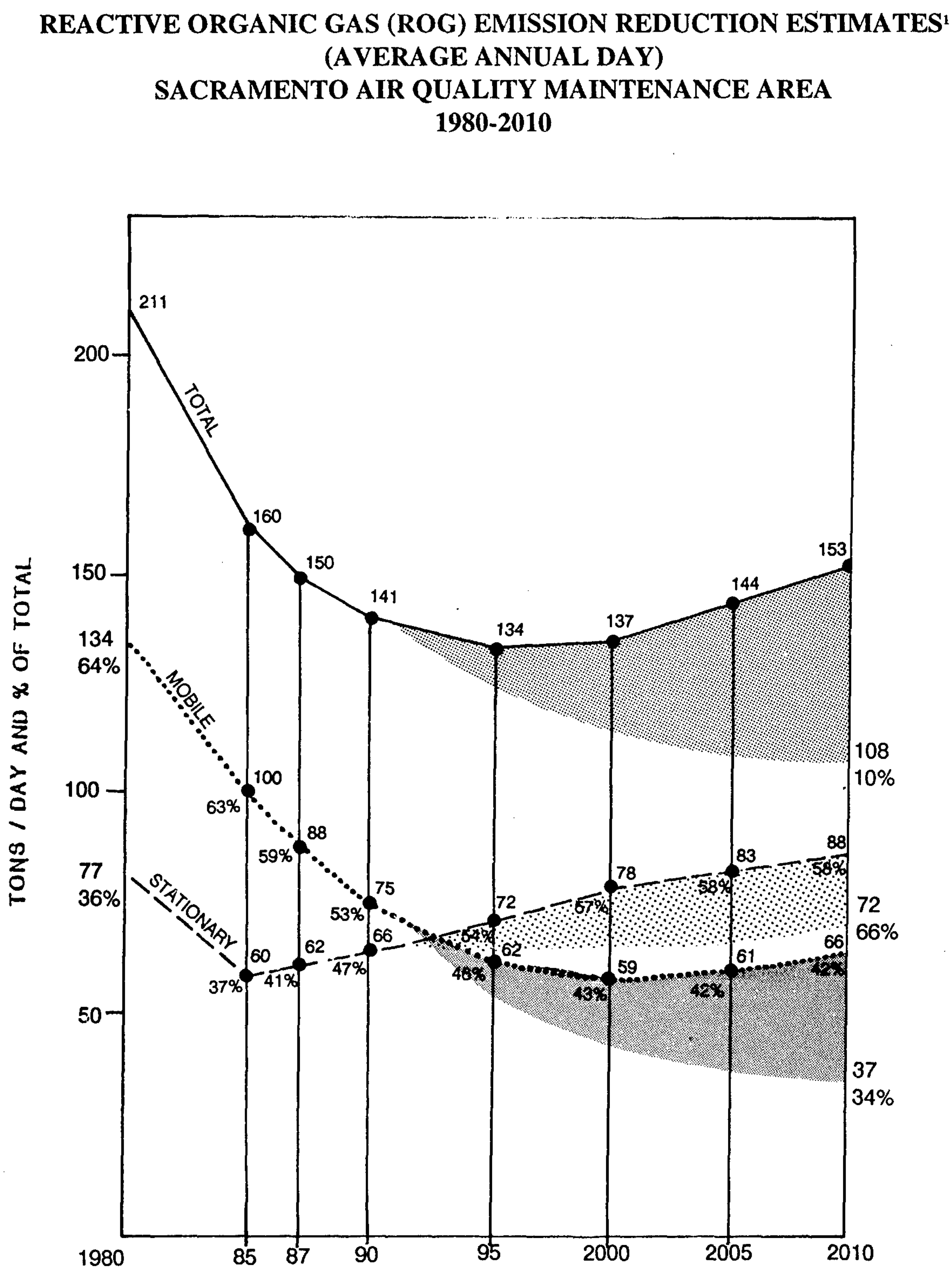
SACOG Interim Regional Plan

SACOG's Interim Regional Air Quality Plan is intended to bridge the gap between the 1982 SIP and the implementation of a revised SIP by the ARB in October 1993. As indicated in Figure 12-2, the plan seeks substantial reductions in ROG's by the year 2010. These reductions are to be accomplished through a combination of stationary emissions controls carried out by the Sacramento District and the Placer and Yolo/Solano Air Pollution Control Districts; onboard emissions controls implemented by the ARB; and transportation emissions controls implemented by the cities and counties within the Maintenance Area. These emission

TABLE 12-2. EPA Reasonable Progress Criteria

Date of Action	Responsible Agency	Measure
7/1/90	SACOG	Submit 1987 base year emission inventory.
9/30/90	ARB	Submit detailed schedule for development, adoption, and submittal of SIP.
10/1/93	ARB	Submittal of SIP - Reductions necessary to attain NAAQS. - Implementing agencies and rules/regs. - Demonstration of plan sufficiency (minimum 3% annually until attainment).
9/90	SMAQMD, PCAPCD, YSAPCD	Good faith adherence to projected schedule of SIP development.
1990	SACOG	Submittal of annual demonstration that measures adopted or to be adopted will achieve 3% or maximum feasible annual reduction. (See attachments.)
9/90	SMAQMD, PCAPCD, YSAPCD	Adopt enhancements to I/M program to meet standards in EPA's proposed Post-1987 Ozone/CO Policy (implement program within 6 months of adoption).
9/30/90	SMAQMD	Correct reasonably available control technology (RACT) deficiencies or post-1987 deficiencies in specified stationary source emission rules. (See attachment.)
9/30/90	SMAQMD	Adopt specified new stationary source emission rules to reflect RACT committed to by SMAQMD in letters of September 23, 1988, and September 26, 1989. (See attachment.)
9/30/90	PCAPCD	Correct RACT deficiencies or post-1987 deficiencies in specified stationary source emission rules. (See attachment.)
9/39/90	YSAPCD	Correct RACT deficiencies in specified stationary source emission rules. (See attachment.)
7/1/91	SMAQMD	Adopt the following revisions to existing New Source Review (NSR) rule (Rule 202). 1. Delete exemption for new and innovative technology (Section 103). 2. Delete exemption for cogeneration/resource recovery (Sections 104 and 105) or modify these sections so that exemption does not apply to nonattainment pollutants. 3. Modify intermittent facilities exemption (Section 106) to require Federally-enforceable permit conditions limiting operation of the facility. 4. Modify net emissions increase provision (Section 219) to include emissions from intermittent facilities. 5. Modify offset requirements (Section 302) to replace "anticipated" with "permitted." 6. Delete clean pocket exemption for CO (Section 302.2). 7. Modify operating permit program (Sections 410 and 411) to meet Federal requirements. 8. Modify Section 413.5 to ensure that only actual emission reduction may be used to compute a source's net emissions increase.
7/1/91	PCAPCD, YSAPCD	Revise New Source Review rule to comply with all Federal requirements for NSR rules.

Source: EPA Advance Notice of Proposed Rulemaking, March 1, 1990
SACOG Sacramento Area Council of Governments
ARB State Air Resources Board
SMAQMD Sacramento Metropolitan Air Quality Maintenance District
PCAPCD Placer County Air Pollution Control District
YSAPCD Yolo-Solano Air Pollution Control District



1. Totals may not add due to rounding.
2. Source of emission estimates without additional controls: Air Resources Board Technical Support Division - Preliminary data subject to revision (EMFAC 7D/BURDEN 7A - Average Daily Emissions).
3. Reduction estimates based on ARB, SACOG and APCD estimates.

FIGURE 12-2. Reactive Organic Gas Emissions Reduction Estimates

control measures and SACOG's estimate of the reductions they could achieve are set forth in Tables 12-3, 12-4, and 12-5.

In addition to developing an Interim Regional Air Quality Plan, SACOG has undertaken the development of an urban airshed model for the Sacramento area. The model is intended to serve as a technical guide to evaluating the control strategies needed to permit Sacramento to attain Federal and State ozone standards. Development of the model requires recordation of multiday ozone episodes at multiple sites which have ozone concentrations above the applicable standards. Sacramento typically experiences such episodes during the summer months; however, the summer of 1989, for unknown reasons, produced insufficient exceedence data on which to construct the model. Thus, it is possible that the 1993 deadline for developing an acceptable SIP may be extended.

Sacramento Air Quality Act

The Connelly bill became effective on January 1, 1989. The bill created the Sacramento Metropolitan Air Quality Management District (SMAQMD) to assume the functions of the Sacramento County Air Pollution Control District and to undertake the following principal responsibilities:

- Adopt regulations to encourage low-emission vehicles, alternative fuels, ridesharing, vanpooling, peak shifting, and flexible work hours in order to control mobile source emissions and improve air quality in the Sacramento area.

- Adopt regulations to limit or mitigate direct emissions from point and areawide sources.

- Adopt by the end of 1989 an air quality improvement strategy to reduce public exposure to air pollution and toxic air contaminants in Sacramento County.

On December 19, 1989, the SMAQMD adopted the required air quality improvement strategy, which provided goals and strategies to guide district planning in the transportation, clean fuels, land use, and stationary source fields.

TABLE 12-3. New Onboard Mobile Emissions Control Measures

Measure	Implementation Date	Responsible Party	Total Additional Emission Reductions	Comment
1. Improved I&M for cars and light and medium-duty trucks.	1989-90	BAR	*	New program contained in SB 1997 adopted in 1988.
2. Add heavy-duty gas vehicles to I&M Program.	1989	BAR	*	
3. Heavy-duty vehicle smoke enforcement.	1990	ARB/CHP	*	SB 1997 requires ARB/CHP to operate random roadside inspection.
4. Lower, HC, CO standards for light-duty vehicles.	1992	ARB	*	Adoption of 0.25 gram/mile HC standard, 3.4 gram/mile CO standard at 50,000 miles - (compliance at 100,000 miles to follow).
5. Lower HC, CO, and NO_x standards for medium-duty and light-heavy-duty trucks.	1992	ARB	*	Establish more representative test based on a gross vehicle weight rating system.
6. Lower PM standards for medium-duty and light-heavy-duty diesel trucks.	1992	ARB	*	
7. New diesel fuel quality standards.	1992	ARB	*	Established maximum allowable aromatic and sulfur content.
8. Lower gasoline vapor pressure		ARB	*	Lower RVP gasoline may reduce evaporative HC.
9. Lower NO_x standard for light-duty vehicles.	1996	ARB	*	50% reduction from current 0.4 grams/mile standard.
10. Lower NO_x standard for heavy-duty diesel trucks.	1997	ARB	*	Reduce current standard from 6.0 to 5.0 grams/per brake horsepower per hour.
11. Emission standards for construction equipment.		ARB	*	Under study.
12. Moderate methanol penetration of vehicle fleets, conversion of heavy-duty diesel trucks.	1992	ARB	*	Would create methanol emission standards and test procedures in accordance with EPA proposal. Assumes 1994 Federal requirements that alternatively fueled trucks be used in interstate commerce.
13. Full methanol penetration.	1994	ARB	*	Full penetration not likely to occur until 2000+.
14. New alternatively fueled buses.	1991	ARB	*	Require PM standard of 0.1 gram per brake horsepower per hour in order to compel use of PM traps (hardware unproven).
TOTAL (tons/day ROG)			22	

Source: ARB draft 1988 update to post-1987 motor vehicle plan.
* Unknown at this time.

TABLE 12-4. New and Revised Stationary Source Control Measures

Ozone Precursor Control Measure		Proposed Rule Adoption Date	Proposed Rule Effective Date	Estimate Control Efficiency	Total Additional Emission Reductions
Sacramento Metropolitan Air Quality Management District					
Rule 443	Valves and Flanges at Chemical Plants	1/89	1/89	40%	
Rule 445	Perchloroethylene Dry Cleaning	9/90	9/90		
Rule 446	Storage of Petroleum Products	9/90	9/91		
Rule 447	Organic Liquid Loading	1/89	1/90	99%	0.3 tons/day
Rule 448	Gasoline Bulk Plans/Gasoline Delivery - Stage 1 Vapor Recovery	9/90	9/91		
Rule 450	Graphic Arts	9/90	9/91		
Rule 451	Miscellaneous Metal Parts Coating (including aerospace coatings)	9/90	9/91		
Rule 452	Can Coating	9/90	9/91		
Rule 454	Degreasing	9/90	9/91		
Rule 456	Aerospace coatings	4/89	10/89	*	*
Rule	Fiberglass Fabrication/Polyester Resin Use	6/89	1/90	66%	*
Rule	Wood Products Coatings	5/89	5/90	40%	*
Rule	Automobile Refinishing	9/89	9/90	50%	*
Rule	Plastic, Glass, and Rubber Coating	6/89	6/90	50%	*
Placer County Air Pollution Control District					
Rule 212	Storage of Petroleum Products	1/90	2/90	95%	N/A
Rule 213	Gasoline Transfer into Stationary Storage Containers	1/90	2/90	95%	N/A
Rule 215	Transfer of Gasoline into Tank Trucks, Trailers, and Railroad Tank Cars at Loading Facilities	1/90	2/90	99%	N/A
Rule 216	Degreasing	4/90	5/90	40-60%	N/A
Rule 217	Cutback and Emulsified Asphalt Paving Materials	1/90	2/90	50%	N/A
Rule 223	Can Coating	1/90	5/90	60%	N/A
Rule 508	New Source Review	12/89	1/90	Dependent	Case-by-Case
Rule	Aeration of Contaminating Soil	2/90	3/90	90% by weight	*
Rule	Perchloroethylene Dry Cleaning Operations	1/91	2/91	90%	*
Rule	Wood Furniture Manufacturing	4/91	5/91	40%	*
Rule	Semiconductor Manufacturing Operations	12/90	1/91	90%	0.07 tons/day
Rule	Emergency Episode Plan	12/90	1/91	*	10-25% for alter days
Yolo-Solano Pollution Control District					
Rule 2.21	Gasoline Bulk Plans Delivery and Stage II Vapor Recovery	9/90	1/91		
Rule 2.24	Degreasing	9/90	1/91		

Source: SACOG Interim Regional Air Quality Plan
* Unknown at this time
N/A Not Applicable

TABLE 12-5. New Transportation Control Measures

Measure		Estimated Daily VMT Reduction	Proportion of Total Daily VMT[1]	Estimated Daily VT Reduction	Estimated ROG Reduction (tons/day)
Automobile Use Management					
I.	Areawide Car/Vanpooling	794,500	1.7%	100,442	0.5
II.A	City/County TRO[2]	1,402,100	3.0%	177,256	0.9
II.B	Employer Car/Van/Buspool	794,500	1.7%	100,442	0.5
III.A	Pedestrian/Transit Mall	NC[3]	NC	NC	
III.B	Auto-Restricted Periods	420,600	0.9%	53,173	0.3
Traffic Flow Improvements					
IV.A	Freeway HOV Lanes	379,700	0.7%	48,003	0.3
IV.B	Arterial/Dntn HOV Lanes	NC	NC		NC
V.A	Signal & Roadway Improve.	NC	<1.0%		NC
V.B	Freeway Ramp Metering	NC	<1.0%		NC
VI.	Alternative Work Hours	467,400	1.0%	59,090	0.4
Parking Management					
VII.A	Parking Pricing	4,813,800	10.3%	608,571	3.1
VII.B	Parking Supply Limits[4]	NC	<1.0%		NC
VIII.A	Suburban Park & Ride	NC	<1.0%		NC
VIII.B	Fringe Area Park & Ride	0	0%		0
Public Transit					
IX.A	Exclusive Busways	0	0%		0
IX.B	Expansion of Rail Transit	794,500	1.7%	100,442	0.5
X.	Short-Range Transit Imp.	NC	<1.0%		NC
Nonmotorized Alternatives					
XI.	Bikeways & Bike Support	NC	<1.0%		NC
XII.A	Teleconferencing	NC	<1.0%		NC
XII.B	Telecommuting	420,600	0.9%	53,173	0.3
Clean Fuels					
XIII.	Alternative Motor Fuels	--- cannot yet be determined ---			
Land Use					
XIV.A	Mixed Land Use	NC	<1.0%		NC
XIV.B	Jobs-Housing Balance	NC	<1.0%		NC
Public Education					
XV.	Public Awareness Campaign	NC	---		NC
TOTALS		10,287,700	21.9%	1,300,592	6.8

Source: SACOG Interim Regional Air Quality Plan

1 Project 2010 daily VMT is 46,736,000 for passenger cars, light-duty trucks, and motorcycles; 54,236,000 for the entire fleet.
2 These two programs overlap somewhat. The combined net effectiveness will probably be 2,169,400 VMT (4% of daily total) and 1.7 tons/day.
3 NC means no credit taken for this measure.
4 Implemented in conjunction with an aggressive parking pricing program.

Sher Bill

Under the Sher bill, the SMAQMD and the Yolo/Solano and Placer County Air Pollution Districts are required to develop comprehensive plans to attain Federal and State air quality standards. Using 1987 as the base year, these plans must demonstrate the potential to achieve at least a 5 percent annual reduction in pollutant precursors until compliance with State standards has been achieved. Each district must apply reasonably available control technology on all existing emission sources and adopt reasonably available transportation control measures. The Sher bill also requires the ARB to adopt rules to control emissions from consumer solvents and to tighten controls on onboard emissions from mobile sources. Districts must update their plans every 3 years, with the first plans due no later than July 1, 1991.

Federal Enforcement Mechanisms

Failure of the Sacramento area to make reasonable progress toward the adoption of a satisfactory SIP could lead EPA to promulgate a FIP no later than February 1992. The measures contemplated by EPA in this regard include a variety of mobile and stationary source control measures similar to those contained in the SACOG Interim Regional Air Quality Plan. EPA has acknowledged that its ability to implement these measures may be limited because the agency is legally authorized to promulgate only those measures which it can enforce with its own resources. This requirement could limit available measures since EPA is faced with the possibility of implementing four other ozone FIP's in California.

EPA's enforcement authority in this regard, however, is not limited to the promulgation of a FIP. Sacramento's continued failure to attain the Federal ozone standard, or to at least make reasonable progress toward that goal, could result in the imposition of sanctions by EPA. These sanctions could include withholding, reducing, or placing conditions on Clean Air Act grant funds and/or funds for local highway construction. A ban on stationary sources and a cutoff of sewage treatment grant funds could also be considered.

The SMAQMD has already been directed to deny permits for any new facilities with uncontrolled volatile organic carbon (VOC) emissions of 100 tons per year or greater, or for any modifications to existing facilities which would increase uncontrolled emissions of VOC's by more than 40 tons per year.

Sacramento 1991 Air Quality Attainment Plan

Pursuant to the Federal Clean Air Act Amendments of 1990, the SMAQMD prepared an attainment plan, published in July 1991, to address the continuing nonattainment issues for ozone, carbon monoxide, and, to a lesser degree, PM_{10}. The plan calls for an aggressive program to reduce emissions of ROG's, NO_x, and CO through the year 2010. An annual average reduction in basinwide ROG emissions of 3.1 percent over this period is projected, along with an annual average reduction in NO_x emissions of 2.4 percent. These reductions in ozone precursors are thought to bring about attainment with the ozone standard and ensure maintenance of the ozone standard in the future. Similarly, an annual average reduction in carbon monoxide emissions of 2.2 percent is projected.

Key elements of the plan include major stationary source emission reductions from controls on such sources as dry cleaners, architectural coatings, pesticide use, and many other sources. Also part of the plan are improvements in the emissions control from motorized vehicles and equipment and substitution of alternative, cleaner-burning fuels, such as methanol. Transportation control measures such as increasing usage of mass transit and encouraging the use of carpooling and bicycles are components of the plan as well as indirect controls such as parking. The plan involves major commitments of public resources toward the goal of providing cleaner air to the Sacramento area and will require the placement of air quality issues as a major priority in public funding and effort. Key to the success of the plan will be public education in the areas of air pollution concerns and controls.

Existing Air Quality

Most of the entire Sacramento air basin has been declared a nonattainment area for ozone. To classify as a nonattainment area for ozone, an area need only have 1 hour of concentrations in excess of the standard. Although monitoring data clearly reveal that there are significant differences in the air quality from one location in the Sacramento air basin to others, virtually all the monitors have had at least one violation. Sacramento Metropolitan Airport, the nearest monitoring station to the Natomas area, has far fewer violations of the ozone standard than areas to the east and northeast of metropolitan Sacramento. The North Highlands monitoring station, another station near the Natomas area, also shows lower concentrations of ozone than the areas to the east and northeast of metropolitan Sacramento.

The other major pollutant of concern in Sacramento is carbon monoxide. Carbon monoxide concentrations in the Natomas area are not in violation of the standards. However, portions of the urbanized lower American River area contain locations where high carbon monoxide concentrations have been measured.

Existing emission rates for the Natomas and lower American River areas were estimated based on previous studies of emissions for the Sacramento area as a whole prepared by SMAQMD. Emission sources considered include motor vehicles, space heating, dry cleaners, light industry, commercial development, and a variety of other sources reflecting the full range of emission sources identified by SMAQMD in the air quality plan for Sacramento. Using ratios of population and developed acreage, Sacramento countywide emission estimates taken from SMAQMD were scaled to reflect the Natomas and lower American River areas alone. Based on this methodology, existing emissions of pollutants in these areas are shown in Table 12-6.

TABLE 12-6. Existing Emission Rates - Natomas, Lower American River

Area	ROG (ton/yr)	NO_x (ton/yr)	CO (ton/yr)
Natomas	1,644.1	1,192.2	8,722.2
Lower American River	17,944.5	13,013.2	95,201.8

Source: TRC Environmental Consultants, Inc.

UPPER AMERICAN RIVER

The western portion of this project area is located in the Mountain Counties air basin, under the jurisdiction of the Placer County Air Pollution Control District. Although western Placer County (just west of the City of Auburn) is within the boundaries of the Sacramento District, the project area proper is outside of the Sacramento District. All of Placer County, except that segment in the Lake Tahoe air basin, has been designated as a nonattainment area for ozone and unclassified for PM_{10}. EPA also has proposed to redesignate the County under the Federal Act.

Because of the direction of prevailing air currents and the action of the Sierra range as a climatological barrier, the

Auburn area is subject to heavy influence from air contaminants originating in the Sacramento area, as well as from agricultural burning activities in the valley. Traffic on I-80 and Highway 49 and local industries also are significant sources of air pollution. Concentration of air contaminants occurs most often when the atmosphere is stable and winds are light for long periods of time.

IMPACTS

SIGNIFICANCE CRITERIA

The SMAQMD was contacted to assist in determining what significance thresholds would apply to the proposed project. According to the SMAQMD's CEQA Section, the New Source Review rule contains the district's only significance thresholds (Nancy Ormandy, personal communication, 1991) which apply only to new stationary sources. The district currently does not have adopted thresholds for indirect sources which could be applied to the project's short-term construction emissions. The district is currently revising the New Source Review rule to include significance thresholds for both direct and indirect sources. The new threshold limit, however, was still being considered at the time of report preparation.

CEQA Guidelines suggest that an air quality impact will "normally" be considered significant if it will "violate any ambient air quality standard, contribute substantially to an existing or projected air quality violation, or expose sensitive receptors to substantial pollutant concentrations (Guidelines 15064(e); Appendix G(x))." In the absence of locally adopted indirect source thresholds and consistent with CEQA Appendix G Guidelines, the following threshold was developed with the SMAQMD for this report: Any project-generated pollutant emission which is designated nonattainment by the ARB and cannot be offset elsewhere in the air basin is considered to have a significant impact on air quality. Any predicted project-induced exceedence of Federal or State Ambient Air Quality Standards or inconsistencies with adopted air quality plans is also considered to have a significant impact on air quality.

NO-ACTION ALTERNATIVE

Under this alternative, no Federal action would be undertaken to modify the existing flood control system along the American River. As a result, the undeveloped portions of the Natomas basin would remain agricultural, and existing emission rates for the area, as shown in Table 12-6, would continue relatively unchanged. Furthermore, vacant lands in the Pocket and Meadowview areas of the City would remain undeveloped (see Chapter 4, Land Use), and localized emissions from nonagricultural vehicular sources in these areas would remain relatively unchanged.

The effect of the no-action alternative on regional emissions in Sacramento is difficult to quantify. It is assumed that growth constrained by high base flood elevations in the Natomas, Pocket, and Meadowview areas would be absorbed elsewhere in the region. Thus, on a regional scale, the vehicular emissions attributable to this growth might not be significantly different with or without the project. There could even be an increase in regional emissions if the growth projected for the Natomas, Pocket, and Meadowview areas occurred instead in a dispersed pattern over a wider portion of the Sacramento metropolitan area.

Regional growth in the Auburn area would proceed under the no-action alternative as anticipated under current California State Department of Finance population projections and adopted local plans. Project-related emissions would be avoided. However, since most of Placer County is likely to be designated as a nonattainment area for ozone, regional air pollution would remain a problem.

SELECTED PLAN

Direct Impacts

Natomas. Natomas area flood control improvements would result in both short- and long-term impacts on air quality. Short-term construction emissions would occur during project development, and, to a lesser extent, long-term emissions would occur during project operation.

Construction impacts on air quality would include dust/particulate generation from earthwork activities and combustion emissions resulting from heavy-duty construction equipment. These short-term project emissions are discussed separately below.

Dust would be generated during excavation activities, soil loading and dumping, initial clearing and grading, and from the operation of trucks and other heavy-duty equipment on unimproved dirt roads and levees. The amount of dust emissions generated by the project would depend on soil moisture, wind speed, activity level, and silt content of the soil. Dust is typically generated at the rate of 1.2 tons/acre/month of construction activity (EPA, 1985). Land requirements for the proposed Natomas area flood control improvements, including the borrow site (116 acres) and all proposed levee improvement areas (18.6 acres), total approximately 134.6 acres. Using the above-mentioned dust generation factor and assuming all improvements are constructed simultaneously, the proposed flood control improvements could generate approximately 161.5 tons of dust per month of construction.

On a short-term basis, construction activities of major land development projects potentially generate concentrations of particulates that exceed the National Ambient Air Quality Standards (EPA, 1985). Because the proposed project represents a major undertaking primarily involving earthwork, short-term localized exceedence of State Ambient Air Quality Standard for PM_{10} is anticipated. Consequently, the project's dust and particulate generation would be considered a significant short-term impact on air quality. Regular watering can suppress the amount of dust generated on the construction site, and project phasing can reduce the magnitude of PM_{10} emissions; however, the residual impact for PM_{10} would remain significant.

In addition to generating particulates, construction equipment used for excavation, hauling, clearing/grading, compacting, and other similar construction techniques would produce combustion emissions (hydrocarbons and oxides of nitrogen). These emissions would also occur at varying degrees on a short-term basis at the following locations: the borrow site, each improvement site, and along proposed haul routes. Combustion emissions from construction employee commuter traffic would also be a result of the project. For this analysis, combustion emissions were divided into two major categories: heavy-duty construction equipment and construction employee/miscellaneous commuter trips. Analyses of these emissions are presented separately below.

To quantify the total combustion emissions expected to be generated by heavy-duty construction equipment, the amount, type, and length of use (in days) were estimated for each piece of construction equipment. The equipment estimates were developed on the basis of consultations with engineers familiar with the project. Total haul trips by dump trucks are based on the use of 25 cubic-yard-capacity trucks and the estimated fill requirements for each improvement site. The estimated heavy-duty construction equipment was then modeled using standard EPA air pollution factors to calculate daily and total project heavy-duty equipment combustion emissions (EPA AP-42, 1976). A separate model run was conducted for each of the nine improvement sites.

Table 12-7 summarizes the results of the detailed modeling. As shown in Table 12-7, total emissions attributable to heavy-duty construction equipment would be substantial. These would include ozone precursor emissions (NO_x and Exhaust Hydrocarbons) of 2.489.3 pounds per day and CO emissions at a rate of approximately 1,001.8 pounds per day. These emissions are considered a short-term significant unavoidable impact.

Lower American River. The selected plan would not require any construction in the lower American River area or result in any direct impacts on air quality.

Upper American River. Upper American River air quality impacts would be short term and result from aggregate extraction, dam construction, excess material disposal, and Highway 49 and Ponderosa Way replacements. These impacts are discussed separately below.

Aggregate extraction and processing would result in both particulate and combustion emissions at the extraction site. Extraction would be accomplished by blasting, which results in large quantities of dust and particulate generation. Because of this, short-term localized exceedence of State Ambient Air Quality Standard for PM_{10} is anticipated. Consequently, where blasting is required, project-generated dust and particulate emissions would be considered a significant short-term impact on air quality.

Processing procedures would immediately follow extraction. Processing would be conducted at the Old Cool Quarry site. If processing is conducted at another location, additional combustion emissions associated with transport would result as well as dust emissions associated with the added loading and unloading of materials.

Most emissions released during processing are particulates. The type, size, and quantity of particulates depend on the composition of the aggregate itself, the type of processing used, and the machinery used. Specific information concerning the makeup of quarry materials is unavailable at this time. However, assumptions are that the sand and gravel processing system ultimately used will have standard dust suppression systems incorporated in its design. These suppression systems consist of water spray nozzles and wet screens located at various locations throughout the plant. According to a previous study conducted for the Yolo-Solano Air Pollution Control District, a

TABLE 12-7. Heavy-Duty Construction Equipment Combustion Emissions Detailed Modeling Summary

	Emissions in Pounds Per Day[1]					Total Emissions in Pounds				
	CO	Exhaust Hydrocarbons	NO_X	SO_X	Particulates	CO	Exhaust Hydrocarbons	NO_X	SO_X	Particulates
NEMDC	151.6	29.0	412.7	49.5	37.8	9770.0	1840.0	26362.0	3113.0	2359.0
Main	102.5	19.1	208.2	17.4	16.2	7616.0	1364.0	14524.0	1222.0	1198.0
Pump Station	98.9	17.4	186.1	18.3	16.9	1623.0	243.0	2527.0	279.0	247.0
NCC	80.4	13.0	204.7	23.7	16.1	1020.0	153.0	2546.0	291.0	192.0
Fifield	52.3	6.8	77.9	6.3	5.5	245.0	30.0	351.0	29.0	25.0
Sankey	70.7	11.0	128.8	14.6	11.9	3289.0	690.0	8352.0	1028.0	811.0
Dry Creek	92.2	19.1	254.2	28.2	22.4	4135.0	923.0	11583.0	1337.0	1114.0
Arcade	52.4	10.1	134.4	15.0	11.0	1212.0	239.0	3079.0	342.0	255.0
Fremont	300.8	56.2	700.6	83.8	70.2	20792.0	3874.0	47856.0	5956.0	5003.0
TOTAL	1001.8	181.7	2307.6	256.8	208.0	49702.0	9356.0	117180.0	13597.0	11204.0

[1] Daily emission estimates assume worst-case operation of all construction-related vehicles at all improvement sites simultaneously.

Source of emission factors: EPA, 1985 (AP-42, Volume II). Construction vehicle input data based on consultations with project engineers.

750,000-ton-per-year plant can produce approximately 19 tons per year of particulates (Quad Consultants, 1989). This emission level is below the level which requires application of New Source Review rules in the Yolo-Solano APCD. Nevertheless, because the project is located in a district currently classified nonattainment for PM_{10}, the incremental addition of particulate matter as a result of the project-generated increase in processing operations would be considered significant.

Combustion emissions could also be generated both onsite and offsite, depending on the location of the power source for the aggregate crusher. If power generation by combustion is located in a district where ozone is in nonattainment, air quality impacts would be considered significant.

Conveyor systems also produce combustion emissions from generators used to power the electric conveyors. Conveyor systems also produce significant amounts of dust and particulate emissions at loading and transfer points. Dust may also become airborne due to vibration of the belt as it passes over rollers or around drums, as a result of spillage, and at obstructions such as ventilation doors or flaps which the belt may have to negotiate. Overall, dust emissions resulting from use of conveyors would be considered a short-term significant impact subject to mitigation.

The majority of direct impacts on air quality in the upper American River would be related to dam construction. Typical daily heavy-duty equipment emissions associated with dam construction were calculated based on the number and types of construction equipment used during construction of the New Melones Dam. The overall New Melones construction equipment numbers were reduced because (1) a roller-compacted concrete dam requires less production and haul equipment than a large earthfill dam such as New Melones and (2) gravel material will be transported to the flood control damsite by conveyor or rail.

These values were then applied to standard emission factors to calculate daily total construction equipment combustion emissions (Table 12-8). The dam construction emission projections shown in Table 12-8 should be considered order-of-magnitude estimates only, since the specific numbers and types of equipment are presently not known. These construction emissions also would be temporary, further reducing the overall level of impact.

The proposed unsuitable material excavation and temporary storage areas are located in the Placer County Air Pollution Control District (PCAPCD) and the El Dorado County Air Pollution

Control District (EDCAPCD); both are within the Mountain Counties air basin. Both districts have been designated nonattainment for ozone. In addition, Placer County has been designated as a nonattainment area for particulate matter (PM_{10}). The disposal operation would result in mobile source emissions from heavy equipment operation and point source emissions from excavation and placement of the material. Consequently, because of the ozone and PM_{10} nonattainment status, disposal-related emissions would result in significant short-term air quality impacts.

TABLE 12-8. Projected Air Pollutant Emissions for Dam Construction Activities

	EMISSIONS (POUNDS PER DAY)					
	CO	TOTAL HYDROCARBONS	NO_X	REACTIVE ORGANICS	SO_X	PARTICULATES
DAM CONSTRUCTION	290	98	1,375	24	99	64
REGIONAL EMISSIONS (1987)[1]	26,799	9,178	7,347	2,464	1,013	5,495
INCREASE DUE TO DAM CONSTRUCTION	1 %	1 %	19 %	1 %	10 %	1 %

[1] Does not include El Dorado County emission values.

Indirect Impacts

Natomas. Implementation of the selected plan would allow development of areas in the Natomas basin currently in agricultural use. The added development would result in new sources of emissions, the most significant of which would be motor vehicle miles driven in the project area. The SMAQMD is clearly concerned over such development, as illustrated by the following quote from the Air Quality Attainment Plan:

> The District is concerned over energy-inefficient development, such as low-density suburban residential development; service, commercial, and other job sectors which cannot be efficiently served by public transit and other alternative transportation modes; and policies and/or developments from which people are forced to use their cars for all of their transportation needs. These "traditional" patterns of use will lead to an ever-increasing demand for fossil

fuels for energy generation and consequent further degradation of Sacramento's air quality.

An analysis of the potential indirect air quality impacts of the selected plan was conducted by estimating emission rates for the Natomas basin with and without the project. The emission estimates were performed by scaling emission rates from the SMAQMD 1991 Air Quality Attainment Plan. The attainment plan calls for a number of measures to control air quality beyond current levels in the greater Sacramento area. In the subsequent analysis, only those controls listed by the SMAQMD as "Current Controls" have been included in defining emission rates.

Estimating emission rates for any metropolitan area such as Sacramento involves evaluating opposite effects. In one direction, the air quality control agencies are working to reduce emission rates on an areawide basis with such programs as tighter controls on motor vehicle manufacturers, stationary source controls, and transportation control measures. In the other direction, the continued pressures of growth tend to increase the numbers of air pollution sources. The SMAQMD hopes that by implementing a comprehensive program of controls in many different areas it will be able to offset the effects of continued growth in the Sacramento area.

The Natomas basin is unusual because most of the area is relatively undeveloped, and the potential for growth, with the flood protection provided by the selected plan, is much greater than for the Sacramento area as a whole. As a result, when the Natomas basin is considered alone, the increases in emissions from the potential growth made possible by the project far outweigh the efforts of the air pollution control agencies, and a net increase in emissions occurs. Table 12-9 shows total emissions and increases over current levels for the Natomas area. It should be noted that the estimates in Table 12-9 are for development anticipated under adopted local plans by 2010 and do not include plans which are in draft status at this time. For example, the unincorporated area of Sacramento County in the Natomas basin and the area of the Natomas basin in south Sutter County have conducted some planning for future development, but do not have adopted plans for such development at the time of this analysis; thus, the emissions from such development have not been included here. Instead, these emissions are identified in Chapter 18 as part of a discussion of possible future growth scenarios and related impacts.

TABLE 12-9. 2010 Emission Estimates - With Project, Natomas, Lower American River (Under SMAQMD Attainment Plan)

Area	ROG		NO_X		CO	
	Total (ton/yr)	Change from Existing (%)	Total (ton/yr)	Change from Existing (%)	Total (ton/yr)	Change from Existing (%)
Natomas	4,135.4	163	3,446.2	203	21,090.8	153
Lower American River	13,927.5	-22	11,606.3	-11	71,030.4	-25

Source: TRC Environmental Consultants, Inc.

If the selected plan is not implemented, development and growth in the Natomas basin will be limited; consequently, the SMAQMD emissions control program should result in decreased emission rates as compared to existing conditions. Table 12-10 presents the estimated year 2010 emissions for the Natomas basin without the project.

TABLE 12-10. 2010 Emission Estimates - Without the Project, Natomas, Lower American River (Under SMAQMD Attainment Plan)

Area	ROG		NO_X		CO	
	Total (ton/yr)	Change from Existing (%)	Total (ton/yr)	Change from Existing (%)	Total (ton/yr)	Change from Existing (%)
Natomas	1,099.8	-30	916.5	-19.5	5,608.8	-33
Lower American River	13,623.9	-24	11,353.2	-13	69,481.8	-27

Source: TRC Environmental Consultants, Inc.

City models created to evaluate increased CO emissions at the intersections likely to carry the highest volumes of traffic in an urbanized North Natomas suggest that CO impacts at these intersections would fall below State and Federal standards. On a regional basis, however, increased vehicular travel associated with project-induced growth in Natomas could exacerbate ongoing congestion problems on local freeways and existing intersections and contribute to continuing violations of CO standards in localized areas of the City. Project-induced growth would also increase regional emissions of ROG's and NO_X, thereby worsening the area's ozone problems. Yet it is likely that these impacts would occur even without the project since regional growth trends are not dependent on the availability of developable land in

Natomas. Thus, the key to determining the significance of the project's effects on regional emissions is whether these effects are measured by comparison to an existing condition baseline or by comparison to a no-action (without-project) baseline.

As demonstrated in Table 12-9, by 2010, emissions emanating from sources related to Natomas would increase with the project by 150-200 percent over a baseline reflecting existing conditions. By comparison to a no-action baseline, however, the with-project condition might well produce a net decrease in regional emissions. This would depend on how much of the growth precluded from Natomas under the without-project condition would be absorbed elsewhere in the region. Consultants retained by the City to evaluate the effects of the land use planning policy in the 100-year flood plain concluded that projected regional growth trends would be minimally affected if planned development was unable to proceed in North and South Natomas. (See "Economic Impacts of the Proposed City of Sacramento Flood Policy," Economic and Planning Systems, Inc., January 1990.) This suggests that regional emissions would be substantially the same with or without the project. In fact, in its prior deliberations on the North Natomas Community Plan, the Sacramento City Council found that development of Natomas, with its central regional location, could reduce regional vehicle miles traveled by avoidance of a pattern of dispersed suburban growth in the region and improved effectiveness in implementation of an air quality mitigation strategy. If this is the case, the selected plan could actually result in less regional mobile source emissions than the no-action alternative.

Nevertheless, because analysis shows that indirect SMAQMD nonattainment pollutant emissions resulting from the project would increase, the selected plan's indirect air quality impacts would be considered significant by comparison to existing conditions. (See Table 12-9.) This approach is consistent with the air quality significance criteria developed for this project and with applicable State and Federal ozone reduction standards which are tied to a 1987 existing-condition baseline.

The scope of the indirect air quality impacts associated with the selected plan would broaden if the general plan modifications currently under consideration by Sacramento and Sutter Counties are implemented. A discussion of these proposed modifications and their effect on the environment appears in Chapter 18.

Lower American River. In the lower American River area, the selected plan would permit the City to proceed with development of about 1,500 acres of vacant lands, principally in the

Meadowview area, where base flood elevations in excess of 5 feet would otherwise make development infeasible. (See Chapter 4, Land Use.) The air quality impacts associated with this development would be similar to those described for Natomas. Direct source emissions would result from planned residential and commercial uses. Indirect or mobile source emissions would be generated by motor vehicles drawn to the area by these uses.

As in Natomas, it does not appear that the vehicular traffic associated with development induced by the project in the Meadowview area would create new localized CO violations. However, this traffic would contribute to increased emissions of ozone constituents over existing conditions. Consequently, as in the Natomas area, these indirect impacts would be considered significant according to the air quality thresholds established for this project. Whether these impacts would occur even without the project is uncertain, although it is likely that most growth constrained in the Pocket and Meadowview areas would be absorbed elsewhere in the region.

Upper American River. Implementation of an in-kind replacement of Highway 49 at river mile 23.0, as proposed under the selected plan, would not significantly alter traffic patterns in the area and would not, therefore, result in any indirect air quality impacts. However, the State-required route adoption process, which must be undertaken prior to any replacement of the highway, could result in a high bridge alignment. Such an alignment would shorten commute times between residences in western El Dorado County and job centers along the I-80 corridor and would thus contribute to regional growth pressures and associated growth-related impacts, including air quality impacts. The State route adoption process and potential high bridge alignment are discussed in Chapter 17. The effect on regional growth of adopting one of these alignments is discussed in Chapter 18.

400-YEAR ALTERNATIVE

The 400-year alternative would produce substantially the same air quality impacts as the selected plan in the Natomas and lower American River areas. In the upper American River area, the larger dam would require slightly more time to construct than the selected plan and would result in correspondingly greater construction-related impacts on air quality. Operation of the larger structure would not affect the air quality of the area.

150-YEAR ALTERNATIVE

The air quality impacts associated with the 150-year alternative in Natomas would be substantially the same as for the selected plan. This alternative would, however, require significant bank protection and levee improvement along the lower 14 miles of the American River and in the Sacramento and Yolo Bypass systems. This construction activity would produce an increase in emissions over the selected plan in the lower American River area. As with Natomas area levee improvements proposed under the selected plan, construction emissions associated with the 150-year alternative levee improvements would also be considered significant short-term impacts according to the air quality thresholds established for this project.

The 150-year alternative would not require any construction in the upper American River area and would thus avoid the construction-related emissions that would be produced if the selected plan is implemented in that area.

100-YEAR (FEMA) LEVEE ALTERNATIVE

This alternative would generate the same direct air quality impacts as the selected plan in Natomas and substantially the same direct impacts as the 150-year alternative in the lower American River. Indirect impacts in the Natomas and lower American River areas would be the same as with the selected plan. All impacts in the upper American River would be avoided.

100-YEAR (FEMA) STORAGE ALTERNATIVE

This alternative would generate the same direct and indirect impacts on air quality in the Natomas and lower American River areas as the selected plan. It would not, however, require any construction in the upper American River area and would thus avoid the construction-related emissions that would be produced if the selected plan is implemented in that area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

This alternative would generate the same direct air quality impacts as the selected plan in Natomas and substantially the same direct impacts as the 150-year alternative in the lower American River. These impacts would be considered significant short term. Indirect air quality impacts in the Natomas and lower American River areas would be the same as with the selected plan and would also be considered significant. All impacts in the upper American River would be avoided.

MITIGATION

As discussed above, implementation of the selected plan or any project alternatives would result in significant direct short-term air quality impacts. Mitigation measures recommended to reduce direct and indirect air quality impacts are discussed below. Air quality impacts, however, cannot be reduced to less than significant and will require statements of overriding considerations if the project is approved.

DIRECT IMPACTS

Direct impacts would result from construction activities and therefore were found to be significant for the Natomas area under the selected plan and all alternatives. Direct impacts to the upper American River area were also found to be significant for the selected plan and the 400-year alternative due to dam construction, aggregate mining, and Highway 49 and Ponderosa Way replacements. Direct impacts to the lower American River were found to be not significant under the selected plan and 400-year alternative because no construction would be required at these locations. Direct impacts to the lower American River were found to be significant under the 150-year, 100-year (FEMA) levee, and 100-year (FEMA) levee/storage and spillway alternatives due to required levee improvement work.

To reduce direct and significant air quality impacts from short-term construction-related dust and particulates in three study areas under the selected plan and the various alternatives, the following mitigation measures are recommended:

- Water trucks should be used regularly to reduce dust and particulate generation at the construction sites and along unpaved travel roads. All active exposed soil areas shall be sprinkled sufficiently to prevent excessive amounts of dust during grading operations.

- All excavated or graded areas shall be sufficiently watered to prevent excessive amounts of dust at the borrow site.

To reduce direct significant air quality impacts from short-term construction-related combustion emissions in the three study areas under the selected plan and the various alternatives, the following mitigation measure is recommended:

- o The project sponsor shall assure that contractors properly maintain and operate construction equipment and use direct-injection diesel engines or gasoline-powered engines if feasible.

To reduce the project's long-term operational emissions in the Natomas and lower American River study areas under the selected plan and various alternatives, the following mitigation measures are recommended:

- o Pump station diesel engines shall be equipped with the best available control technology to reduce combustion emissions to the greatest extent feasible.

- o Maintenance vehicles should be properly tuned and maintained.

- o Where feasible, vehicles should be fitted with emission reduction equipment.

- o The district shall consider energy efficiency and best available control technology as criteria for purchase of new equipment when expanding maintenance capabilities.

INDIRECT IMPACTS

Analysis indicates impacts from an increase in mobile and stationary source emissions would be generated by increased planned development allowed by flood protection. Consequently, indirect air quality impacts would be significant for the Natomas and lower American River areas under the selected plan and all alternatives. Indirect impacts to the upper American River would not be significant under the selected plan and all alternatives.

The SMAQMD has adopted an extensive plan for attaining and maintaining air quality within the greater Sacramento area, including the Natomas and lower American River areas. Consequently, any project-related mitigation should be based on conformance to this plan. The plan encompasses a wide range of measures to control air emissions from all types of sources. Any proposed stationary sources would need to obtain an air quality permit to operate in the area and would likely need to obtain emission offsets. Proposed development should avoid industrial and commercial projects which involve any direct air quality emissions which cannot be offset. Any stationary sources of air quality emissions in the Natomas area should be reviewed to determine compliance with the SMAQMD plan before approval.

The major provisions of the SMAQMD attainment plan which pertain to the current project involve transportation sources. The SMAQMD has proposed a number of transportation measures aimed at reducing air pollution emissions from motor vehicles. These include:

- Encouraging the use of alternative, less polluting fuels.
- Encouraging and facilitating the use of mass transit with programs such as improved bus service routes and improved fare collection systems.
- Encouraging alternate forms of transportation such as bicycles or walking by improving bicycle lanes and locking facilities and pedestrian access and services.
- Encouraging carpooling with programs such as high occupancy vehicle lanes and ridesharing matching services.
- Cooperating with industry in developing alternative work schedules and work site alternatives.
- Providing guaranteed-ride-home programs.
- Encouraging the use of telecommunications as an alternative to meetings.
- Providing and facilitating public education on the importance of air quality control efforts.

Adherence to the SMAQMD plan could reduce the project's overall indirect effects on regional air quality to a less than significant level. The increased emissions attributable to the project are population driven. The population growth facilitated by the project in Natomas and in the Meadowview portion of the lower American River area is anticipated in existing local plans and was accounted for in the SMAQMD attainment plan. The attainment plan projects that compliance with State and Federal air quality standards will be achieved by 2010 when full buildout under existing local plans will be achieved. Thus, the plan assumes that reductions in emissions attributable to existing sources would be sufficient in magnitude to offset anticipated increases attributable to new sources, including those created by development in the Natomas and Meadowview areas. If this is the case, the project's indirect impacts on regional air quality would be reduced to a less-than-significant level.

On the other hand, Sacramento has failed to comply with previous State implementation plans aimed at achieving State and Federal air quality standards. Thus, there is reason to believe that full compliance with the SMAQMD attainment plan will not be achieved. In that case, the indirect impacts of the project on air quality would not be reduced to a less than significant level, and project-related growth in the Natomas and lower American River areas would contribute to a continuing nonattainment condition in Sacramento.

CHAPTER 13

NOISE

This chapter discusses project-related noise impacts associated with construction activities, increased traffic, and pumping station operations.

EXISTING CONDITIONS

SOUND MEASUREMENT AND CHARACTERISTICS

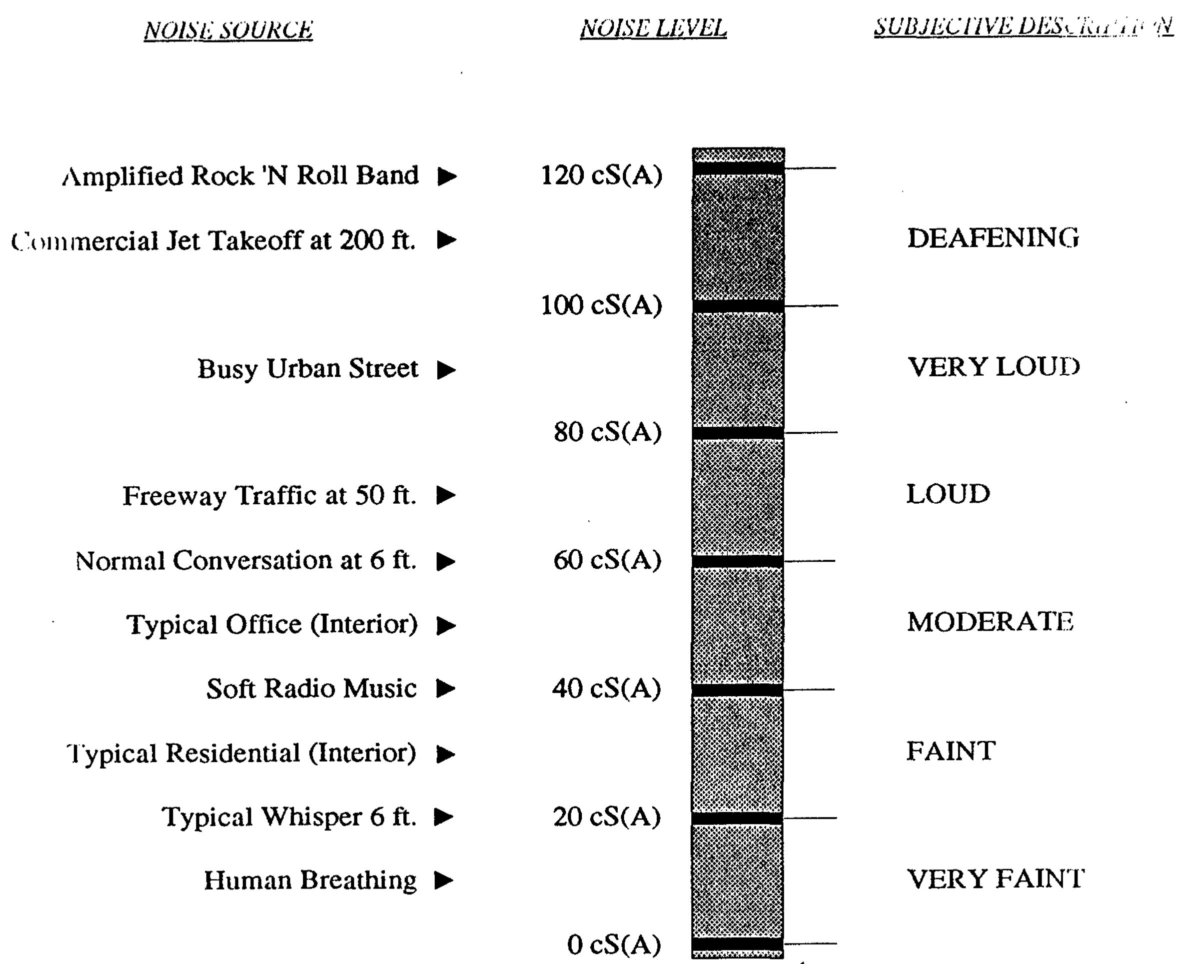
Noise is often defined simply as unwanted sound, which is a subjective reaction to the characteristics of a physical phenomenon. The unit of sound-level measurement is the decibel (dB). A-weighted sound levels (expressed as dBA) are very well correlated with community reactions to noise, and are used throughout this analysis unless otherwise indicated. Statistical descriptors such as the day-night average level (L_{dn}) represent variations in sound levels over time. Figure 13-1 provides examples of sound levels associated with common noise sources.

Noise levels and impacts must be interpreted in relation to the noise standards and criteria applicable in each local jurisdiction affected by the project. The criteria applicable in this case are primarily for noise-sensitive residential uses and are intended to provide a suitable environment for indoor communication and sleep. Draft noise standards for Sacramento County establish maximum exterior sound levels of 50-70 dBA during the day and 45-65 dBA at night. Standards for the City of Sacramento and Placer and El Dorado Counties are 60 dB L_{dn}. Exterior noise exceeding this level is allowed only after detailed acoustical analysis of construction requirements and adoption of noise abatement features.

EXISTING NOISE LEVELS

Natomas

Ambient noise measurements were conducted at levee improvement sites to establish the existing noise environment in the Natomas area. The sound-level measurement equipment used met all pertinent specifications of the American National Standards



Source: Architectural Acoustics, M. David Egan (1988)

FIGURE 13-1. Examples of Sound Levels Associated with Common Noise Sources

Institute for Type I sound-level measurement systems. The results of ambient noise measurements are presented in Table 13-1 and are described below.

TABLE 13-1. Ambient Noise Measurement Results

Project Feature	Location	Date	Time	Level dBA	
				Leq[1]	Lmax[2]
NEMDC	East levee/ Santiago Avenue	8/13/91	12:35 p.m.	51.1	77.6
NEMDC	East levee/ Fairbanks Avenue	8/13/91	1:20 p.m.	60.6	90.1
Main Avenue Bridge	West levee 50 ft south of Main Avenue	8/13/91	3:30 p.m.	61.5	81.7
Arcade Creek	Northeast of Pamela Drive/ Diamond Avenue intersection	8/13/91	1:47 p.m.	45.3	78.0
Pumping Station	NEMDC Pump Site	8/13/91	4:00 p.m.	52.1	69.8
Dry Creek North	511 Ascot Avenue	8/13/91	2:48 p.m.	49.7	70.1
Dry Creek South	Terminus of Claire Avenue	8/13/91	2:25 p.m.	48.8	81.0
Borrow Site	Garden Highway at Borrow Site	8/13/91	4:35 p.m.	56.2	85.9

Note: All noise measurements taken with B&K type 2222 noise meter. Total elapsed time per measurement: 15 minutes.

[1] Leq is the total sound energy of time-varying noise over the sample period.
[2] Lmax is the maximum sound level recorded during the sample period.

As shown in Table 13-1, noise readings of 51.1 and 60.6 dBA Leq were recorded at the NEMDC monitoring sites during the 15-minute sampling period. These noise measurement sites were situated midway between the NEMDC levees and residential neighborhoods located adjacent to the levees. The primary noise sources at these locations during the sampling period were jet planes, vehicle traffic, children playing, and, at the Santiago Avenue measurement site, vehicle traffic on West El Camino Avenue. Residences immediately east of the NEMDC are also frequently affected by railroad noise when trains pass on the adjacent Union Pacific rail line (approximately 75 feet west of the existing residences). If a train had passed during the sampling period, noise measurements at these locations would have been appreciably higher.

At the Main Avenue bridge site, noise measurements were made on the NEMDC west levee 50 feet south of Main Avenue. A noise measurement of 61.5 Leq was recorded during the sampling period. Primary noise sources included traffic on Main Avenue and aircraft.

At the Arcade Creek site, ambient noise measurements of 45.3 Leq were recorded. Primary noise sources at this location were children playing and vehicle traffic on Arcade Boulevard.

A measurement of 52.1 Leq was recorded at the pumping station site. Primary noise sources included traffic on East Levee Road, birdsong, and aircraft.

Ambient measurements at the Dry Creek north and south levee improvement sites were 49.7 and 48.8 Leq, respectively. Primary noise sources at the north levee site included birdsong, aircraft, and light background noise from East Levee Road traffic. At the south levee site, livestock, children playing, and aircraft comprised the primary noise sources.

At the borrow site, a 56.2 Leq ambient noise measurement was recorded. Primary noise sources included traffic on the Garden Highway and aircraft.

Ambient noise measurements were not made for some of the Natomas area improvement sites in rural portions of Sutter and Sacramento Counties. These include the Natomas Cross Canal, Pleasant Grove Creek Canal, Fifield, and Sankey Road sites. Existing dominant noise sources in these areas range from birdsong and wind to roadway, railroad, aircraft, and commercial and industrial activities. Noise levels in these rural areas are typical of low-density urban areas and are primarily traffic related. Existing noise levels in these rural areas are estimated to be in the range of 50-55 dB L_{dn}, which is within locally accepted limits.

Lower American River

Existing noise conditions at levee improvement sites in the lower American River area are similar to existing noise conditions reported for the urbanized areas of Natomas. These lower American River improvement sites are located in the southwest end of the American River Parkway. Levees are situated along the edge of the parkway with the following existing adjacent uses: waterside uses include recreational, and landward-side uses include commercial, industrial, and residential. This setting is very similar to that described for the Natomas area NEMDC south of I-80. Consequently, existing noise levels in the lower American River area are assumed to be similar to noise levels reported for the NEMDC; ambient background levels ranged from 51.1 to 61.6 dBA.

Upper American River

Existing noise levels in El Dorado and Placer Counties where dam construction and Highway 49 and Ponderosa Way replacements are proposed are also assumed to be relatively low. Noise levels in nearby communities are typical of low-density urban areas and are primarily traffic related.

Aside from traffic on nearby roads and occasional aircraft, the major source of noise in the immediate vicinity of the Old Cool Quarry is the quarry operation itself.

The nearest residences are 2,000 feet from Old Cool Quarry. For the existing quarry operation, blast noises at these residences are typically less than 135 dB (Office of Surface Mining, 1979). Because of the current low production levels, the sound levels are much less. However, occasional louder blasts may occur. Truck and miscellaneous plant noises are generally much less perceptible at the nearest habitation, although sound levels may exceed 85 dB at the source.

IMPACTS

SIGNIFICANCE CRITERIA

The noise impact analysis was prepared in accordance with "Guidelines for Noise Study Reports as Part of Environmental Impact Reports" issued by the California Department of Health Services, Office of Noise Control.

Site inspections, accepted noise modeling techniques, and utilization of existing noise data were employed to assess project-generated noise impacts. Site inspections were conducted to identify existing noise sources and to locate noise-sensitive land uses in the nearby vicinity. Noise-sensitive land uses were typically considered to be residential, educational, church, library, and health-related facilities, and significant noise sources included surface traffic, railroads, industries, and aircraft.

Noise impacts were assessed at each of the sites by comparing project-generated construction and operational noise levels, existing noise levels, and the criteria and standards contained in applicable planning documents. The criteria applicable in this case are primarily for noise-sensitive residential uses and are intended to provide a suitable environment for indoor communication and sleep. The noise standard which would apply to each project improvement site is contained in the General Plan Noise Element for that respective jurisdiction. All respective noise elements cite 60 dBA L_{dn} as the established daytime residential noise standard. Short-term construction-generated noise is normally exempt from these noise standards. Nevertheless, potential noise impacts on sensitive receptors must be evaluated. For the purposes of this report, impacts are considered significant if project-generated noise levels would exceed the above-adopted noise standard in areas of sensitive receptors.

NO-ACTION ALTERNATIVE

Direct noise impacts would be avoided with selection of the no-action alternative.

Continued population growth and urbanization of open space are expected to occur in some portions of the project area even without the project. (See Chapter 4, Land Use.) General noise levels are expected to increase over time wherever low-sound levels associated with agricultural use and open space are replaced by higher levels caused by new roadways and urbanization.

SELECTED PLAN

Direct Impacts

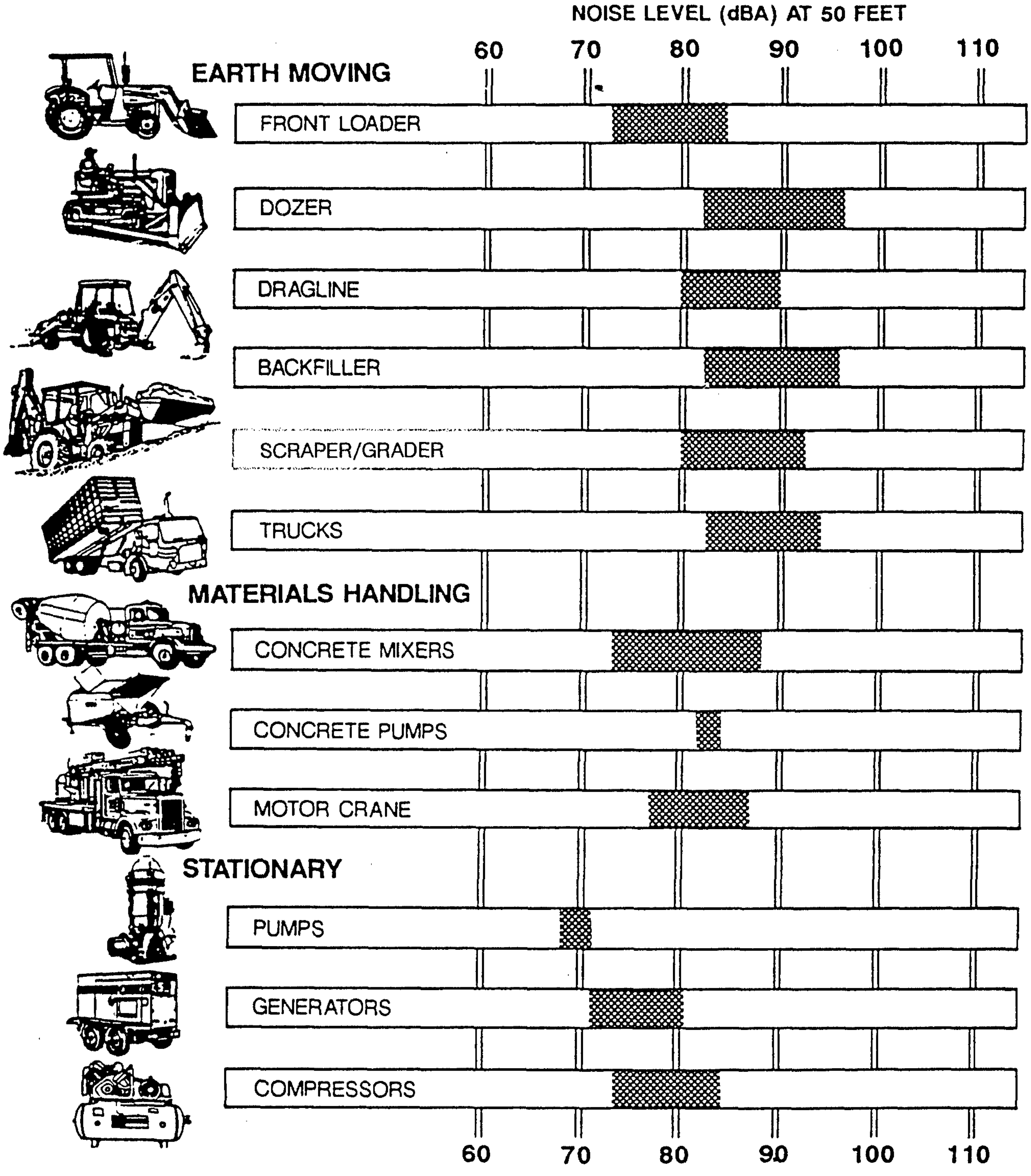
Natomas. The direct noise impacts of proposed Natomas area flood control improvements can be separated into short-term construction impacts and long-term operational impacts. These two categories are discussed separately below.

Short-term potential noise impacts could occur as a result of construction activities (onsite) or as a result of construction vehicle traffic along proposed haul routes (mobile offsite).

During construction projects, short-term noise impacts tend to occur in discrete phases. They are normally dominated initially by earth-moving sources, then by foundation and parking area construction, and, finally, by finish construction. The proposed Natomas improvement projects consist primarily of earth-moving activities; however, concrete, asphalt, and carpentry work would be done at several improvement sites. Because earth-moving sources are generally the noisiest, the earth-moving phase of project construction was selected as the basis for noise impact analysis.

In general, noise from project earthwork activities would dominate the noise environment in the immediate area over the length of the construction corridor. The temporary construction noise impacts of proposed levee improvements would vary markedly between improvement sites because the noise level of construction equipment ranges widely as a function of the equipment used, its activity level, and local environmental considerations (that is, noise barriers). Figure 13-2 shows typical construction equipment noise levels at 50 feet. The operational noise level generated by construction equipment can vary by as much as 15 dBA.

Earth-moving equipment noise typically ranges from about 70 to 95 dBA at 50 feet from the source. Spherically-radiating point sources of noise emissions are atmospherically attenuated by a factor of 6 dBA per doubling of distance. The quieter earth-moving noise sources would, therefore, drop below 60 dBA by about 300 feet from the source, while the loudest sources may



Source: EPA, 1971; "Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances." NTID300.1

FIGURE 13-2. Construction Equipment Noise Levels still be detectable above the local background noise beyond 1,000 feet from the construction area.

To estimate the noise levels that would be generated by the proposed project, the types of construction equipment and numbers required for each improvement site were estimated and modeled. Estimates of the equipment required to complete proposed earthwork improvements were based on consultations with engineers familiar with the project. Noise emission factors contained in the EPA publication "Noise From Construction Equipment and Operations" (1971) were used during noise modeling. The modeling conducted assumes a worst case scenario of simultaneous operation of all construction equipment required at each improvement site at an assumed use factor of 73 percent.

Table 13-2 summarizes the results of noise modeling by improvement site and presents three important pieces of information. First is the distance from each improvement site to the nearest sensitive receptor; second is the project-generated heavy-duty construction equipment Leq noise levels in dBA which would occur at the sensitive receptor location (in instances where <60 appears in this column, no sensitive receptors were located within the 60 dBA Leq project-generated noise contour line); and third is the distance from the source to the 60 dBA Leq noise contour line. The resulting Leq noise contours are plotted in Figures 13-3 and 13-4. The potential impacts to noise-sensitive receptors based on the noise levels shown in Table 13-2 and contours plotted in Figures 13-3 and 13-4 would be considered short-term significant for receptors (residential) located adjacent to the following improvement sites: the NEMDC east and west levees, NEMDC pumping station site, Sankey Road site, Dry Creek north and south levees, borrow site, and Arcade Creek north and south levees.

The results contained in Table 13-2 and Figures 13-3 and 13-4 are considered worst case. The modeling techniques used do not consider the effects of noise barriers such as houses, fences, or vegetation. Consequently, the distances to the 60 dBA Leq noise contour would actually be less than those shown in Figures 13-3 and 13-4 in heavily urbanized areas where noise barriers are adjacent to the construction site. Most notably, this would occur at the borrow site because of the Sacramento River levee and along the NEMDC because of existing backyard fences, vegetation, and structures.

Construction noise also would be generated by increased traffic on area roads. Truck traffic associated with transporting heavy materials and equipment would be the most significant project-generated mobile noise source. Because this increase would be of short duration and primarily limited to

TABLE 13-2. Noise Modeling Summary[1]

Improvement Site	Distance from Source to Nearest Sensitive Receptor (feet)	Total Leq Daytime During Normal Operating Hours at Nearest Sensitive Receptor (dBA)	Distance from Source to 60 dBA Leq Contour in feet (dBA)	Significant Impact to Sensitive Receptors
NEMDC	150	78	1,200	Yes
Main	NA	<60	3,800	No
Pumping Station	650	66	1,300	Yes
NCC	NA	<60	1,200	No
Fifield	NA	<60	1,200	No
Sankey	100	82	1,300	Yes
Dry Creek	100	82	1,200	Yes
Arcade	50	88	1,200	Yes
Borrow Site	500	69	1,300	Yes

[1] Assumes worst case simultaneous operation of all construction vehicles.

Sources: EPA (1971), Noise from Construction Equipment and Operations, EP PB 206 717.
Harris, C.M. (1979), Handbook of Noise Control, 2nd Edition.

daytime hours, and because the majority of haul routes follow heavily traveled roadways with existing elevated traffic noise levels, impacts would be considered short-term adverse but less than significant.

The selected plan includes constructing a gated pumping station along the NEMDC above Dry Creek. Pumps would run only during major storms, so operations would be infrequent and temporary. Operations could increase background noise close to the pumping station. These noise levels could vary, based on the number and size of pumps operating at once and whether they are enclosed. In its noise analysis for this project, Brown-Buntin Associates, Inc., reviewed the EIR for the Ophir Pumping Station in Placer County. Assuming a similar system would be used at the NEMDC, each unshielded pump would produce 80 dBA at 3 feet and 50 dBA at 100 feet. If one unshielded pump ran continuously for 24 hours, it would produce about 56 dB L_{dn} at 100 feet. This would be considered acceptable under any local standards and, therefore, not significant.

Lower American River

The selected plan would not involve any construction or cause any direct noise impacts in the lower American River area.

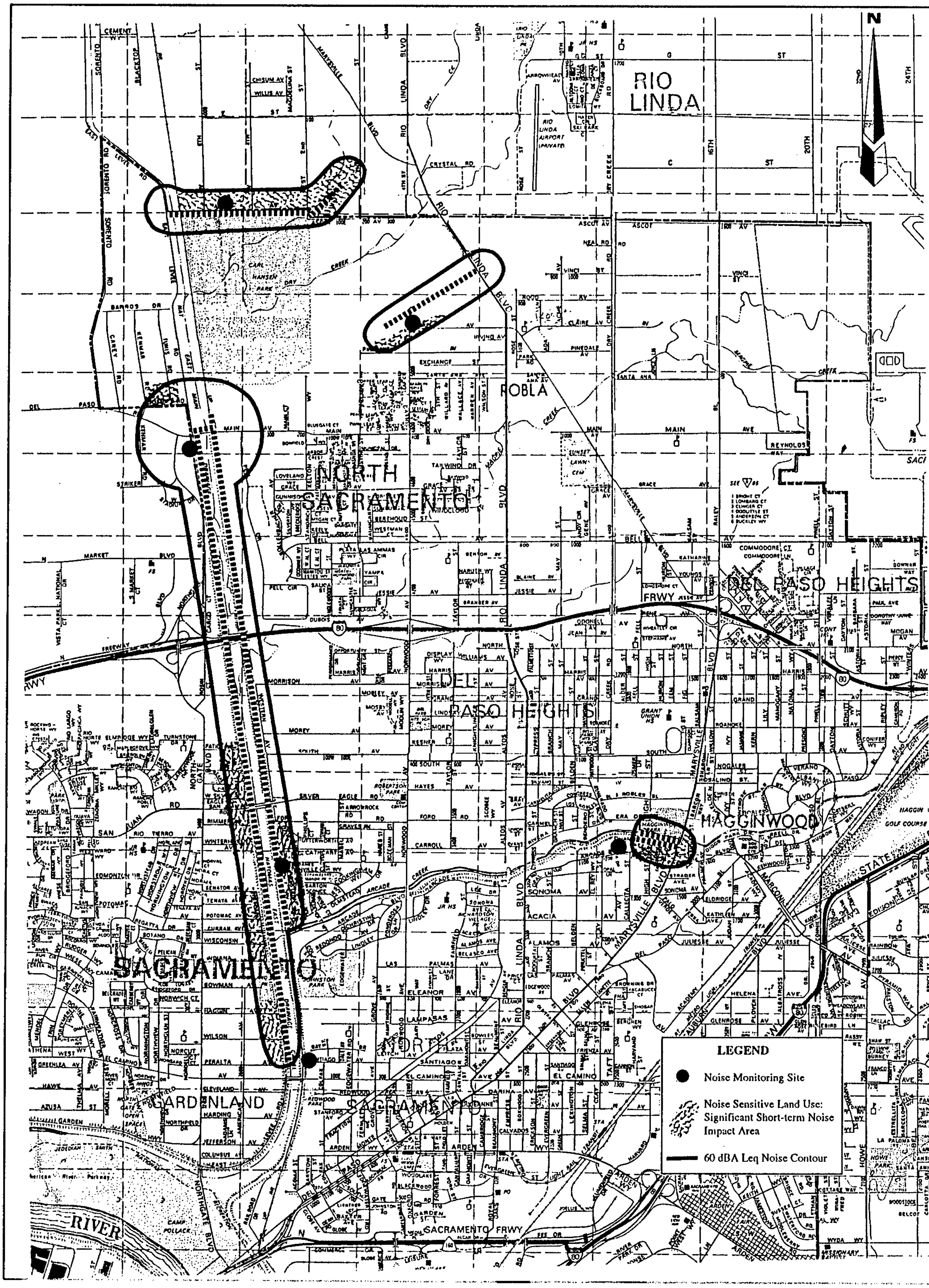


FIGURE 13-3. Southern Improvement Sites, Noise Monitoring Locations, and Predicted Short-Term Noise Impact Areas

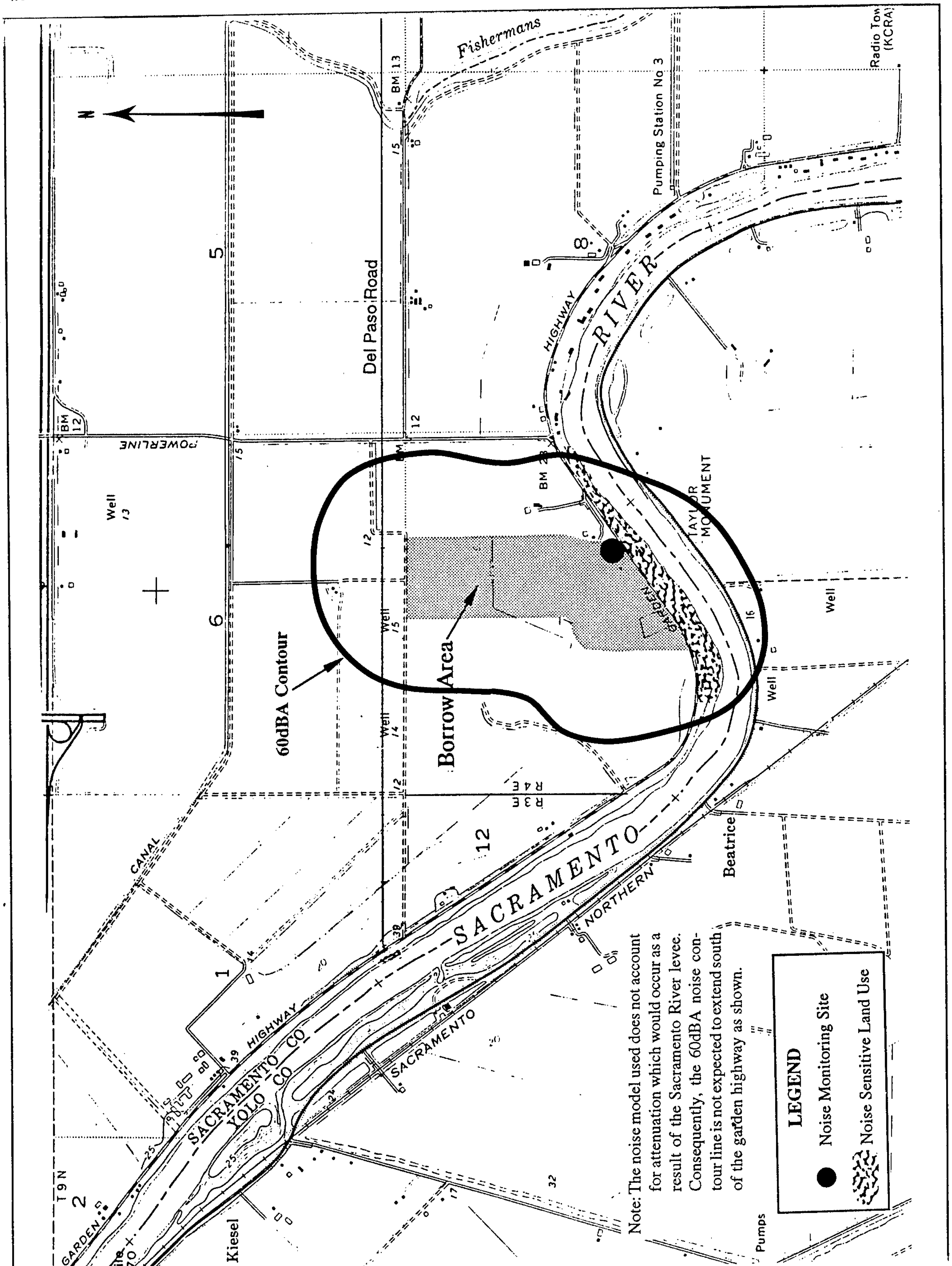


FIGURE 13-4. Borrow Site: Ambient Noise Measurement and Predicted Short-Term Construction Noise Impact Areas

Upper American River

The selected plan would require aggregate mining at the Old Cool Quarry for use in dam construction. During mining activities, a number of noise-generating sources would be in operation. Some of the sources would be intermittent and some constant; some sources would be stationary while others would be mobile.

Major sources of noise generation would be drilling rigs, blasting, crushing, and loading and hauling of equipment. Overall noise generation could also be expected to occur during nighttime hours due to high production rates necessitated by the construction schedule (2- to 3-year construction period). Table 13-3 details potential quarry noise sources.

TABLE 13-3. Old Cool Quarry Daytime Sources of Noise Generation

Noise Source	Maximum Anticipated Noise Level (1)
Blasting	130 dB (2)
Drill, 6-inch	89 dB (2)
Drill, 2-3-inch, airtrack with compressor	83 dB (2)
Shovel (Cat 245)	75 dB (2)
Cone Crusher	79 dB (3)
Jaw Crusher	82 dB (3)
Screens	76 dB (3)
Dozer	80 dB (2)
Grader	80 dB (2)
Loader	79 dB (4)
Truck	80 dB (4)
Truck (Cat 733 B)	77 dB (2)
Scraper	81 dB (2)

(1) All levels A-weighted with slow meter response at 50 feet except blasting, which are linear, peak, at 1,000 feet.
(2) Deem, 1985-88
(3) Skega, 1977
(4) EPA, 1971

Noise

Construction and mining activities, especially blasting and operation of heavy equipment, would create temporary noise increases near the quarry site. Initially, temporarily increased noise levels can be anticipated from the development/construction and later during operation of the conveyor transport system used to move material from the Old Cool Quarry to the damsite. Because they are powered by electricity, the conveyor motors would cause only minor noise impacts. Noise from these motors, however, combined with noise generated from conveyor apparatus (that is, belts, pulleys, and rollers) and the aggregate itself as it vibrates during transport, is anticipated to increase the ambient noise levels within the canyon area immediately adjacent to the conveyor system.

Existing background noise levels in these canyon areas were assumed to be relatively low. Existing noise sources are limited to sounds produced from river current, birdsong, aircraft, and recreational users, and, in some areas, vehicular traffic on Highway 49. The existing use along the conveyor corridor is for recreation and wildlife habitats. Noises associated with the conveyor are expected to increase ambient noise levels heard by nearby recreational users and wildlife. However, because operational noises are not expected to affect sensitive receptors or significantly disrupt existing uses along the conveyor route, these impacts are considered adverse but less than significant.

Dam construction would also require increased mining operation at the Old Cool Quarry. Noise from blasting is the loudest existing noise source at the quarry. Blasting activities can produce noises up to 130 dB 1,000 feet from the source. Earth-moving equipment generally produces the next loudest operating noise, ranging from about 70 to 90 dBA 50 feet from the source. The greater noise produced by blasting is normally considered more tolerable because of its short duration. Noise from mining and construction equipment operation is more noticeable because of the extended generation intervals.

Aggregate handling and processing and small stationary noise sources have lower initial noise levels, so their corresponding noise impact zones are much smaller. Noise emissions from haul trucks, compressors, pumps, etc., are generally attenuated to acceptable levels within 500 feet of the noise source. Smaller, discrete sources such as generators and compressors are also more readily controlled with heavy-duty mufflers designed to minimize noise generation.

The current operation at Old Cool Quarry occasionally receives complaints when operations are conducted at times other than normal working hours. To date, no noise monitoring has been conducted for the site. The construction schedule for the dam would necessitate nearly continuous quarrying and processing for 2-3 years. Because of this, noise impacts associated with aggregate production from Old Cool Quarry are considered significant and unavoidable.

Construction activities at the Highway 49 and Ponderosa Way replacement sites and the damsite near river mile 20.1 would also generate construction noise from heavy-duty equipment similar to the equipment listed in Figure 13-2. However, these impacts would not be significant due to the isolated nature of these worksites and the lack of nearby noise-sensitive receptors. Construction-related traffic would be generated in the Auburn area, but until the numbers and types of transport equipment are known, the extent of noise generated by those activities cannot be determined. Consequently, construction noise impacts at the damsite, Ponderosa Way, and Highway 49 bridge site would be considered short-term adverse, but less than significant.

Indirect Impacts

Natomas. Project-induced growth in the Natomas area would produce the following significant noise impacts:

- Some residential land uses designated west of I-5 would be in areas where noise levels due to airport operations would exceed locally adopted standards.

- Land uses along major roadways would be exposed to noise levels exceeding locally adopted standards.

- In some residential areas, such as along I-5, it would be very difficult to achieve locally adopted standards for outdoor noise.

- Residential uses within the noise contours of the proposed stadium in North Natomas could experience annoying stadium noises.

The scope of the indirect noise impacts associated with the selected plan would broaden if the General Plan modifications currently being considered by Sacramento and Sutter Counties are implemented. A discussion of these proposed modifications and their effect on the environment is included in Chapter 18.

Lower American River. Project-induced growth would occur in the lower American River area on vacant land in the Airport/Meadowview and Pocket sections of Sacramento. This growth would produce the following significant noise impacts:

- Residential areas along Florin Road, Meadowview Road, 24th Street, I-5, and the Western Pacific Railroad would be exposed to noise levels above 60 dB and, in some cases, as high as an L_{dn} of 70.

- Traffic generated by project-induced development would increase noise levels along I-5 south of Meadowview Road by up to 8 dB.

Upper American River. Replacement of Highway 49 at river mile 23.0, as proposed in the selected plan, would not significantly alter traffic patterns in the area and therefore would not result in any indirect noise impacts. However, the State-required route adoption process which must be undertaken prior to any relocation of the highway could result in a high bridge alignment. Such an alignment would shorten commute times between residences in western El Dorado County and job centers along the I-80 corridor and would thus contribute to regional growth pressures and associated growth-related impacts, including noise impacts. The State route adoption process and potential high bridge alignments are discussed in Chapter 17. The effect on regional growth of adopting one of these alignments is discussed in Chapter 18.

400-YEAR ALTERNATIVE

Noise impacts associated with levee and dam construction work in this alternative would be substantially the same as in the selected plan. However, because it would take slightly more time to construct the larger dam, the duration of some of the impacts would be longer. Indirect impacts would be the same as in the selected plan.

150-YEAR ALTERNATIVE

Construction and traffic-related impacts in Natomas would be substantially the same for this alternative as for the selected plan, but would be more widespread and of longer duration along Dry and Arcade Creeks. This alternative requires a pumping station on the lower American River near the Mayhew Drain to operate during major storms. The specific siting, design, and noise generation for this pumping station are presently not defined. Consequently, the noise impacts associated with this pump are considered potentially significant and subject to mitigation planning.

The extensive levee and bank protection required by this alternative along the lower American River would generate construction noise near residential areas. Construction-related traffic would also temporarily increase noise on access roads. These impacts would be considered short-term adverse in most areas since construction activities would be temporary and would occur during the day. Nevertheless, consistent with the Natomas area analysis, heavy-duty construction equipment would be expected to produce noise levels which exceed adopted standards in some areas where noise-sensitive receptors are located adjacent to the construction site. In these cases, impacts would be considered short term but significant.

The 150-year alternative would also require alteration of the Folsom Dam spillway to allow for an increase in design release events. This would require the use of materials handling and stationary source construction equipment similar to those listed in Figure 13-2. As shown in Figure 13-2, these pieces of equipment can produce noise in the 70 to 88 dBA range as measured 50 feet from the noise source. In addition to these pieces of equipment, the use of jackhammers would be anticipated to break up concrete below the spillway. Jackhammers can produce noise levels of up to 90 dBA at 50 feet. Delivery truck traffic and other mobile sources would also add to construction noise at the improvement site. Thus, all sources of project construction noise would contribute to a short-term noise impact to nearby sensitive receptors. This impact would be considered significant and unavoidable.

This alternative would avoid all project-related noise impacts in the upper American River area.

100-YEAR (FEMA) LEVEE ALTERNATIVE

The direct noise impacts associated with this alternative would be the same as with the selected plan in Natomas, and substantially the same as the 150-year alternative in the lower American River area as described above. Indirect noise impacts would be the same as with the selected plan; however, all project-related noise in the upper American River area would be avoided.

100-YEAR (FEMA) STORAGE ALTERNATIVE

The direct and indirect noise impacts associated with this alternative in the Natomas and lower American River (Folsom Reservoir) areas would be the same as in the 150-year alternative; however, all project-related noise in the upper American River area would be avoided.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The direct noise impacts associated with this alternative would be substantially the same as with the 150-year alternative. Indirect noise impacts would be the same as with the selected plan; however, all project-related noise in the upper American River area would be avoided.

MITIGATION

DIRECT IMPACTS

Noise mitigation measures may be directed at either the source, the sound transmission path, or the receiver. In general, controlling the source of noise is most effective, although noise-level restrictions may be limited by technology or preempted by Federal or State regulations. Noise control at the source is the responsibility of the operator and is often the most cost-effective means of reducing these impacts. Control of noise along the transmission path is usually accomplished by setbacks or shielding the source from the receiver. Effective shields include earthberms, walls, buildings, and existing topography. Noise control may be achieved by soundproofing buildings or otherwise isolating people from the sound source. Controlling noise at the source and along the transmission path would be the most effective means of mitigation for the proposed project. The following specific measures are recommended to reduce identified noise impacts.

Construction Noise

Heavy-equipment noise would be the major concern during levee-related and dam construction activities. Primary sources of noise in these cases are engine exhaust, fans, transmissions, and other mechanical equipment. Heavy equipment is typically fitted with mufflers and engine enclosures to allow operation in noise-sensitive areas. Thus the source of noise may be controlled within technological limits by requiring adequate mufflers and enclosures to be maintained on heavy equipment and other noise-producing tools.

When reasonably controlled, construction noise is often accepted by the public during daytime hours (7 a.m. to 5 p.m.).

People are less tolerant of noise and may complain if nonemergency construction activities continue at night. Preventing nighttime construction near noise-sensitive receptors can effectively reduce public concerns.

The following measures, therefore, are recommended to reduce the project's short-term construction-related noise impacts on adjacent noise-sensitive land uses.

- o Construction activities, including equipment warmup, at the NEMDC, pumping station, Sankey Road, Arcade Creek, Dry Creek, and lower American River improvement sites shall be limited to the hours of 7 a.m. to 5 p.m., Monday through Friday, unless a waiver is received from the appropriate agency. Construction equipment maintenance and servicing at these construction sites shall be confined to the same hours. This condition shall be placed on the grading permit.

- o Mufflers shall be provided for all project-related heavy construction equipment and stationary noise sources (such as diesel generators). Stationary noise sources shall be located at least 300 feet from occupied residences or contractors shall be required to provide appropriate noise-reducing engine-housing enclosures.

- o Equipment warmup areas, water tanks, and equipment storage areas shall be placed in a central area as far away from existing residences as is feasible.

Implementation of the above onsite construction noise mitigation measures would reduce the project's short-term noise impacts to the greatest extent feasible. However, due to the close proximity of existing noise-sensitive receivers (residences), the project's short-term construction noise impacts would remain significant and unavoidable at the following locations: existing residences located adjacent to the NEMDC east and west levees and the pumping station; a single farmhouse located just west of East Levee Road near the southern end of the Sankey Road improvement site; residences located adjacent to Arcade Creek, Dry Creek, and lower American River improvement sites. (See Figure 13-3.)

Increased mining operation at the Old Cool Quarry, including blasting, would create temporary noise increases near the quarry site. To help reduce noise impacts to nearby residences in the Auburn Lake Trails subdivision (potentially 60-70 people in

25-30 homes), blasting would be limited to daytime hours. However, other quarrying and processing activities would be required about 20 hours each day for the dam construction period. Thus, noise impacts associated with aggregate production from the quarry would be significant and unavoidable.

Background ambient noise levels would also increase in areas adjacent to the conveyor route; however, no sensitive receptors are located nearby the conveyor alignment. Consequently, these impacts would remain adverse but less than significant.

Construction-related traffic noise can be reduced at noise-sensitive receiver locations by ensuring that all traffic complies with applicable noise emission standards. Often traffic routing can be selected to minimize exposing these areas to heavy truck traffic.

To reduce the project's mobile source construction noise impacts, the following measures are recommended.

- All on-road mobile construction vehicles (dump trucks) shall be equipped with mufflers.
- All dump truck haul trips shall follow only the haul routes analyzed in this report unless a waiver is received from the appropriate agency.
- No dump truck haul trips shall be allowed in residential areas prior to 8 a.m. or after 6 p.m.

The above mobile source noise mitigation measures would reduce project-generated mobile source noise to the greatest extent feasible. Residual impacts would be considered adverse but less than significant for residential areas near the Dry and Arcade Creek improvement sites under the selected plan. Where haul trips occur in residential neighborhoods in the lower American River area under the project alternatives, residual mobile source noise impacts would also be considered adverse but less than significant.

Pumping Station Noise

To reduce the project's long-term operational noise impacts, the following mitigation measure is recommended.

- Engines which power the proposed NEMDC pumping station and control structure shall be enclosed to shield nearby sensitive receptors from engine noise.

Because the worst case noise analysis concludes that NEMDC unshielded pumping station operational noise levels would not affect adjacent noise-sensitive land uses, implementation of the above measure would further reduce operational noise levels and residual effects would be considered not significant. Acoustical studies should be conducted for the American River Mayhew Drain pumping station in the 150-year alternative to determine noise impacts once the specific equipment and site have been selected.

INDIRECT IMPACTS

Surface Transportation Noise

Development exposed to surface transportation noise in the Natomas, Pocket, and Meadowview areas should be designed to be consistent with the noise goals of the City's General Plan. Residential land uses should be developed so there is some usable outdoor space with an exterior noise level that does not exceed an L_{dn} of 60 dB. Indoor noise levels should not exceed an L_{dn} of 45 dB.

Stadium Noise

The City has determined that it is infeasible to prohibit residential development within the 40 dBA maximum instantaneous A-weighted sound level contour of the stadium planned for North Natomas. Hence, some project-induced residential development located within this contour would experience significant and unavoidable stadium noise impacts.

Airport Noise

The City has determined that it would be infeasible to prohibit residential land uses within the noise contours of the airport west of I-5. However, the North Natomas Community Plan states that development of residential uses west of I-5 should not proceed until it can be documented that aircraft noise in this area does not exceed a combined noise exceedence level of 60 dB, a level of outdoor noise considered acceptable under applicable City standards.

CHAPTER 14

RECREATION

This section summarizes the existing recreation resources and opportunities present in the study area, describes the recreation component for the flood control project, evaluates the impacts to recreation caused by the proposed flood control alternatives, and discusses mitigation measures for these impacts. The Recreation Resources Appendix provides further information on the recreation base of the study area and the assumptions supporting this section.

EXISTING CONDITIONS

NATOMAS

Natomas consists of farmlands and former farmlands now converted to urban development. Although little public recreation development occurred prior to urbanization, privately owned farmlands were historically used for bird hunting and bird watching. Today, landowners often lease hunting rights on farms to hunting clubs.

The Sacramento River, a major State and regional recreation resource, borders the west side of Natomas. While many of the lands along the riverbanks are privately owned, the river itself is a popular site for fishing and the enjoyment of water sports, ranging from jet skiing to kayaking. River access is from public boat launching ramps and private marinas.

The American River Parkway and Discovery Park border the southern portion of Natomas. Discovery Park, at the confluence of the Sacramento and American Rivers, is managed by the Sacramento County Department of Parks and Recreation. This popular recreation area comprises about 150 acres, including picnic sites and swimming beaches, with a variety of support facilities. East of Discovery Park, the American River Parkway extends 23 miles upstream to the Folsom State Recreation Area at Nimbus Dam.

Bordering the eastern edge of Natomas is the NEMDC, which lacks public access or recreation facilities, except for a 0.6-mile segment of the Sacramento Northern Trail, a bicycle/

pedestrian trail along the east levee near the mouth of the NEMDC. Recreation in this area consists primarily of bike riding and playing by children and teenagers from adjacent neighborhoods. Adults and neighborhood children regularly fish in the channel and its tributary streams. Illegal off-road vehicle use does occur on the levees and in the channel areas. Transients also camp there, and there is evidence of illegal dumping of trash and refuse. The lack of defined public access, illegal activities, and the litter-strewn landscape deter additional public use of this area.

Within urbanized South Natomas, the existing recreation resources consist of neighborhood parks, community parks, and City parkways. There is a significant backlog of park development required to meet the minimum standards of the South Natomas Community Plan. New parks and recreation facilities must be financed out of general City operating funds or through local assessment districts. The plan also states that a system of on-street bicycle routes should be provided for commuters and that attractive off-street bicycle paths should be constructed for recreation. To date, the only off-street bicycle path in the area is the Jedediah Smith Trail along the American River Parkway.

Lower Dry and Arcade Creek

West of Marysville Boulevard, Arcade Creek is confined by 5- to 20-foot-high levees. No public access has been developed through Hagginwood Park, which abuts the creek, but some access is provided from the Sacramento Northern Trail, which crosses the creek. The City of Sacramento's Trail Master Plan calls for the eventual development of a paved foot and bicycle trail along this creek.

Dry Creek has several channels and, except at its confluence with the NEMDC, is not confined by levees. No public access has been developed along Dry Creek, but the City has purchased 250 acres near the NEMDC confluence for future golf course and athletic field development. Sacramento County has developed the Cherry Island Golf Course about 8 miles upstream of the confluence. The County's Open Space Master Plan calls for a parkway/open space corridor with a paved recreation trail along all of Dry Creek into Roseville, Placer County, and eventually to Folsom Lake, thereby creating a more than 50-mile-long loop trail system with the American River Parkway.

LOWER AMERICAN RIVER

The American River Parkway includes a series of 14 parks distributed on publicly owned lands along the lower American River. Earthen levees 20 to 30 feet high border much of the lower half of the parkway, blocking out surrounding urban development and activity. These physical barriers and extensive stands of mature riparian forest give the parkway a "wilderness in the city" quality.

The Jedediah Smith Trail provides bicycle, pedestrian, and equestrian trails from Discovery Park to Folsom Reservoir and is one of the parkway's most popular features. The trail also connects with the Sacramento River Trail and Old Sacramento State Historic Park. The 23 miles of river below Nimbus Dam is included in both the State and Federal wild and scenic river systems.

Managed by Sacramento County Parks and Recreation Department, the parkway is recognized as one of the Nation's premier urban parkways, providing outstanding recreation for the 750,000 people who live within a 30-minute commute. Estimated parkway use in 1988 was 5.5 million visitors. That figure is expected to grow to 7.5 million by 2000 and to 9.6 million by 2020 (Hinton, 1987). A 1983 Sacramento County survey revealed that 32 percent of these visits were associated with water-dependent activities (swimming, boating, and fishing) and 53 percent were associated with water-enhanced activities such as jogging, nature study, hiking, and picnicking. Entrance fees are charged for all automobile access roads during peak-use seasons from late spring to early fall.

The lower American River is a major site for recreational boating, including rafting, kayaking, and canoeing, and accounts for about 662,000 user-days annually, or 12 percent of the total recreation for that area (SWRCB, 1988). Seasonal temperatures and riverflows affect commercial rafting. When ambient temperatures are cold, rafting declines, even during the peak recreation season. About 90 percent of the annual rental business occurs between Memorial and Labor Days, although prime conditions may exist into October (David Hill, pers. comm., 1989).

Swimming and wading are other popular water-dependent activities affected by riverflows. These activities account for about 10 percent of the total recreation in the parkway, or about 552,000 annual visits. Of the 10 popular swimming areas, only

Paradise Beach and Tiscornia Park have beaches with extensive areas of sand.

Lake Natoma

Formed by Nimbus Dam, Lake Natoma is the downstream end of the Folsom Lake State Recreation Area and serves as a re-regulating reservoir for the varying water releases from Folsom Dam. Because there are only slight variants in water fluctuation, the lake has developed an attractive, natural-appearing band of riparian vegetation around its shores.

Lake Natoma is managed by the California Department of Parks and Recreation (DPR) as a passive recreation area, emphasizing nonmotorized water recreation. Developed facilities include the California State University at Sacramento's aquatic center, a picnic area, and an 8.4-mile segment of the American River paved bicycle and pedestrian trail, which continues to Folsom Reservoir.

Bank fishing is common at the lake, and swimming and diving occur at the rock outcrops at the lake's upper end. Since water temperatures during the summer are cooler here than at the upstream Folsom Reservoir, the lake is less heavily used for swimming and wading.

Folsom Lake

Folsom Lake State Recreation Area is one of the most heavily used units in the California State Park System. Proximity to a major metropolitan area, arid summer climate, high regional interest in recreation, and diminishing open space and recreation resources make the lake a significant regional and State recreation resource. Activities include sailing, water and jet skiing, and wind surfing. The lake's upper arms are designated slow zones for quiet cruising, fishing, and nature appreciation. Brown's Ravine Marina provides 670 berthing slips for year-round mooring (depending on lake levels) and small craft rentals and supplies. Recent dredging of the marina for fill material for the Mormon Island Dam repairs should allow longer periods of use at the marina for both moored and launched boats.

The lake has up to 75 miles of undeveloped shoreline, providing quality swimming beaches, some with lifeguard services. Summer water temperature averages 72 °F, enhancing both water-oriented and shoreline activities. An area with important scenic, natural, and cultural values surrounds Folsom Lake and provides opportunities for camping, picnicking, hiking, and nature study. About 160 miles of unpaved roads and trails are available for hiking and horseback riding, in addition to the 8.4-mile paved bike trail connecting with the parkway's Jedediah Smith Trail.

According to DPR, the optimal lake elevation for recreation use is 436 feet mean sea level (m.s.l.), which makes all facilities available and allows the beaches to accommodate high use levels. Approximately 9,600 surface acres are available at this elevation. Lake elevations higher than this reduce the carrying capacity of the lake as some boat ramps and parking spaces are eliminated. Most of the boat ramps are unusable around elevation 420 (8,500 surface acres), and by elevation 405 (7,300 surface acres), only one boat ramp is still usable for launching.

May through August changes in water-surface elevations will have greater effects on use patterns. In winter, use patterns exhibit a greater degree of flexibility relative to water-surface elevations. One hundred percent of potential use is never realized because of displacement; that is, as conditions become ideal for one recreational activity, they deteriorate for another. For example, with increased water skiing, windsurfing conditions deteriorate because of wake disturbances.

Currently, about 2.1 million recreation users visit Folsom Lake annually. About 95 percent of the day-users and one-third of the campers come from the Central Valley, one-third from the San Francisco Bay Area, and the remaining one-third from elsewhere. Visitation data collected from 1976 through 1987 by DPR show 141,000 as the average monthly visitation to Folsom Lake. Visitation peaks in summer. The lowest use period was in December 1982 (7,224 visits), and the highest use month was 502,187 in June 1985.

An additional significant impact associated with lowered lake elevations is the effect on the operational aspects of managing the park. At pool elevations of 426 feet (9,000 surface acres) and above, the shoreline serves as a natural barrier to vehicular traffic, thereby protecting sensitive resources. When the shoreline recedes, unauthorized off-road vehicle activity increases dramatically, resulting in serious damage to natural and cultural resources around the lake. Illegal activities, such as firearms violations and illegal drug and alcohol abuse, also increase because of the difficulty of finding or pursuing persons in remote areas of the park.

UPPER AMERICAN RIVER

The USBR contracted with the DPR to provide recreation and public-use management services on the lands within the boundaries of the multipurpose Auburn Dam project, known as the Auburn State Recreation Area. This area includes 42,000 acres and 48 miles of the North and Middle Forks of the American River from the damsite to the Iowa Hill bridge and Oxbow Reservoir, respectively.

Rushing rapids, punctuated by deep clear pools within steep canyons, surrounded by wooded ridgelines, articulate the essence of the American River through this area. This juxtaposition of rugged terrain and free-flowing water creates a dynamic setting for a diversity of unique recreation opportunities from whitewater boating to recreational gold mining and picnicking.

Its proximity to major population centers and diverse recreation base make the Auburn State Recreation Area one of the most used and significant recreation resources in northern California. The expected growth of the surrounding Mother Lode and Sacramento metropolitan areas will make this resource more important for future generations. The recreation area is especially accessible to the surrounding population because of its location near major transportation corridors. Interstate 80 lies along the northwest margin of the area and brings it within a 2-hour drive from much of the San Francisco Bay area, and even less from Reno. State Highway 49 traverses the Auburn State Recreation Area from the north and south.

Local interest in outdoor recreation is intense. Bicycling (road and mountain biking) has increased dramatically in the area. There is continuing demand for equestrian trails and other trails. Boat registration is twice the statewide average. Indications are that there will be a continued increase in demand and a continued deficit in resources to meet this demand regionally.

The Tevis Cup (endurance horse ride) and the Western States Endurance Run (foot race), both 1-day, 100-mile events using the Western States Trail, draw entrants from all over the world. Approximately 72 miles of hiking trails, 66 miles of equestrian trails, and 15 miles of fire road are open to mountain bikes in the Auburn State Recreation Area and provide year-round recreation opportunities.

Whitewater boating on the Middle and North Forks of the American River is of State and national significance. Both forks offer overnight camping opportunities, hiking trails, cultural and natural observation sites, and a diversity of difficulty in whitewater rapids from beginning to advanced boating skill levels. The nearby South Fork of the American River offers a less challenging whitewater experience, and because of the predominance of private lands and development along the river corridor, camping is restricted. The nearest similar "wilderness" whitewater river, providing overnight trips, is the Tuolumne River, about 100 miles southeast of the recreation area.

Also of significance is the scenic value of the upper American River. Many tributary streams flow into the forks of the American at a very high gradient, creating small cascades and waterfalls. The major rapids on the main stems of the North and Middle Forks provide unique scenic features in a setting with few visible human intrusions. The North Fork of the American remains one of the last free-flowing rivers in California. Equally significant is the concentration of historic sites and remains in the canyons, especially along the Middle Fork.

A study is under way to determine whether or not the Middle Fork of the American River from Oxbow to the confluence with the North Fork of the American River is eligible for classification as a wild and scenic river. A multiagency team headed by the Forest Service will make an initial determination regarding eligibility. Should the river be classified as eligible for wild and scenic status, it would be further evaluated for suitability by the USBR. The USBR will incorporate that study into the multipurpose dam study it is undertaking. For a river or a section of a river to be eligible for wild and scenic status, it must be determined to be "outstandingly remarkable" based upon one or more of the following criteria: scenic, recreational, geological, fish and wildlife, historical, cultural, and ecological values.

The Bureau of Land Management (BLM) was authorized by Congress in 1989 to undertake a study of the American River watershed ". . . for the purpose of determining the feasibility and desirability of designating a National Recreation Area (NRA) within the American River watershed in association with a flood control or multi-purpose dam located at or near the site of the Auburn Dam." The BLM determined that the American River watershed fully meets all the NRA eligibility criteria of being sufficiently spacious, having an abundance of outstanding natural and cultural features, offering a wide variety of recreation opportunities, and being adjacent to a fast-growing metropolitan area of more than a million people. The BLM, however, was unable to draw any conclusions regarding desirability and recommended that the issue be readdressed once the issue of the dam is resolved.

Although other recreation areas such as the lower American River Parkway are more heavily visited regionally (5 million), the Auburn State Recreation Area (500,000) is still an important recreation resource for the Sacramento metropolitan area. Since it is within a 20- to 50-minute drive for most area residents, the area provides a quick afternoon escape. The cool waters of the area offer a compelling respite when temperatures in the Sacramento area exceed 110 °F. This increase in visitation adds to parking congestion at the confluence on summer weekends. The most popular month for the recreation area is July, when about 20 percent of annual visitation occurs. Some 46 percent of the annual use is between June and August, and use tapers off in the fall and winter.

RECREATION PLAN

RECREATION PLAN FORMULATION

The Federal Water Project Recreation Act of 1965 provides that recreation be considered as a full project purpose in connection with Federal water resources projects, provided that a non-Federal sponsor participates in the planning and construction of recreation facilities and assumes all operation and maintenance responsibilities of the completed project.

In June 1989, the Corps sent a letter to State and local agencies having recreation responsibilities, requesting a statement of interest in participating in recreation development as part of the study. This letter was followed with a meeting of potential recreation sponsors to discuss recreation opportunities within the study area, explain constraints on Federal participation in recreation development, and gauge local interest.

Many agencies expressed considerable interest in including recreation features in the project. However, only the Sacramento County Department of Parks and Recreation and City of Sacramento Department of Parks and Community Services identified potential projects and were willing to cost-share in the development and construction of the facilities.

Because of the uncertainty associated with actions at the USBR Auburn site and current planning under way for recreation development of these lands, no interest was expressed at this time for recreation development in these areas.

Subsequent coordination meetings and field visits between the Corps and the City and County of Sacramento identified several potential areas of recreation development. These include development of hiking, bicycling, and equestrian trails along the NEMDC with connectors along Dry and Arcade Creeks, trail development along the Sacramento River levees (Garden Highway and the Pocket areas), and purchase of private property within the American River Parkway for development of intensive public use, river access, and passive wildlife habitat enhancement.

The trail development and associated facilities in Natomas are included in the project alternatives and are discussed in more detail in the next section and the Recreation Resources Appendix.

Because the ARWI does not cover any work on the existing Sacramento River levees, the Garden Highway and Pocket trails are not considered in this study. Instead, these trails were considered for inclusion in the ongoing Sacramento Urban Levee Rehabilitation Project, which was initiated to bring the Sacramento River levees back to design standards. However, because the recreation design process could not keep pace with the levee work, recreation trails were not included as part of that levee project.

There is one surface street crossing on the Jedediah Smith bike trail at Del Paso Boulevard. This is a heavily traveled road which at times is dangerous for cyclists to cross. Therefore, for safety reasons the main trail will be rerouted to the south about 1,600 feet and beneath the Highway 160 bridge to avoid the need for street crossings. This will connect the Jedediah Smith Trail and the proposed NEMDC trail, creating a loop system with the Sacramento Northern Trail. This will allow for the anticipated increase in trail use.

NATOMAS RECREATION FACILITIES

The recreation features in Natomas would include paved pedestrian/biking trails (9.5 miles) and unpaved equestrian trails (7.5 miles) along the proposed levees and channels of the NEMDC and lower Dry Creek and Arcade Creek. (See Figure 14-1.) The trail system would be located entirely off-street and use overpasses and underpasses to avoid surface crossings of arterial streets wherever possible. Additional minor connector trail

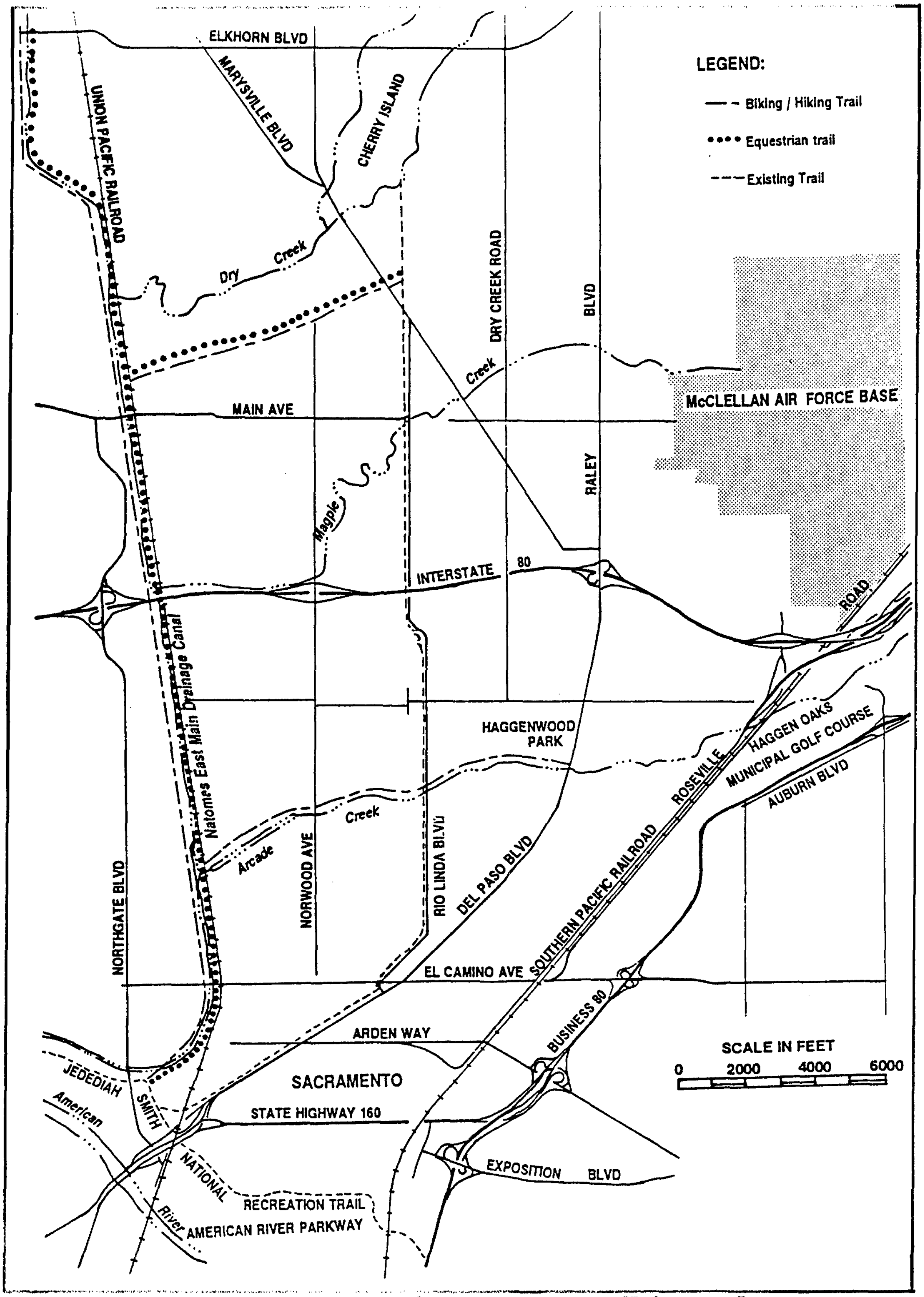


FIGURE 14-1. Proposed Recreation Features - Natomas Area

segments would be developed to link the trails to the adjacent neighborhoods.

Existing and planned City and County parks would be used as staging areas (parking and restrooms). Shade tree plantings would also be implemented along the NEMDC to enhance the recreation trail if compatible with flood control requirements. For safety reasons, a 1.1-mile section of the Jedediah Smith Trail would be rerouted to connect with the NEMDC trail.

The City and County of Sacramento will serve as the local sponsors for the proposed trail along the NEMDC and Lower Dry and Arcade Creeks. The portion of the 50 percent cost share to be borne by each agency will be determined through an agreement to be negotiated between the two participating parties.

In general, the local sponsors wish to have a minimal level of development. The surrounding area has a high vandalism and crime rate, and elaborate facilities (except for those with controlled entry) are not desired. Basic trails would include recreation trail elements such as trash containers, occasional picnic tables, shade trees, and drinking fountains.

Riparian shade tree planting (40 percent Fremont cottonwood, 20 percent willow, 20 percent white alder, and 20 percent valley oak) will be considered for planting along existing barren sections of the NEMDC. Oaks would be planted only on the slightly higher trail bench slopes. Because of Sacramento's extremely hot summer temperatures and predominantly clear skies, shade trees enhance the quality of this recreation resource. The low floodflow velocities of the NEMDC may allow trees and shrubs to remain in the channel without compromising the channel's floodflow capacity.

RECREATION COSTS

The estimated initial cost of the recreation features is approximately $1.4 million. (See Table 14-1.) Annual costs, including operation and maintenance of the facilities, are estimated at $890,000. A detailed cost estimate is presented in the Designs and Cost Estimates Appendix.

The levees and channels of the NEMDC, Arcade Creek, and lower Dry Creek are held in easement by the local reclamation and flood control districts as part of the existing Sacramento River Flood Control Project. The adjoining private land parcels actually extend under the channels and levees. For a public recreation trail corridor, full fee title purchase or recreation easement would be required. The Federal Government will provide 50 percent of the costs of recreation facilities and land costs.

TABLE 14-1. Recreation Costs

Item	Cost
Recreation Features	$ 1,400,000
Lands	6,770,000[1]
Environmental Mitigation	0
Engineering, Design, Supervision, & Administration	610,000
Total First Costs	$ 8,780,000
Average Annual Equivalent Costs	$ 790,000
Operation & Management	100,000
Total Annual Costs	$ 890,000

[1] Includes land and acquisition costs.

The real estate cost applicable to the recreation plan is the difference between the existing flood control easements and fee purchase, or additional recreation easement, which would be cost shared. Costs associated with the minor separable lands required for trail access and necessary health and safety facilities are also applicable to the non-Federal 50 percent cost-sharing requirement. As realigning the bike trail would be done on County land, no costs are attributed to the recreation plan for these lands, which are already flooded intermittently as part of the existing flood control system.

RECREATION BENEFIT ANALYSIS

Table 14-2 provides an estimate of the existing recreation use of the undeveloped drains and creek channels in the portions of the project area proposed for recreation development and the expected increase in use of these areas over the project's economic life. Also shown is the anticipated use of these areas if the proposed project facilities are constructed. Estimates are based on 1987 use surveys of similar central California recreation areas and 1989 and 1990 use data for American River Parkway facilities. Subtracting the estimated existing use without the project from the use with developed facilities in place provides an estimate of the new recreation use which would result from the proposed recreation facilities.

TABLE 14-2. 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
NEMDC 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
Jedediah Smith Trail	109,100	136,700	163,700	204,600	54,600	68,200
TOTAL	111,800	139,800	381,900	477,400	270,100	337,600

Estimates of the recreation day-use value for the existing unimproved recreation activities in the study area and for the recreation activity expected with the new facilities are provided in Table 14-3. 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). These procedures take into account the type of facilities available, access, location, and uniqueness of the recreation activities.

Recreation benefits were calculated from the day-use recreation values shown in Table 14-3 and average annual recreation use derived from Table 14-2. Benefits for new recreation use were derived from the net increase in recreation use in the project area and the day-use value of the developed recreation facilities. An additional benefit for increasing the value of the existing unimproved recreation use was also calculated. It is assumed those people already using the project area would continue to do so, but that the new facilities would make the recreation experience more valuable. The project

TABLE 14-3. General Recreation Unit Day Values

Value Per Recreation Day		
Trail	Existing (Unimproved)	With New Facilities
NEMDC	$ 3.00	$ 4.01
Dry Creek	3.00	4.78
Arcade Creek	3.00	4.78
Jedediah Smith	5.16	6.32

benefit of that existing recreation is the difference between existing recreation values and developed recreation values shown in Table 14-3, multiplied by the amount of recreation currently taking place in the area.

Table 14-4 displays these benefits. The average annual values were calculated using an 8-3/4 percent interest rate and a 100-year period of analysis.

The proposed recreation developments are expected to provide in excess of over 335,000 additional user days with a value of approximately $1.67 million annually. This results in a net annual project benefit of around $900,000 and a benefit-cost ratio of 1.0.

TABLE 14-4. Recreation Benefits ($1,000's)

Trail	Value of Increase	Change in Value for Existing	Total (Average Annual)
NEMDC	$ 368	$ 3	$ 371
Dry Creek	277	3	280
Arcade Creek	440	3	443
Jedediah Smith	360	116	476
TOTAL	$1,445	$ 125	$1,570

IMPACTS

SIGNIFICANCE CRITERIA

Impacts to recreational resources are considered significant if the project would cause a substantial long-term disruption of an existing recreational activity which is recognized institutionally in the plans and policies of public agencies or private organizations, or which is identifiable based on the general popularity of the activity.

Institutional Recognition

Institutional recognition is based upon acknowledged laws, adopted plans, and other policy statements of public agencies and private organizations. The proposed recreation plan for this study takes into account the recreation plans for the City and County of Sacramento. Both plans include trail development along the NEMDC. The proposed NEMDC trail in the selected plan can be said to have a beneficial level of significance. Should the portion of the Middle Fork of the American River under study for inclusion in the national wild and scenic rivers system or the area obtain NRA status, then the level of significance would be evaluated under the appropriate criteria.

Public Recognition

As discussed above, both the upper and lower American River areas have traditionally been popular sites for a wide range of recreational activities. Along the Middle Fork of the American River, whitewater rafting, camping, fishing, and gold mining are enjoyed by 500,000 visitors each year. Folsom Reservoir and the American River Parkway provide fishing, boating, swimming, and hiking activities to 7.6 million visitors each year.

NO-ACTION ALTERNATIVE

Natomas

Park development, as specified in the Natomas Community Plan, would continue until it met the City plan standards for neighborhood and community parks and parkways. If the rate of development decreased because of the lack of flood protection, the rate of parkland and recreational facility development would slow as well. Because of high land costs, it is doubtful new parks or trails would be created unless directly tied to development projects. Existing parks and parkways could possibly experience the impacts of floodwaters under the no-action alternative. Some recreation activities could be temporarily disrupted due to flood-related damage to facilities until repairs and maintenance can be effected.

Lower American River

Sacramento County estimates indicate that use of the American River Parkway will increase from 5.5 million people in 1988 to 7.5 million in 2000. Recreation use of the Folsom Lake State Recreation Area is also expected to climb from 2.1 million to 3.4 million visits by 2000. Increasing population will put increasing demands on the recreation resources and lead to more overcrowding of the facilities.

Upper American River

Since construction on the USBR multipurpose dam project at Auburn was halted, the DPR has managed recreation use in the Auburn State Recreation Area. With the uncertainty over when the project may be completed, the DPR is developing an interim management plan to provide safe public access to the area. It is currently assumed that there will be no changes in the ownership patterns of State, Federal, and private lands. No plans now exist with any Federal, State, or local agency to provide new or improved recreation facilities for this area, and peak season use is at or near full capacity at existing facilities and access points. It is assumed the existing annual visitation level will increase to approximately 600,000 persons and would be maintained in subsequent years.

It is possible that the remaining potential for a multipurpose dam at the site would continue to deter land-management agencies from providing adequate development of the river for recreation purposes, as did the "interim" status of the full-size Auburn Dam project.

SELECTED PLAN

Direct Impacts

Natomas. Levee improvements would have negligible direct impacts on public or private recreation as there are no developed facilities in these areas. Some temporary disruptions to the existing unofficial uses of the NEMDC will occur during the construction of the levee improvements and the pumping structure.

The proposed project recreation features would provide 9.5 miles of off-street recreation corridors between Rio Linda, North Sacramento, and Natomas and the American River Parkway. The trails would complement plans by Sacramento County to develop a parkway and off-street trails along upper Dry Creek to Gibson Ranch Regional Park and into Placer County, eventually linking the American River Parkway to the proposed City of Roseville trail system and Folsom Reservoir.

Trail development would encourage additional public recreation along the NEMDC and neighboring creeks, making significant new areas of relatively natural open space more easily available to the region. Shade tree plantings using native species are expected to make this area more attractive to recreation users.

Additional storage at Auburn would prevent high flows such as those of February 1986. By reducing the higher flows and raising and widening the levees, possible damages to other proposed facilities in Natomas could be reduced and maintenance costs decreased.

Lower American River. Since no levee improvement or channel work would occur in the American River Parkway under this alternative, existing recreation facilities and resources would mostly remain undisturbed. However, by rerouting the Jedediah Smith Trail, safety will be increased at the Del Paso Boulevard crossing and a loop trail system established.

No construction activity is anticipated at Folsom Reservoir and Lake Natoma; therefore, there would be no impacts due to construction.

Flow releases from Folsom Dam would remain the same as the without-project operations up to the objective release of 115,000 cfs. Additional storage at Auburn would prevent high flows such as those of February 1986. By reducing the higher flows, damages to facilities in the parkway could be reduced and maintenance cost to Sacramento County Department of Parks and Recreation could be decreased.

Flood control operations at Folsom Dam and Reservoir would remain the same as under without-project conditions, so existing recreation would not be affected.

Upper American River. Construction activities for the flood control dam would cause the majority of significant impacts in this area. The Auburn damsite has been closed to public use since the USBR project began in the 1960's. Little existing public recreation now exists in the area, so impacts would be minimal in the immediate dam vicinity and adjacent staging areas.

Aggregate mining associated with construction activities from the Old Cool Quarry (Spreckles) would have limited impacts on recreation along the upper American River. No known permitted recreation activities are associated with the site. However, Old Quarry Road, which is also a portion of the Western States Trail, could be temporarily closed for public use until completion of the conveying operations. This would be a short-term significant adverse impact to trail users as well as for special athletic events such as the Tevis Cup and Western States Trail Run. Rerouting during mining operations could be arranged to lessen this impact.

The cleansed aggregate would likely be transported to the damsite by a temporary conveyor belt system placed on an existing roadway or trail alignment. The final alignment of the conveyor system will determine whether or not there will be any significant impact to river recreation. Should the alignment take the conveyor system across the river, some restrictions regarding access, including boating and rafting, will be initiated. Any restriction will be temporary and not result in full closure of the river. Mining and associated transportation activities would last from 2 to 3 years.

Construction of a bridge and approach roadways at Ponderosa Way also could impede public access to the North Fork if road closures or construction-induced delays occur during spring or early summer high-use periods. Temporary closure of Highway 49 may be required during construction of a new bridge and approaches. Also, the existing Highway 49 bridge and approaches could be retained if a local agency agrees to maintain the area. Areas along the construction route and near the confluence of the North and Middle Forks would experience some closures during construction.

The primary recreation impact would result from periodic temporary inundation of the river up to the 923.7-foot elevation. (See Figures 14-2, 14-3 and 14-4.) This inundation would likely be during mid-winter (December-February) rainstorms. Over time, however, this periodic inundation would result in changes in the density of vegetation along the forks of the river and at Lake Clementine due to accelerated mortality. Furthermore, this

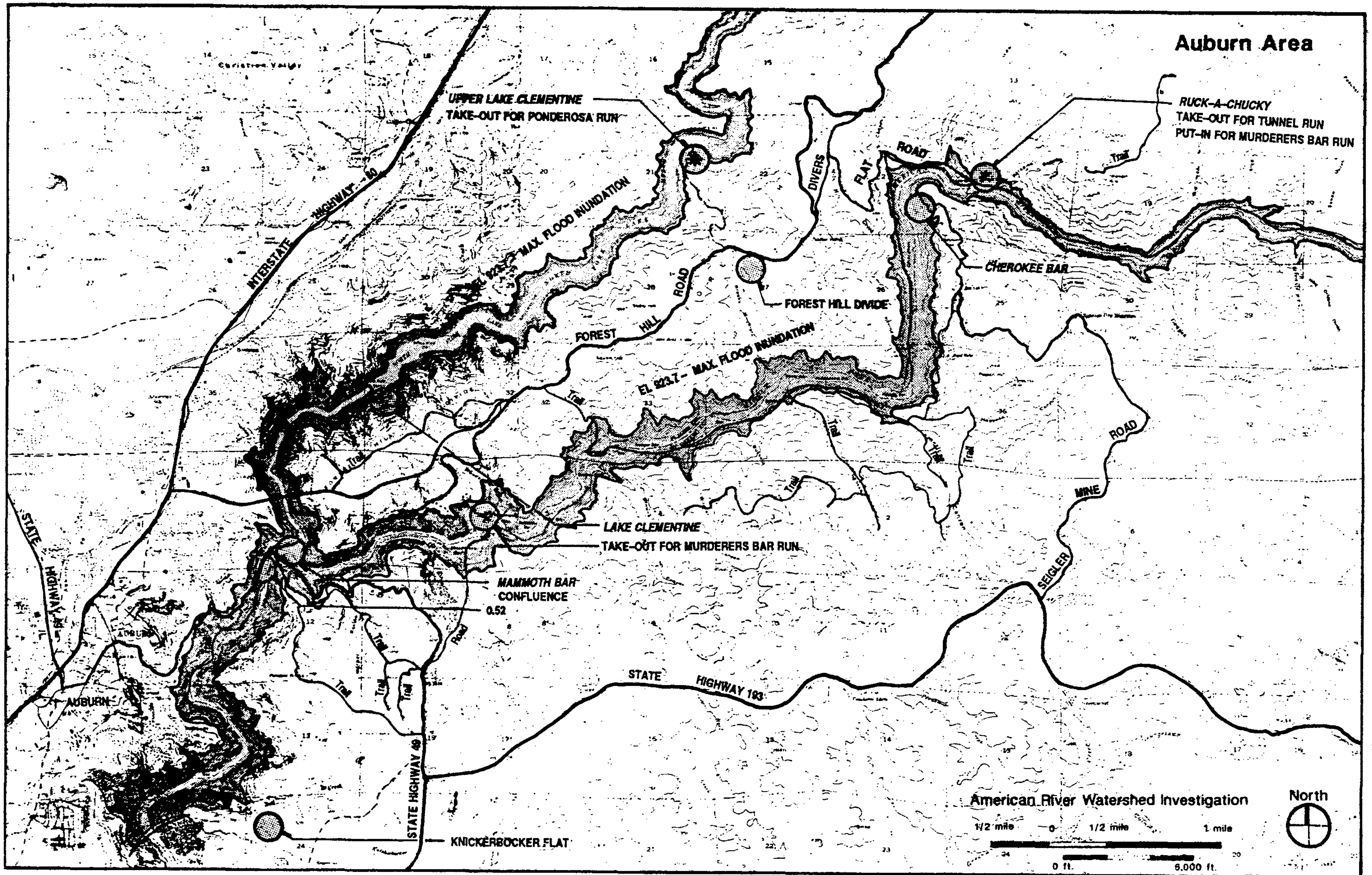


FIGURE 14-2. Recreation Facilities - Upper American River

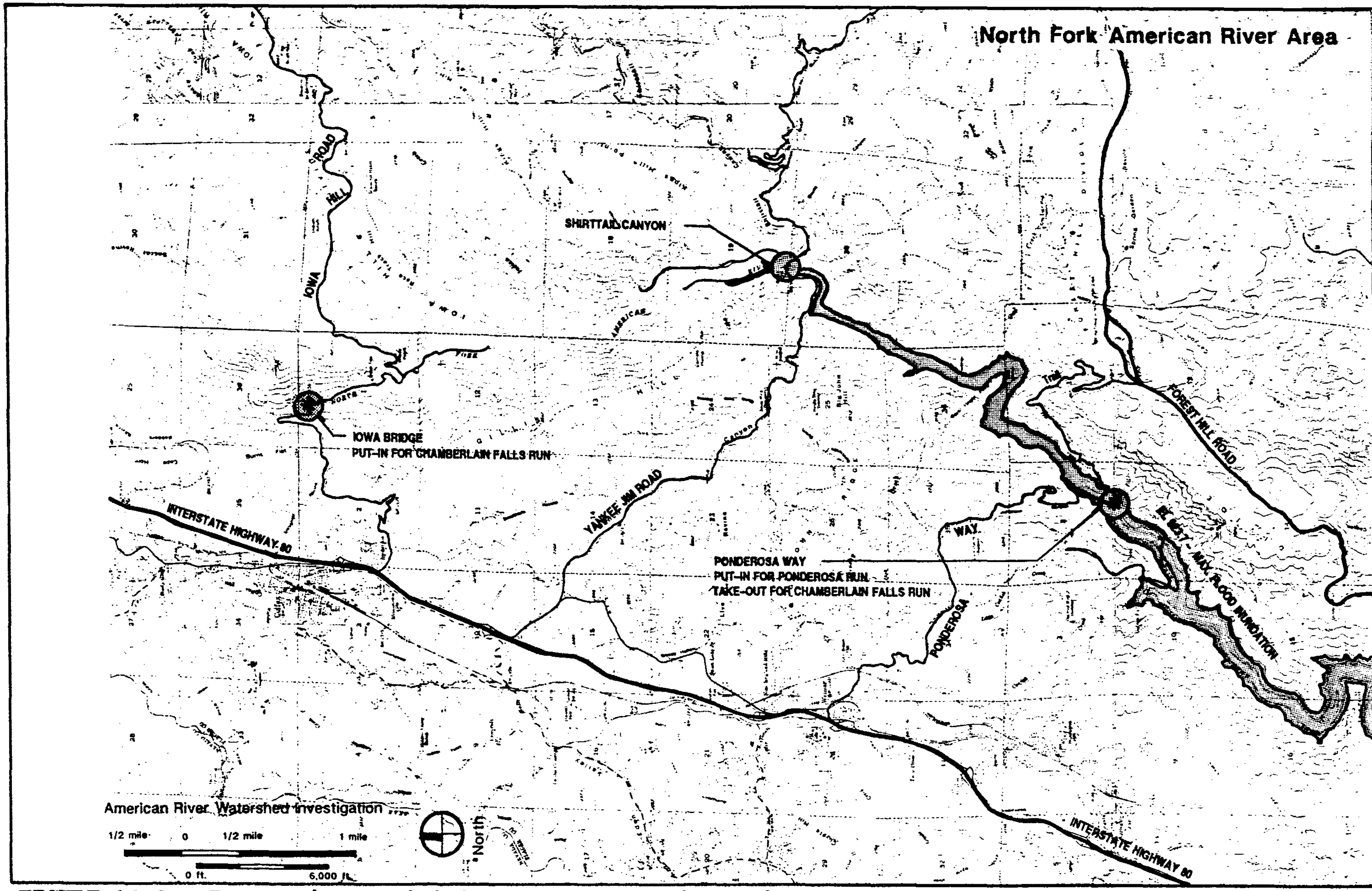


FIGURE 14-3. Recreation Facilities - Upper American River

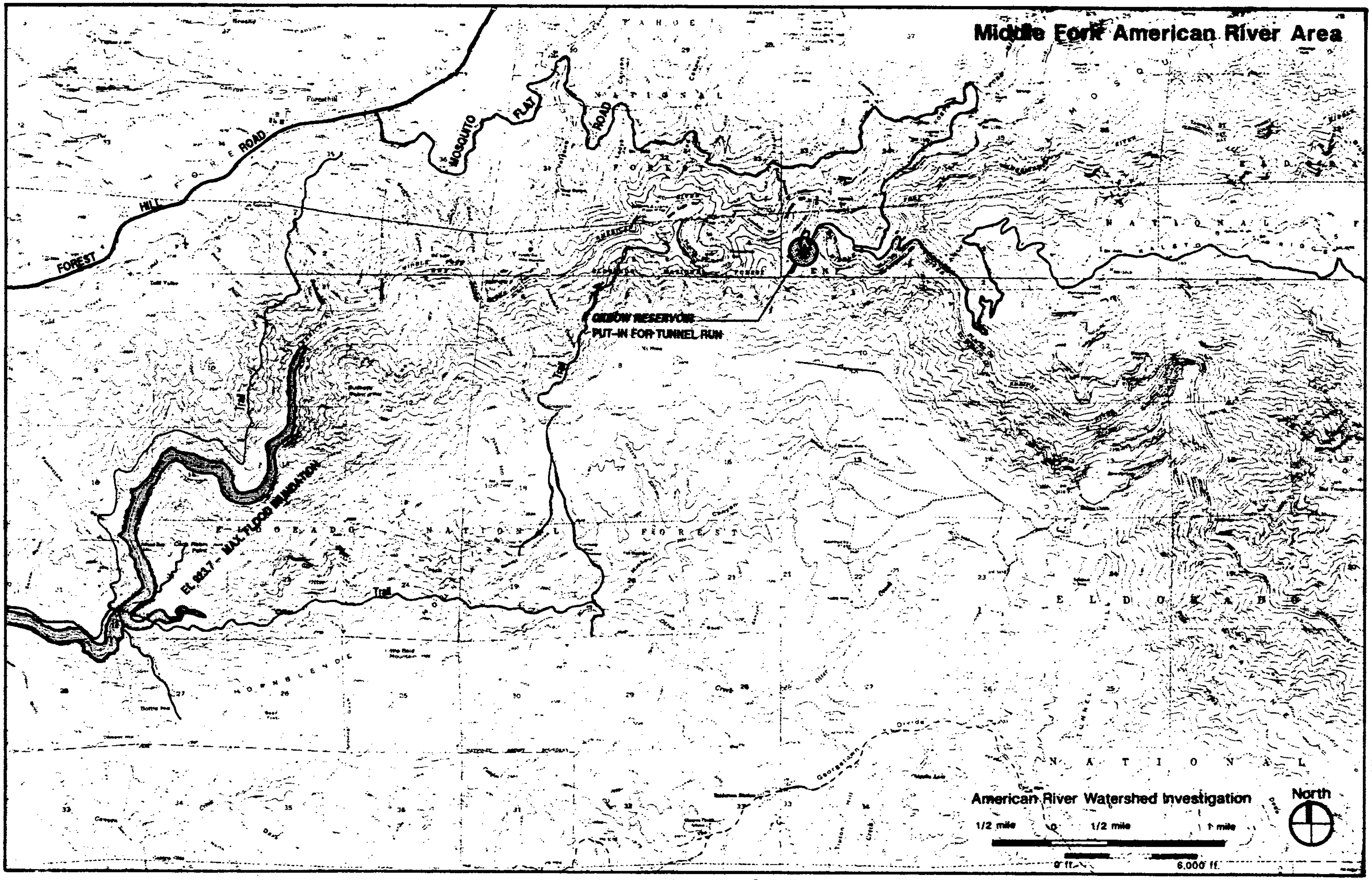


FIGURE 14-4. Recreation Facilities - Upper American River

inundation could increase soil instability along the walls of the canyon and cause sloughing in portions of the inundation zone. This sloughing could cause trail slippage or block trails, creating public safety concerns and at least affect recreation use. Trail reconstruction and repair will be incorporated into the operation and maintenance of the project. The extent of changes are described in Chapter 7, Fish, Vegetation, and Wildlife. These changes in the overall appearance of the area would significantly affect the quality of the recreation experience.

Because the majority of recreational use in the upper American River is tied directly to water access, this use would not be disrupted by changes in vegetation or the visual resource base. Since much of this use is from the regional community, it is unlikely that recreation would be displaced to other areas.

Inundation of the upper American River might cause floating debris such as logs, limbs, and sediment to be deposited on roads, trails, or other recreation sites and cause disruptions until maintenance crews could clear the obstructions. It is also possible that some trails would wash out along lower-lying trail alignments including the Western States Trail. This would constitute a significant adverse impact.

The selected plan calls for retaining all existing public lands within the flood control pool. It is also assumed public lands existing outside the flood control pool area, but within the 42,000-acre USBR Auburn Dam project boundary, would be retained in public ownership. The USBR and Department of Parks and Recreation are expected to continue to manage these existing lands until a long-term decision is made to develop the resources available at the Auburn site. Thus, no loss of public access to recreation resources would be expected.

Confluence Area. The confluence area is one of the highest use areas on the upper American River because of its location and access from State Highway 49. Recreation from December through February is only about 6 percent of the annual total; the resulting loss of 3,150 visitor days out of over 500,000 would be considered less than significant. This loss would occur only after heavy rains when a flood pool is established.

It is not the loss of visitor days that is significant; with proper mitigation, there may actually be an increase in use. It is the change to the resource base, and that relationship to experiential values, that is important. The periodic inundation of the canyon by the flood control pool will result in changes in the composition of bank vegetation along the rivers and at Lake Clementine. It is estimated that a 200-year event will create a flood control pool with a surface elevation 923.7 which could last up to 7-1/2 days. Should the pool remain at that elevation for more than 7 days, the complete chaparral community, along with the interior live oak and the canyon oak, would experience some mortality rate. This die-off of a portion of the chaparral and evergreen plant communities would change the overall appearance of the area.

Because the majority of use in the affected area is directly tied to water access or off-highway vehicle activity, use will not be significantly affected by changes in the vegetation or visual resource base. While use levels may not change, a certain percentage of users will be negatively affected from an experiential perspective. Because a large number of these users are from a regional area, it is assumed few will make a conscious decision to recreate elsewhere, primarily because there are no regionally substitutable resources.

These forementioned impacts will take place within the first few large floods. After a period of time, grasses will replace chaparral, and inundation-tolerant tree species will replace the oaks. Eventually, vegetation in the canyon will be reestablished naturally, and the resource base change will not affect recreation. However, sloughing and slippage of the slopes may have continual impacts to recreation after each inundation.

After Highway 49 is replaced, the responsibility for maintenance of the existing, or "historic," portion of the highway into the canyon is expected to be turned over to either Placer or El Dorado Counties. Access would remain at least initially. However, periodic inundation of the highway could increase maintenance costs associated with repairing the roadway. If costs become prohibitive for the Counties to continue needed maintenance, access to the river from the historic roadway could be eliminated.

Lake Clementine. The 200-year peak flood pool would be 203 feet above the surface of Lake Clementine. The marina's floating docks, now permitted to the Auburn Boat Club, may be adversely affected by periodic inundation. The gas sales service and existing toilet facilities not capable of withstanding periodic inundation may need to be removed or replaced to prevent contamination of the lake. The existing launching ramp would not be affected.

Upper North and Middle Forks. Project operations would not significantly affect the amount or patterns of use associated with either fork of the river. Though a 200-year flood would create a flood control pool extending approximately 3 miles upstream of Ponderosa Way (the last point for whitewater boating activity on the North Fork), inundation would last for less than 6 days during a period of minimal use, with little quantitative impacts. On the Middle Fork, the pool would extend to Buckeye Point, submerging the Greenwood Bridge crossing under approximately 90 feet of water at peak inundation. Recreation impacts would be negligible.

The new roadway bridge and approach roadways at Ponderosa Way could be widened to alleviate some of the current parking and traffic problems. Turnarounds and parking areas could be created on the old roadway by DPR.

Numerous access roads to recreation sites in the upper American River could be affected by periodic inundation.

Indirect Impacts

Natomas. Growth in North Natomas induced by flood protection would result in a permanent loss of bird hunting and bird watching activities on agricultural lands converted to urban use. This would be a significant adverse impact. The increased growth would result in development of community parks and open space areas as required by the individual general plans, changing the density and character of recreation opportunities in this area.

Lower American River. Increased urbanization of Natomas and along the lower American River would lead to higher recreation use of the American River Parkway and increase the congestion already experienced at peak summer and weekend times.

Upper American River. No impacts.

400-YEAR ALTERNATIVE

Impacts of this alternative are similar to those of the selected plan. Construction impacts in Natomas and on the American River would be almost identical. Levee work is only slightly more than for the selected plan; construction of pumping facilities and recreation features would be the same. The larger dam at the Auburn site would result in somewhat greater construction impacts. More aggregate materials would be required for the larger dam. Temporary disruptions of river-based recreation activities and access roads would be the same as with the selected plan.

Operational impacts in the lower American River would be the same as with the selected plan. Outflows from the 400-year structure would be lower than with the selected plan, possibly reducing potential sloughing impacts in the inundation zone. Inundation effects on existing roads and trails would be the same as with the selected plan.

Indirect impacts are triggered once the 100-year FEMA level of protection is reached. These are the same as for the selected plan. If the smaller dam is seen as an impediment to a larger, full-scale multipurpose Auburn Dam, there would be a higher likelihood that a land management agency would be willing to invest in recreation facility development along the river.

150-YEAR ALTERNATIVE

Direct Impacts

Natomas. Work in Natomas would consist of levee raising and recreation trail development. Recreation impacts for this alternative would be similar to those described for the selected plan.

Lower American River. Reoperation of Folsom Dam would alter flow patterns during non-flood periods in the lower American River from those under without-project conditions. In general, flows would be higher in the fall and early winter as Folsom Reservoir was lowered. Flows would be somewhat less in the spring as a greater storage space was filled. The principal water-dependent recreation activities affected by these altered flows would be boating (including rafting, kayaking, and canoeing), swimming, and wading. USBR operation models provide data for determining impacts on critical or threshold flows for these activities, based on operating plans for 650,000 acre-feet of flood control storage space in Folsom Reservoir and year 2020 water use projections.

Studies conducted for East Bay Municipal Utility District identified 2,000 cfs as the minimum flow necessary to support all forms of boating (kayaking, rafting, and canoeing) and 1,500 cfs as the minimum flow required to support wading and swimming (Watson, 1985).

Although additional structural protection would be provided for levees and banks against higher flows, releases of up to 180,000 cfs would cause greater damage than would be experienced under without-project conditions. After high flows, recreation use of some areas would be interrupted for extended periods of time during repair and cleaning of the damaged facilities. Some additional damage could occur to the natural vegetation, affecting, at least temporarily, the esthetic value of these areas and the enjoyment of recreation users.

Significant alterations to the lower American River Parkway would be required to accommodate floodflows up to 180,000 cfs. Levee raising, slurry wall construction, and riprap placement would disturb substantial areas of the parkway. Of these alterations, most would result in only a temporary impact to recreation; however, the removal of vegetation to accomplish the levee raising or other improvements would significantly degrade the quality of the parkway for 5 to 10 years. Placement of riprap would result in the permanent loss of vegetation and visual quality and lessen the quality of the recreation experience. This would be a significant impact.

The majority of the levee raising and riprap placement would take place between Rio Americano High School and the Highway 160 bridge. Some 21,800 linear feet of the bikeway, 2,400 feet of park roads, and 2,400 feet of fences would also be removed and relocated, creating further temporary disruptions. Extensive construction of levee protection could affect the designation of the lower American River as a recreation river under the Wild and Scenic Rivers Act.

To accommodate the higher flows anticipated under this alternative, modifications to or replacement of the Howe Avenue bridge, H Street bridge, and the Union Pacific Railroad trestle near Highway 160 would be required. Portions of the Jedediah Smith Trail in the parkway would be temporarily closed or rerouted during construction of these bridges.

Estimated impacts to water-dependent recreation during the peak recreation months of June through September were based on these threshold flows and USBR operation model flow predictions. Flows in the lower American River would be reduced to a level that would have an adverse effect on boating (greater than the without-project condition) only during below normal and dry water years. Swimming and wading activities would be affected by reoperation only in dry water years. It is estimated that 199,000 user-days of boating activities and 138,000 user-days of swimming and wading activities would be lost during the assumed

100-year life of the project. This would be a significant impact. No impacts were anticipated during other types of water years.

A higher objective flood control release of 180,000 cfs from Folsom Reservoir would adversely affect existing recreation facilities in the American River Parkway. At the current objective release of 115,000 cfs, recreation facilities, levees, and banks are damaged. Design flows of 180,000 cfs would significantly increase this damage. Repairs for damaged facilities would be more extensive and costly, and delays in returning these facilities to normal use could be greatly extended.

Water-surface elevations at Folsom Lake directly influence the recreational quality of the resource and affect attendance and user-behavior patterns. The main recreation use season, May through August, is most sensitive to water-surface elevations. Use patterns during the winter months are not as dependent on water-surface elevations (DPR, 1989).

The DPR identified recreation impacts at Folsom Reservoir that would result from fluctuations in water-surface elevation. The following areas represent the lake's full range of facility development and recreation use patterns: Beals Point, Brown's Ravine, Dike 8, Granite Bay, Peninsula, and Rattlesnake Bar. Use stage curves were developed for each area reflecting (1) use patterns by use area, (2) seasonal use pattern changes, and (3) changes in use levels relative to lake water-surface elevations. These curves were combined to represent reservoirwide recreation activity at various stage levels.

Attendance was projected from the base year to the year 2000 and is expected to increase to 3.4 million visitors by that year. Annual attendance numbers were grouped into monthly estimates and weighted according to the percentage of occurrence for given water-year classifications. The USBR operations model study for Folsom Reservoir was used as a model to determine water-surface elevations for the base condition and the 650,000 acre-foot reoperation scenario (150-year alternative). Table 14-5 presents annual attendance changes associated with changes in water-surface elevation for the 100-year (FEMA) storage and 150-year flood control plans.

TABLE 14-5. Folsom Reservoir Reoperation - Annual Decrease in Recreation Use

Activity	100-Year (FEMA) Storage Alternative	150-Year Alternative
Swimming	42,900	85,500
Camping	4,400	5,700
Windsurfing	8,300	9,200
Picnicking	24,100	27,100
Fishing	48,200	83,400
Boating (Launch)	110,400	159,300
Boating (Non-launch)	5,500	(5,300)[1]
Jet Skiing	12,400	16,200
Swimming (Non-designated)	20,500	11,500
Berthing	12,600	14,200
Equestrian	1,200	2,100
Boat Camping	1,500	2,000
Hiking	100	100
Special Events	0	0
Net Increase	292,100	411,000

[1] Bracketed numbers represent an increase in use.

As water-surface elevations are drawn down during winter for flood control, spring runoff and precipitation will recharge Folsom Reservoir 70 percent of the time. While the main recreation season elevations may be lower as a result of drawdowns, they remain within the range of good to excellent for recreation. This anticipated change in recreation use, based on the above assumptions for Folsom Reservoir, is shown in Table 14-5 for both the 100-year and 150-year alternatives. It is expected that user days under these alternatives would only increase in one category (non-launch boating). Dry and critical water years are more significantly affected by the drawdown regimes.

Lowering the spillway at Folsom Dam would require a periodic closure of Dam Road, which could disrupt normal traffic flows and result in delays of recreation trips in the vicinity and detours through the City of Folsom. Closure of the road could be coordinated to avoid the peak traffic times and minimize the potential disruption.

Upper American River. Not applicable. The 150-year plan includes no work in the upper American River.

Indirect Impacts

Indirect impacts would be the same as with the selected plan.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Direct Impacts

Natomas. Recreation impacts for this alternative caused by levee work and construction of recreation facilities would be similar to those described for the selected plan.

Lower American River. Increasing objective releases to 145,000 cfs would require similar, but less extensive, levee and bank protection work than would be required with the 150-year alternative. Recreation on the trails would be interrupted or detoured to surface streets during construction and relocation of the trails. Recreation trail use would also be interrupted during modifications to the Union Pacific Railroad trestle near Highway 160. Higher objective releases from Folsom Reservoir would increase damage to recreation facilities in the parkway and increase Sacramento County's operating expenses.

Upper American River. This alternative includes no work in the upper American River area.

Indirect Impacts

Indirect impacts would be the same as with the selected plan.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Direct Impacts

Natomas. Recreation impacts for this alternative caused by levee work and recreation feature construction would be similar to those described for the selected plan.

Lower American River. This alternative retains the existing objective release of 115,000 cfs. Thus, no increased maintenance costs due to erosion damage are expected. Flow changes from the increased storage in Folsom Reservoir would not be significant enough to affect threshold recreation flows on the lower American River. No loss of recreation would be expected. However, a modified flood control storage operating plan would have impacts on recreation at Folsom Reservoir similar to those of the 150-year plan, but to a lesser extent. Water-level changes in the reservoir would result in an annual loss of approximately 292,100 visitor days. (See Table 14-5.)

Upper American River. This alternative would avoid any direct impacts in the upper American river.

Indirect Impacts

There are no indirect impacts to recreation in Natomas with this alternative. On the lower American River, impacts will be the same as with the selected plan. This alternative would avoid any impacts in the upper American River area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

Direct Impacts

Natomas. For this alternative recreation impacts caused by levee work and construction of recreation facilities would be similar to those described for the selected plan.

Lower American River. Increasing objective releases to 130,000 cfs would require similar, but less extensive, levee and bank protection work than would be required with the 150-year alternative. Recreation on the trails would be interrupted or detoured to surface streets during construction and relocation of the trails. Recreation trail use would also be interrupted during modifications to the Union Pacific Railroad trestle near Highway 160.

Spillway construction-caused closures of Folsom Dam Road would be similar to those for the 150-year plan.

Higher objective releases from Folsom Reservoir would increase damage to recreation facilities in the parkway and increase Sacramento County's operating expenses. Some recreation opportunities would be temporarily lost during repairs and cleanup activities after floods.

No recreation impacts are expected from the changing flow regime created by increased storage in Folsom Reservoir. Changed flood control storage would affect recreation at Folsom State Recreation Area to a lesser extent than the 590,000 acre-foot level of storage. Exact impacts have not been modeled for this elevation.

Upper American River. There are no impacts to recreation in the upper American River with this alternative.

Indirect Impacts

Indirect impacts will be with the same as with the selected plan.

MITIGATION

SELECTED PLAN

Natomas

Mitigation for impacts resulting from constructing the recreation features is provided in the 280-acre mitigation site in Natomas.

Lower American River

There are no impacts to recreation in the lower American River with this alternative.

Upper American River

Construction areas will be reclaimed as part of normal construction procedures following accepted industry standards to as close to preproject conditions as possible. Impacts to the Western States Trail would be short term but significant. Rerouting the trail around the quarry during the period of operation would allow for continued trail use. After dismantling the conveyor system, any trail damage caused by the conveyor will be repaired. Operators of major events such as the Western States Run and Tevis Cup would be notified to reroute around any construction closure areas. If the event cannot be rerouted, the construction operations will be altered for the duration of the event so as to allow the events to continue.

The flood control dam will increase maintenance costs to those agencies operating recreation features in the upper American River. These costs will be a project operation and maintenance responsibility of the non-Federal sponsor. The non-Federal sponsor will have responsibility to maintain or make further disposition of the abandoned section of Highway 49.

Inundation is expected to change the composition of the bank vegetation along the river. The resulting mortality to oaks and chaparral would have a significant impact on the recreation experience as it relates to visual resources and esthetics. A program of tree removal and reseeding should be instituted to expedite the transition and stabilize the canyon walls as described in the Adaptive Management Plan.

400-YEAR ALTERNATIVE

The impacts for this alternative are similar to those for the selected plan; therefore, the mitigation would be the same.

150-YEAR ALTERNATIVE

Natomas

No mitigation is required; construction-related cleanup of the area and planting of native riparian tree species will enhance recreation use of the area.

Lower American River

Water-dependent recreation on the lower American River is not a project purpose of Folsom Dam and Reservoir. Operation of Folsom Reservoir for the authorized project purposes of flood control, water supply, and power production results in adequate downstream flows. Losses to recreation would be significant if flows are less that 2,000 cfs for boating and less that 1,500 cfs for swimming and wading. Whenever possible, flows should be maintained to meet these minimum levels.

Damages caused by the higher objective release would increase the County of Sacramento's costs to operate and maintain the American River Parkway. Increasing structural protection would mitigate for damages but result in impacts to visual resources and the overall recreation experience. These could be partially mitigated through esthetic treatments and replantings.

Temporary losses of recreation opportunities during construction of levee and bank protection, recreation facilities, and bridge modifications can be mitigated through rerouting.

Based on the projected water-surface elevations, no net adverse impacts are expected during the main recreation season for Folsom Reservoir. Significant changes in visitation are experienced during the winter months, but are a small part of the overall annual recreation use. Recreation is not an authorized project purpose, but results from adequate reservoir area surface levels and area made available by operation for authorized project purposes of flood control, water supply, and power production. No mitigation is provided for lost recreation opportunities.

Upper American River

There are no impacts to the upper American River with this alternative.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Natomas

No mitigation is required; construction-related cleanup of the area and planting of native riparian tree species will enhance recreation use of the area.

Lower American River

Damages caused by the higher objective release would increase the County of Sacramento's costs to operate and maintain the American River Parkway. Temporary losses of recreation opportunities during construction of levee and bank protection, recreation facilities, and bridge modifications could be mitigated through rerouting of the trails.

Upper American River

There are no impacts to recreation in the upper American River with this alternative.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Natomas

No mitigation is required; construction-related cleanup of the area and planting of native riparian tree species will enhance recreation use of the area.

Lower American River

Water-dependent recreation on the lower American River is not a project purpose of Folsom Dam and Reservoir. Operation of the reservoir for the authorized project purposes of flood control, water supply, and power production results in adequate downstream flows. Losses to recreation would be significant if flows are less that 2,000 cfs for boating and less that 1,500 cfs for swimming and wading. Whenever possible, flows should be maintained to meet these minimum levels. This will be defined in the operation and maintenance guidelines for the project. There will be no mitigation for Folsom Reservoir impacts.

Upper American River

There are no impacts to recreation in the upper American River with this alternative.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The impacts for this alternative are similar to impacts for the 150-year alternative; therefore, the mitigation would be the same.

CHAPTER 15

SOCIOECONOMICS

Project impacts on the socioeconomic structure of the project area were determined by comparing existing and future without-project socioeconomic conditions to the future with-project conditions forecast in the land use analysis. Baseline information on population, housing, economy, emergency services, water supply, solid waste, sewage systems, and schools was derived from master plans, community plans, the 1980 U.S. census, and other sources.

EXISTING CONDITIONS

NATOMAS

Population

For purposes of the analysis, Natomas, with a population of over 35,000, is divided into three subareas, City Community Plan area (plan area), unincorporated North Natomas (unincorporated area), and south Sutter County. Most of the population resides in the plan area, which has been one of Sacramento's fastest growing areas over the past decade (South Natomas Community Plan, 1988). According to the 1980 census, Natomas averaged 2.45 persons per household. (See Table 15-1.)

Housing

A moratorium on residential construction currently prevents any further development of housing in Natomas until adequate flood protection is provided. Although a few scattered housing units are for sale, no large housing tracts are being developed or sold at this time.

In 1989 Natomas had approximately 13,500 housing units. Nearly 13,300 units are in the plan area, which has a combination of single-family dwellings, duplexes, and apartment complexes, most of which were built after 1970 (City of Sacramento). If the moratorium is removed and residential development is resumed, the mixture of densities is expected to continue at the current rate. The unincorporated area and south Sutter County have fewer homes, which are small ranches with a single home or small clusters of two to five homes.

TABLE 15-1. Natomas Population Characteristics

Characteristic	Unincorporated Area	City Community Plan Area	South Sutter County	City of Sacramento
Income Level (1980)	$16,719	$18,250	$18,545	$14,604
Population (1988)	840	30,170	5,950	334,500
Average Persons Per Household (1980)	2.5	2.3	2.7	2.5

Sources: Population & Housing Data by Community Plan Area, City of Sacramento, February 1990; North Natomas Community Plan, July 1985 and 1983 City and County Data Book.

In 1989 the price of a home in Natomas averaged $112,500, which would require a family income of $45,000 to purchase. Monthly rent for a two-bedroom apartment averages $475. The vacancy rate for both single- and multi-family housing units is low.

Water Supply

The City of Sacramento obtains its water supply from both surface- and ground-water sources. The city has water rights to both the American and Sacramento Rivers; these water rights are fixed by a permanent contract with the USBR (City of Sacramento General Plan, January 1988). In 1987 the city used 106,500, or 33 percent, of its total water rights. The City currently has rights to enough quality surface water to supply all planned growth within the city limits until buildout. Thirty public and privately owned water purveyors governed by the Public Utilities Commission supply water for areas outside the city limits.

The Sacramento River, Riverside, and American River Water Treatment Plants supply about 85 percent of the surface water to the plan area. The plan area is serviced mainly with surface water, while the unincorporated area uses well water with limited service from the Sacramento Metropolitan Airport, Northgate Water Maintenance District, and Rio Linda Water District to accommodate urban development. There is currently no contract for treated water supply for south Sutter County, which is dependent on ground water for agricultural land. The County assumes that the Natomas Mutual Water District will provide water for urbanization.

Residential users within Natomas consume 8,000 gallons per acre per day. Per capita residential water use is estimated at .19 acre-foot annually (Boyle Engineering, 1989). The daily consumption of water is about 4,000 gallons per acre for commercial users and about 1,700 gallons per acre for industrial users.

Sewage System

The City and County of Sacramento are serviced by the Sacramento Regional County Sanitation District. Existing district facilities in North Natomas were constructed to serve South Natomas and adjacent areas. South Sutter County uses septic tanks for sewage and is not provided service from any other source at this time. Flows for the Sacramento area average 400 gallons per day for single-family dwelling units, 300 gallons per day for multi-family units, and 2,625 gallons per day for commercial/industrial property.

Solid Waste

The City collects and transports all City residential solid waste to the landfill site at 28th Street and A Street. Capacity is anticipated through 1991 (pers. comm., City Solid Waste), and the City is planning to use the County site at that time. Each Sacramento resident disposes of approximately 4.26 pounds of solid waste per day, and commercial/industrial land disposes of approximately 1 pound of solid waste per 100 square feet per day. County solid waste is taken to the County landfill site on Keifer Boulevard, which is expected to be at capacity by approximately 2005. The south Sutter County landfill site will also soon be at capacity. Capacity figures for the Sacramento City and County landfill sites are based on population projections, which do not include development of unincorporated areas.

Emergency Services

Natomas has no hospital facilities, although a hospital to serve the area is proposed at a Northgate Boulevard site. The Sacramento Fire Department operates two fire stations to serve the area: Natomas Fire District Station 18, which services the north area, and Station 15, which services the south area. Station 15 is a temporary facility and will be relocated to the northeast corner of the NEMDC and West El Camino Avenue. The Pleasant Grove Fire Department provides protection for south Sutter County.

The Sacramento City Police Department provides protection for the plan area. The department, which currently has a ratio of 1.7 police officers (uniformed and civilian) per 1,000 persons, would like to have a ratio of 2 officers per 1,000 persons (pers. comm., Sacramento Police Department, 1990). The unincorporated areas are under the jurisdiction of the Sacramento County Sheriff's Department. The Sutter County Sheriff's Department provides protection for south Sutter County.

Schools

Lack of space for students at all levels of education is a severe problem in this area. The schools are overcrowded, and funds are not available to build new schools.

Four school districts--Natomas Union, North Sacramento, Del Paso Heights, and Grant Joint Union, with six elementary schools and two intermediate schools--serve Natomas. (See Table 15-2.) Natomas Union School District is experiencing one of the highest enrollment growth rates in Sacramento although enrollment has slowed because of the building moratorium. At this time there is no high school within Natomas. Most high school students attend Rio Linda High School, and some go to Grant High School. Grant Joint Union High School District purchased a site to build a high school on Rosin Boulevard; however, the Natomas area was split into a separate school district, and the district has canceled its plans to build. Natomas Union School District will become a unified school district in July 1992 and is currently looking for a site to purchase for a high school.

Elementary age students (K-8) in south Sutter County attend Pleasant Grove Elementary, Browns Elementary, or Marcum-Illinois Elementary, each of which is in the student's own school district, and then transfer to the East Nicolaus Joint Union High School District to complete the higher grades. East Nicolaus has a capacity of 375 students and a current enrollment of approximately 195.

TABLE 15-2. Public Schools Servicing Natomas (1989/90 School Year)

School	Grade	District	Capacity	Occupancy	Vacancies
Jefferson	K-6	Natomas Union	620	767	-147
Bannon Creek	K-6	Natomas Union	620	340	280
American Lakes	K-6	Natomas Union	870	723	147
Hazel B. Strauch	K-6	North Sacramento	620	450	170
Althea Smythe	K-6	North Sacramento	620	589	31
Garden Valley	K-6	Del Paso Heights	360	309	51
Pleasant Grove	K-8	Pleasant Grove	240	170	70
Browns Elementary	K-8	Browns Elem.	299	156	143
Marcum-Illinois	K-8	Marcum-Illinois	160	106	54
Rio Tierra	7-8	North Sacramento	810	808	2
Natomas Union Jr. High	7-8	Natomas Union	350	303	47
Grant High School	10-12	Grant Joint Union H.S.	1,500	1,500	0
Rio Linda Sr. High	9-12	Grant Joint Union H.S.	1,400	1,744	-344
E. Nicolaus Joint Union High School	9-12	E. Nicolaus Joint Union H.S.	375	195	180

Economy

The civilian labor force of the area includes the large population base in the Sacramento Metropolitan Statistical Area, which comprises El Dorado, Placer, Sacramento, and Yolo Counties. The labor force, which is diverse (Table 15-3), averaged 555,200 in 1987 and is projected to increase to 648,100 in 1992 (Employment Development Department, 1989).

The service industry, retail trade, and government are expected to provide nearly two-thirds of all new jobs. The 1989 unemployment rate of 4.9 is low compared to the 1989 statewide average of 5.1 percent (Employment Development Department, 1989).

TABLE 15-3. **Annual Average Wage and Salary Employment, Historical 1987 Forecast 1992 El Dorado, Placer, Sacramento, and Yolo Counties** 1/

INDUSTRIES	HISTORICAL 1987	FORECAST 1992	PERCENT CHANGE 1987-1992
Total, all industries	555,200	648,100	16.7
Total agriculture	8,500	8,900	4.7
Total non-agriculture	546,600	639,200	16.9
Mining	800	900	12.5
Construction	32,500	40,400	24.3
Manufacturing	40,500	50,100	23.7
Nondurable goods	16,000	18,800	17.5
Food & kindred products	7,000	7,800	11.4
Paper, printing & publishing	5,500	6,800	23.6
Chemicals & allied products	800	1,100	37.5
Other nondurable goods	2,700	3,100	14.8
Durable goods	24,400	31,300	28.3
Lumber & wood products	4,800	6,000	25.0
Stone, clay, & glass products	2,100	2,500	19.0
Primary & fabric metals	2,500	2,600	4.0
Other durable goods	15,100	20,200	33.8
Transportation & public utilities	24,600	27,300	11.0
Wholesale trade	25,800	31,400	21.7
Retail trade	106,700	125,400	17.5
Finance, insurance, & real estate	33,500	41,300	23.3
Services	116,400	142,200	22.2
Government	165,800	180,200	8.7
Federal	29,800	29,600	-0.7
State and local	136,000	150,600	10.7

Source: Employment Development Department Annual Planning Information, Sacramento MSA

1/ Annual average industry detail may not add to totals because of independent rounding.

The community plan area has many small businesses (hair salons, cleaners, video stores, restaurants, grocery stores, and liquor stores), which are supported by local residents. The unincorporated area is primarily agricultural land with rice as the major crop. Light industrial land use is slowly increasing with the construction of office complexes and warehouses near Northgate Boulevard and Del Paso Road.

Sutter County's economy is based primarily on agriculture, retail trade, service industries, and government employment within the Sacramento area. In 1989 Sutter County had an unemployment rate of 13.0 percent, the second highest rate of any county in the State. The largest employment growth is in retail trade and services.

LOWER AMERICAN RIVER AREA

The lower American River area consists of five subareas: Dry Creek, North Sacramento, South Sacramento, Rancho Cordova, and Richards Boulevard.

Population

The area has a population of approximately 372,000. (See Table 15-4.) The majority of the population resides in the south Sacramento area. A more detailed breakdown is available for these areas in the City of Sacramento Population and Housing Data Report, 1990.

Housing

The cost of housing surrounding the lower American River project area varies from $70,000 to $129,000. (See Table 15-5.) Although the majority of land in lower American River is developed, a significant amount of vacant land in south Sacramento is designated for residential use. Of the approximately 149,000 housing units in the lower American River area, the majority are in South Sacramento. (See Table 15-6.)

Water Supply

Water rights, supply, and water demand on a per capita basis and by land use type are the same as those for Natomas.

TABLE 15-4. 1989 Population

Area	Population
North Sacramento	54,950
South Sacramento	295,000
Dry Creek	2,500
Rancho Cordova	18,910
Richards Boulevard	580
TOTAL	371,940

Source: City of Sacramento General Plan, City Planning Department, January 1988, and Population & Housing Data by Community Plan Area, City of Sacramento, February 1990.

TABLE 15-5. 1990 Average Housing Costs, Lower American River

Area	House	Rent for two-bedroom Apartment
North Sacramento	$70,000	$480
South Sacramento	$114,000	$515
Dry Creek	not available	not available
Rancho Cordova	$129,000	$500

Source: The Answer Book, Sacramento Bee, January 29, 1991

TABLE 15-6. 1989 Housing Estimates, Lower American River

Location	Housing Units
North Sacramento	21,980
South Sacramento	118,000
Dry Creek	1,000
Rancho Cordova	7,560
Richards Boulevard	230
TOTAL	148,770

Sewage System

The Sacramento Regional County Sanitation District collects wastewater for the area. Unincorporated portions are serviced by County Sanitation District 1. Sewage flows average 400 gallons per day for single-family dwellings, 300 gallons per day for multi-family units, and 2,625 gallons per day for commercial and industrial property.

Solid Waste

Data are the same as those for Natomas.

Emergency Services

Several fire districts within the Sacramento Fire Department provide fire protection. The Sacramento City Police Department provides police protection.

Schools

Five of Sacramento's eight school districts are within the project area and provide public education from kindergarten through 12th grade.

Economy

Local workforce data for the Sacramento metropolitan area are shown in Table 15-3.

UPPER AMERICAN RIVER

The study area was divided into the following subareas: reservoir area; City of Auburn; and the El Dorado County region south of the American River, which includes Cool-Pilot Hill, Greenwood, Garden Valley, Georgetown, and Lotus-Coloma.

Population

Based on local planning agency estimates, total 1990 population within the upper American River study area was 41,290. Much of the demographic data are from the 1980 census and may be substantially revised upon completion of the 1990 census.

The Auburn area's median age of 37.8 years was significantly higher than that of Placer County (32.2 years) or the State

(29.9 years). More recent trends indicate a higher percentage of younger working families with children in the 5-19 age category. Auburn's 1980 population was predominantly white, with females constituting 55.1 percent. The 1991 Department of Finance estimates the countywide household size at 2.6 persons per unit. However, for this analysis a household of 2.5 persons was assumed to reflect statewide trends in declining household size. The 1980 annual median family income of $20,772 was comparable to the County and the State, although the household median income was substantially lower. In 1985, Auburn had a per capita income of $12,753, the second highest in the County (Sacramento Bee, 1990).

In 1980, the El Dorado County subareas of Cool-Pilot Hill, Greenwood, Georgetown, and Garden Valley were all within census tract 306; Lotus-Coloma was within census tract 309. Demographics for census tract 306 were a median age of 34.3 years, which is younger than the County average of 35.3 years; a retired population of 12 percent, higher than the County average of 9 percent; 2.7 persons per household; and a median household income of $16,546 and a median family income of $18,379 annually, which was 3 percent less than County household income and 8 percent less than County family income. An estimated 6.6 percent was below the poverty line.

Statistics for census tract 309 were a median age of 32.8 years; a retired population of 6 percent; 3.1 persons per household; and a household income of $21,694 and a family income of $22,421, which were significantly higher than the County average. Only 2.4 percent were below the poverty line. Females constituted about half of the total 1980 population, which was predominantly white. The 1991 Department of Finance estimates the household size countywide at 2.7 persons per household. For purposes of this analyses, 2.5 persons per household was assumed to reflect State trends in declining household size.

Housing

Most of the City of Auburn is designated for residential uses, with an average density of about four units to the acre. In 1989, an estimated 69 percent were single-family as compared to 77 percent in Placer County. Single-family units are projected to continue to increase proportionately to multi-family units because of the limited vacant land zoned for medium density units (Elan & Associates, 1985). Housing in the outlying areas is primarily lower density, single-family detached. In 1989, there were 4,324 housing units within the City of Auburn. The total number within the Auburn Plan Area is unknown. The 1989 vacancy rate of 4.5 percent for all housing is a significant decrease from the rate in 1980. The 1989 vacancy rate for Placer County was 18 percent because of the large supply of seasonal housing.

The median sale price of a home in 1989 was $155,200. The average monthly rent for a two-bedroom apartment was $530 (Sacramento Bee, 1990). Housing affordability was identified as a serious problem in the 1985 Housing Element when sales prices were much lower.

For the El Dorado County subareas, information being developed for the draft El Dorado County Circulation Element indicates there are approximately 4,000 housing units within the traffic zones which roughly coincide with the subareas. The majority of residential uses are low density, single-family units. The largest subdivision, Auburn Lake Trails with its potential for 1,106 units, is in the Cool-Pilot Hill area. Limited duplex development exists in Cool-Pilot Hill and Georgetown.

The 1980 census indicated a vacancy rate of 16.5 percent for Cool-Pilot Hill, Greenwood, Georgetown, and Garden Valley and 5 percent for Lotus-Coloma. The higher rate is presumably due to the amount of seasonal occupancy and does not truly reflect actual year-round housing availability. Housing cost data are limited. According to the 1980 census, average sales prices in the Lotus-Coloma area were significantly higher than in the remainder of the study area. The median price for a home in the Placerville area is currently $160,000, and monthly rentals for two-bedroom apartments average $500 to $600. The Cool-Pilot Hill and Georgetown Area Plans cite the lack of affordable housing.

Water Supply

Placer County's water supply is adequate to meet its water needs past the year 2020. However, about 212,000 acre-feet of the net surface water supply is not deliverable. Placer County has studied various alternatives to deliver American River water (Corps of Engineers, 1990).

During the preconstruction phases of the USBR authorized Auburn Dam, Placer County constructed its Middle Fork American River Project, including the Ophir Tunnel, to provide additional water for Placer County. The tunnel was to convey water from the proposed Auburn Reservoir to Auburn Ravine and then to western Placer County. 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 provides a maximum of 50 cfs and serves a portion of the Loomis basin in western Placer County (Tesea, pers. comm.). The tunnel is inefficient because of its limited capacity and high operation, maintenance, and energy costs.

Placer County Water Agency provides treated water to the City of Auburn and adjacent areas from two water treatment plants. The plant in North Auburn has a maximum design capacity of 10 million gallons per day; the Bowman plant has a maximum capacity of 5 million gallons per day, but is being upgraded to 20 million gallons per day (Tesea, pers. comm). Peak consumption per housing unit is estimated at 1,500 gallons per day. Urban per capita use is 204 gallons per day (Maisch, pers. comm.), which equates to .229 acre-foot per year. Placer County Water Agency also provides irrigation water to the area. The Nevada Irrigation District provides treated and irrigation water to the areas off Bell Road and Highway 49 north of Auburn. The outlying rural homesites are served by wells.

The Georgetown Divide Public Utilities District, which receives most of its water from the Stumpy Meadows Project, delivers treated water to portions of Cool (741 connections), Greenwood (90 connections), Garden Valley (625 connections), and Georgetown (675 connections) (Davis, pers. comm.). The district also provides irrigation water as far south as Pilot Hill and is currently contemplating an extension which would provide 200 new hookups in the Pilot Hill area (Davis, pers. comm.). The project's safe yield (the amount of water that can be counted on in critically dry years) is about 10,400 acre-feet. In those areas not served by the district, ground water is the primary water supply. Applied water use in 1990 was estimated at 8,020 acre-feet, of which about 68 percent was used for agriculture (Department of Water Resources, 1989). Urban per capita water use was estimated at 204 gallons per day, or .229 acre-foot per capita per year (Department of Water Resources, 1989).

The El Dorado Irrigation District provides a combination of treated and irrigation water to the Lotus-Coloma area. Wells in some areas have marginal yields or have potential problems with septic tank contamination (El Dorado County Planning Department, 1981). The district's main source of water supply is from the Pacific Gas and Electric Company's forebay at Pollock Pines, which is supplemented as needed from the USBR reservoir at Sly Park (Fraser, pers. comm.). Metered demand is 573 acre-feet per year. Per capita use estimates vary widely; therefore, the

204 gallon-per-day use estimated for the rest of the study area was assumed to be reasonable.

The areas served by El Dorado Irrigation District currently have a severe water shortage, and a partial moratorium on additional water hookups throughout the district is currently in effect. Consecutive drought years have caused the district to impose strict conservation measures, cutting consumption by about 30 percent from the 1984 to 1987 period (Business Journal, 1990). According to the El Dorado County Water Agency, there was a water deficit of 4,000 acre-feet in 1990 (Sacramento Bee, 1990).

Sewage System

The City of Auburn, Placer County Sewer Maintenance District No. 1, and the Newcastle Sanitary District serve the Auburn area. The Auburn wastewater treatment plant, located west of Auburn near Ophir Road, was completed in 1977 and was recently upgraded to provide 2 million gallons per day of average wet weather flow (Guillen, pers. comm). Plans are now under way to expand the plant to provide a capacity of up to 3 million gallons per day. Sewer Maintenance District No. 1 has a current design capacity of 1.7 million gallons per day, of which about 1.2 million gallons per day are being used (Tellefson, pers. comm.). Although no expansion is currently planned, funding is available to expand the plant as the area increases in population (Tellefson, pers. comm.). The Newcastle district would expand as needed to handle anticipated growth.

Septic tanks serve a small number of units in the southeast area of the city and larger parcels in outlying areas.

The El Dorado County subareas handle all sewage disposal by septic tanks and have no public sewer service. Steep slopes, shallowness to bedrock, slow percolation rates, and low available water holding capacity severely limit septic field capabilities. All of the higher density development designated within the area plans would require public sewage systems. Parcels less than 4.5 acres would require municipal sewer and/or public water (Prince, pers. comm.). Several of the developments proposed for the Cool-Pilot Hill area would include some form of onsite treatment facilities.

Solid Waste

County and private contractors pick up and dispose of solid waste in the Auburn area at a regional landfill between Lincoln and Roseville, which currently receives 200,000 tons of waste per year (Babbit, pers. comm.). The current lifespan of the landfill is estimated at 22 years, with planned expansion of the site and a recycling facility anticipated to extend the lifespan to 50 years. Countywide waste generation is estimated at 2.9 pounds per capita per day (Babbit, pers. comm.). Toxic wastes are hauled outside the County.

Private contractors dispose of solid waste in the El Dorado County subareas to a landfill at El Dorado south of U.S. 50. Even with the planned expansion of the landfill, the site is estimated to have capacity only until the year 2000 (Morgan, pers. comm.). Waste generation in the plan areas is estimated at about 5.1 pounds per capita per day (Morgan, pers. comm.). Toxic wastes are transported outside the County.

Emergency Services

Acute care community hospitals in Auburn and in Placerville serve the Auburn area and the western slope of El Dorado County, including the subareas. Fire department personnel and ambulance service also provide emergency medical services.

Fire protection for the Auburn area is provided by the City of Auburn, the California Department of Forestry, the Placer Foothills Consolidated Fire Department, and the Newcastle Fire Department. The Auburn stations are manned primarily by volunteers. Placer Foothills Consolidated has the largest full-time staff and serves large portions of the unincorporated area. Newcastle has only one full-time person supplemented by volunteers. With the exception of Newcastle, none of the districts indicated any significant service capability problems. The highest percentage of calls was for emergency medical treatment.

The El Dorado County subareas are served by four local fire protection districts with a total of eight fire station, manned by paid personnel and volunteers. Staffing levels vary, but stations are typically manned 24 hours per day in the fire season. Fire problems include high fire hazards in some areas because of wildland fires and difficult access and lack of water mains. All of the fire protection districts impose special taxes and/or development fees to provide necessary funding for facilities and equipment. Service boundaries do not necessarily follow subarea boundaries, and all districts cooperate under mutual aid agreements. The highest percentage of calls in all of the local districts is for emergency medical service.

The City of Auburn, Placer County Sheriff's Office, the California Highway Patrol, and the California Department of Parks and Recreation are responsible for law enforcement in the Auburn area. The Auburn Police Department currently has 20 sworn officers to serve the city population of approximately 9,600 (Boon, pers. comm.). The minimum staffing level per patrol beat is two officers. A central downtown station serves the city, and a new facility is planned in 1991 (Boon, pers. comm.). The average response time to a priority A call is under 3.4 minutes (Boon, pers. comm.).

The Placer County Sheriff's Department, with 170 sworn officers, also serves the unincorporated Placer County area. The overall County average is 1 officer to 1,100 population, which is below Federal recommendations of 2 officers per 1,000 population. The patrol beat has a minimum of one officer during the day and generally three officers at night. The average response time to a priority A call is 5 minutes (Englinder, pers. comm.). The nearest station is north of Auburn at DeWitt. The major identified deficiency is the lack of jail capacity (Auburn Journal, 1990).

The El Dorado County Sheriff's Department, with a force of 106 sworn officers, serves all of the subareas. With an estimated population of 123,000, the ratio is about 1.2 officers per 1,000 population. The County goal is 1.5 to 1.6 officers per thousand population (Roloff, pers. comm.). Generally, one officer patrols the widespread subareas daily. The average response time for a Priority A call is 17 minutes, but may be longer (Roloff, pers. comm.). The nearest station is in Placerville. Crime problems are generally those associated with rural areas and public use of recreational areas (Roloff, pers. comm.).

The California Highway Patrol serves both the Auburn and El Dorado County areas and provides traffic patrols and responses to accidents and emergencies. In the Auburn area, the patrol currently operates four line beats and has a minimum of four units and a maximum of eight units patrolling an area roughly extending from Colfax to the Sacramento County line, including Highway 49 and the Shirland Tract area (Norton, pers. comm.). Automobile accidents create the highest call for services (Norton, pers. comm.).

The patrol's Placerville office covers El Dorado County subareas. Two line beats cover Highways 49 and 193. Although the area is sparsely populated and only sporadically patrolled (Yates, pers. comm.), the patrol is on call at all times and responds to traffic collisions on public roads and injuries on both public and private property. According to Caltrans statistics, there were 74 automobile accidents, one-half of which involved injuries, on Highway 49 between the Placer County line and Cool from 1987 through 1989 (Sanger, pers. comm.). Compared to normal accident rates for this length and type of highway, the accident rates were from 25 percent higher in 1987 to 45 percent higher in 1989. These rates demonstrate the hazardous nature of this section of Highway 49 and what appears to be an increasingly high accident rate.

State park rangers, who have the full power of California police officers, police all lands within the Auburn State Recreation Area. Responsibilities include public safety, search and rescue, law enforcement, and resource protection.

The California Division of Forestry responds to wildland fires and emergency medical needs (Stoller, pers. comm.). It is responsible for fire control on all State lands and provides protection for Federal lands within the American River Canyon and the Auburn State Recreation area under mutual aid agreements with local fire districts. The steep sloping areas along the Bear and American River canyons can pose extreme fire hazards. The majority of these fires are related to human use (Stoller, pers. comm.). The division also responds to accidents on Highway 49 and to structural fires and emergency medical calls under automatic aid or mutual aid agreements. The division maintains full-scale equipment and permanent staff at its firefighting station near Auburn as well as its main headquarters. Stations at Pilot Hill and Garden Valley are manned part time during the nonfire season and full time during the declared fire season (Fargas, pers. comm.).

The U.S. Forest Service protects forest lands within the El Dorado National Forest from its station in the Georgetown District near Georgetown. Staffing is full time, but increases significantly during the summer months (Earley, pers. comm.). The Forest Service participates in automatic and mutual aid agreements.

Schools

Table 15-7 summarizes data on school districts in the Auburn area and El Dorado County subareas. With the exception of Newcastle, the Auburn school districts are averaging annual growth rates of about 4.5 percent. Total elementary enrollment for 1989-1990 was 3,953. The growth rate exceeds facility capacity, and without expansion the estimated number of

TABLE 15-7. School Districts in Auburn Area and El Dorado County Subareas

School District	Area Served	Grade Level	District Enrollment 1989-90	District Capacity	Unhoused[1]
Ackerman	Auburn Plan Area	K-8	286	280	-6
Auburn Union		K-8	2,558	2,068	-490
Newcastle		K-8	286	270	-16
Placer Hills Union		K-8	1,313	1,000	-313
Placer Union High		9-12	3,371	3,803	+432
Black Oak Mine Unified	Cool-Pilot Hill Greenwood Garden Valley Georgetown	K-12	1,959	1,873	-86
Cold Trail Union	Lotus-Coloma and Other areas outside study area.	K-8	628	500	-128
El Dorado Union High El Dorado High School	Lotus-Coloma and Other areas outside study area.	9-12	1,626	1,435	-191
TOTAL			12,027	11,229	-798

[1] Unhoused students represent a district's permanent capacity minus its existing enrollment. Those districts with surplus classroom space are shown as positive, and districts with overcrowded classrooms are shown as negative.

unhoused students, 819 for 1989-90, will greatly increase in future years. Capacity at Placer Union High will be exceeded by 1995 (Reinking, pers. comm.).

Elementary school growth rates in the El Dorado subareas have fluctuated greatly in recent years and are now at very high levels. Total 1990 elementary population in the Black Oak Mine Unified School District, which serves the majority of the subareas, was 1,449 students, of which 86 were unhoused. The Golden Sierra High School has limited capacity and projects an overall annual growth rate of 5 percent over the next 5 years (Pryor, pers. comm.). The Gold Trail Union School District, which serves the Lotus-Coloma and other areas, has been growing at an annual rate of about 4 percent. The district elementary school, with an enrollment of 628 students, is over capacity and has no room for additional portable classrooms (Herrington, pers. comm.). El Dorado Union High School has 356 unhoused students and no room for major expansion.

All the districts impose developer fees and are pursuing funding through formation under the Mello-Roos Act, which imposes assessments to be used in financing schools and other necessary infrastructure, districts, and year-round schools to provide the capacities needed for existing and projected enrollment.

Economy

The civilian labor force in the region includes the large population base in the Sacramento Metropolitan Statistical Area, which is discussed in the section on Natomas and the lower American River.

Employment in the Auburn Plan Area reflects Placer countywide patterns. The County's labor force reached an average level of 75,500 in 1988. Unemployment is below the State level and reached a low of 3.6 percent at the end of 1989 (Business Journal, 1990). The County has traditionally relied on the railroad, lumber, wood products, and agricultural industries for jobs. More recently, jobs in retail trade, the service industries, and construction have gained significantly in importance, with retail and government accounting for the largest employment category. Demand for construction workers is also expected to remain strong, with the number of workers expected to increase from the 1987 level of 4,300 to 5,700 in 1992 (Employment Development Department, 1989). Auburn's 1988 total taxable sales were approximately $1.35 million, or about 9 percent of the County total (Hayes, pers. comm.).

Limited commercial and industrial development within the El Dorado County subareas constrains employment opportunities. Employment is primarily in the core areas of Georgetown, Cool-Pilot Hill, and Lotus-Coloma. Tourism is the County's economic base, with retail trade and services, construction, and government employment expected to expand. The number of construction workers is projected to increase from the 1987 level of 2,300 to 3,100 in 1992 (Employment Development Department, 1989). Local government employment is associated largely with the administration of extensive public lands. The County's labor force reached an average level of 61,200 in 1988; unemployment is below the State level and dropped to 3.6 percent at the end of 1989 (Business Journal, 1990). Total taxable sales for 1988 were approximately $6.98 million (Hayes, pers. comm.).

IMPACTS

SIGNIFICANCE CRITERIA

For purposes of this analysis, any condition or impact created by the project is considered significant if it substantially affects the economy of any part of the study area or generates a substantial need for housing, water supply, sewage service, solid waste disposal, emergency services, or schools.

The following assumptions were used in the socioeconomic analysis.

- Indirect impacts in Natomas and lower American River would be the same for all the alternatives. Once a 100-year level of protection is achieved and FEMA flood plain restrictions eliminated, land use changes that create secondary impacts (urbanization of agricultural and wildlands) would proceed according to existing general plans. The only direct impacts for each alternative in Natomas and lower American River are construction related. These impacts would be less than significant due to the adequate construction workforce within the Sacramento area and sufficient housing for the nonlocal workers.

- The only significant adverse impacts resulting from the selected plan and 400-year alternative in upper American River are direct construction impacts. These result from the relocations and potential traffic safety hazards related to project construction, including the Highway 49 replacement. It is anticipated that all impacts could be mitigated to a less than significant level. The only difference in direct impacts between the selected plan and 400-year alternative would result from the intensity of activities associated with construction. These differences are not considered significant.

- In the Auburn area and El Dorado County subareas, the same growth and related socioeconomic conditions are anticipated under with- or without-project conditions. Major issues concerning growth are the lack of needed infrastructure to effectively serve growth and community perception of an acceptable level of urbanization. The level of growth that would actually occur would ultimately be determined by land use policies of Placer and El Dorado Counties. Impacts would be either mediated or worsened by local jurisdictions' growth management policies. Under either the selected plan or the 400-year alternative, Highway 49 replacement would be in-kind and would not appreciably reduce commute times or facilitate access to northwestern El Dorado County. Therefore, growth inducement from the highway replacement is not anticipated. Significant indirect impacts in the upper American River area are not anticipated from either the selected plan or 400-year alternative.

NO-ACTION ALTERNATIVE

Natomas, Lower American River

Flood Damage Impacts. Under the no-action alternative, no Federal or State action would be taken to increase the existing level of flood protection afforded to the lower American River and Natomas areas. The Corps estimates that average annual flood damages under this alternative would be in excess of $190 million.

More than 350,000 people live in the 100-year flood plain of the American River, and nearly 390,000 live in the 400-year flood plain. Significant portions of this flood plain could flood to a level of 5 feet or more in the event of a levee failure. Public safety impacts would depend on the location and magnitude of flooding, time of day, population at risk in the flood plain, warning time, ability to evacuate, and effective implementation of a flood plain evacuation plan. Flooding could be swift and extensive, placing a heavy strain on the evacuation capabilities of the responsible local agencies.

The Corps estimated that even with a relatively long warning time (2-6 hours) prior to the outbreak of flooding, a 200-year storm could cause approximately 30 fatalities. This figure could increase to about 100 if the warning time were relatively short (less than 1 hour) or the magnitude of the storm were extraordinarily severe (400-year).

Studies on the effects of natural disasters on local economies indicate that flooding in Sacramento would have a significant short-term effect on the community due to disruption of business and governmental activities, destruction of capital equipment and public infrastructure, and temporary dislocation of portions of the local workforce (Fugro-McClelland, 1991). Long-term aggregate effects on the local economy would not be significant; however, subgroups within the community could suffer enduring hardship. Low-income areas in the flood plain would recover less quickly than high-income areas. Reconstruction in the deepest portions of the flood plain would be significantly affected by applicable FEMA regulations. If flooding occurs in the Natomas and Pocket areas of the city, it is assumed that flood damages will exceed 50 percent of the value of the damaged property. Under existing FEMA regulations, residents experiencing this level of damage would be permitted to rebuild their homes only if the new structures were elevated above the base flood elevation. Because of the severity of existing elevations, this regulation would make it infeasible for most damaged homes to be replaced and would force existing residents to abandon the flood plain. Land values in the Pocket and Natomas areas would suffer accordingly.

In addition to housing, flooding would have a significant short-term impact on solid waste disposal. It is estimated that a flood covering the entire flood plain would generate up to 90,000 tons of debris to be cleared up and disposed of (Fugro-McClelland, 1991). This volume of material would be roughly equal to the amount of fill normally deposited in the City's current landfill site during a 4-month period.

Growth-Related Impacts. Without Federal action to control floodflow in the American River, the conditions necessary to proceed with development in all areas of the 100-year flood plain could not be fulfilled. As of October 1, 1992, the expiration date of the special legislation, all new development in the 100-year flood plain would have to comply with FEMA flood plain management regulations predicated on FEMA's new base flood elevations. It is assumed that, under these conditions, new development would not be feasible in the Natomas and Meadowview areas of the City where high base flood elevations would make it infeasible to comply with FEMA standards. As a result, growth which would otherwise have been absorbed in these areas would shift to less flood prone areas of the region.

Development would be feasible in North Sacramento, Rancho Cordova, and South Sacramento where base flood elevations are modest (1 to 3 feet). In these areas it is assumed that growth would take place in accordance with existing local plans which call for buildout by the year 2010. This growth will increase the existing population of the lower American River area by about 57,250, bringing the total to 439,250. Most of this increase would be absorbed in the South Sacramento area. The added residents would require an estimated 22,900 additional housing units and generate a need for an extra 83,457 acre-feet of water annually above existing conditions. New housing developments in this area would create an additional 8,015 gallons per day of sewage flows compared to existing conditions, requiring the City and County to build new facilities to accommodate this added flow. Solid waste disposal would increase by 243,885 pounds of solid waste per day. An additional 114 police officers would need to be hired in order to maintain the desired standard of 2 officers per 1,000 residents. Additional students from new development would require additional classrooms and facilities, straining an already overcrowded system.

Upper American River

Growth-Related Impact. Growth rates would be higher than the State average. Population growth rates were extrapolated from California Department of Finance projections, Department of Water Resources 1989 projections for western El Dorado County, and information from County planning staffs and regional planning organizations. Projected population for 2010 is 79,252. Buildout population under current area plans is estimated at 114,056.

Population. Only Auburn is expected to reach buildout under current plans by the year 2010. Based on projected population rates, none of the El Dorado County subareas would reach buildout by 2010. In areas such as Cool-Pilot Hill and Georgetown, where buildout populations greatly exceed current population, buildout can be expected relatively far in the future. Auburn, with 73 percent of the total population, would continue as the largest urban center. However, the El Dorado County subareas would experience significantly higher rates of growth than the Auburn area, with major population centers in Cool-Pilot Hill and Georgetown.

Housing. The demand for additional housing to accommodate the future population growth would be substantial. As there is limited housing development in the El Dorado County subareas, the impacts would be greatest in these plan areas.

A total of 31,700 housing units are anticipated within the overall plan area by 2010. Based on current area plans, there would be an estimated 50,291 housing units at buildout. Auburn would continue to have the greatest concentration and mix of housing. In El Dorado County, the largest concentration would be in Cool-Pilot Hill, which also would have the largest increase in medium and high density units. Medium density development is also included in the plans for Garden Valley and Georgetown and to a lesser degree in Lotus-Coloma.

Water Supply. Expansion of water treatment plant facilities and conveyance systems would be required to serve projected population in both the Auburn and El Dorado County areas.

The Placer County Water Agency has previously indicated it has the ability to provide treated water for a holding capacity of 57,000 persons, as provided for in the Auburn Area General Plan (Elan & Associates, 1985). Estimates of future water supply and demand in the Georgetown Divide Public Utility District service area assume that the ground-water supplies would be phased out as a primary supply and replaced by surface water. Water balances for the district show an adequate water supply through 2000 and an accelerating shortage through the year 2010. A shortage of approximately 7,000 acre-feet is projected by 2010 (Corps of Engineers, 1990, and Department of Water Resources, 1989). New water sources under study include the proposed Canyon Creek Reservoir, which would meet the district's water needs beyond 2020 (Department of Water Resources, 1989).

The demand for increased surface water would require major facility expansion by the district. Also, the development of needed water supply sources would require major capital expenditure. Currently, funding is not available for such improvements. New surface-water developments would be expensive and may be too costly for sparsely populated areas. These areas may continue to rely on ground water (Department of Water Resources, 1989).

The water balance for the El Dorado Irrigation District shows an accelerating water shortage, estimated at 12,000 acre-feet by 2010 (Department of Water Resources, 1989). The El Dorado County Water Agency recently endorsed construction of the White Rock Penstock Diversion to serve western El Dorado County. The plan would provide up to 40,000 acre-feet and would provide water "for rapid residential growth" through 2011 (Sacramento Bee, 1990). Two other dams are also endorsed and could come on line within 10 years. Questions remain as to the water rights and funding needed to construct these projects. Improvements on a major distribution system have also increased short-term water supplies and allowed additional water connections. There are no plans for any major expansion of water facilities to serve the Lotus-Coloma area due to the relatively slow growth in the area (Fraser, pers. comm.). The Lotus-Coloma area would have increased demand, which would be small in terms of overall district supplies and would not be significant.

Sewage System. To serve projected population growth, sewage treatment plant facilities and sewage lines would have to be expanded in all of the subareas. The buildout under the current Auburn plan would require expansion of the existing treatment plants. This is anticipated under ongoing planning by the servicing districts.

Higher density development, which is anticipated in all of the subareas, would require public sewer service. As this does not currently exist, a major expansion program would be required in the Georgetown Divide Public Utility District, which would service all but the Lotus-Coloma area. The El Dorado Irrigation District would service Lotus-Coloma. Currently, no financing arrangements are available to accommodate public sewer requirements.

Solid Waste. Solid waste generated by the projected buildout population in the Auburn Plan Area could be accommodated by existing and planned landfill capacity and recycling programs.

The solid waste generated in the El Dorado County subareas in combination with other waste generated in the County would require a new landfill site or significant expansion of the existing site by the year 2000 and other methods to reduce waste volumes.

Emergency Services. Demand for medical services would increase due to the population growth. The City of Auburn plans to build a new public safety building to house fire and police departments, which would serve a city population of 30,000 (Auburn Journal, 1990). The major expansion requirement would be increased personnel. The Placer County Sheriff's office would require a significant increase in personnel and presumably facilities including jail expansion.

An increase in California Highway Patrol personnel would also be required. As much of the lands will remain sparsely populated, personnel requirements would remain below those typical of urban areas. However, given the limited police patrol now in the area, the requirements for the El Dorado County Sheriff's Department would be substantially increased. As areas intensified in development, including expanded commercial uses, an increase in urban crimes could also be expected. Facility requirements are unknown, but may include the need for a substation. A larger population and more urbanized uses would significantly increase the demand for police services and for equipment and facilities. The potential impacts on police services would depend largely on the availability of funding to provide needed manpower and facilities.

The increased population and higher density of development, as well as expanded commercial and industrial uses, would significantly increase demand for fire protection services, equipment, and facilities. Based on existing trends, the highest demand would be for medical aid, vehicle accident calls, and hazardous material incidents. The potential impacts on fire services would depend on the availability of funding to provide needed manpower and facilities.

The City of Auburn has a 5-year plan which would add to the number of full-time personnel and provide 24-hour manning within its service area. Other fire districts would also require expansion in manpower and equipment.

The El Dorado County subareas are generally well served in terms of manpower and equipment. The biggest problems would continue to be the time and difficulty in responding to calls from remote areas, lack of water mains, and the high wildland fire hazards. Intensified urban development would substantially increase the demand for services. Traffic hazards associated with Highway 49 and calls for emergency services would continue.

Schools. Most of the districts are significantly over capacity or will soon reach capacity. Enrollment growth would be high in all portions of the plan area. Substantial expansion of facilities would be needed to accommodate this growth. Limited space is available within the Auburn school districts for expansion of portables. Therefore, new school construction would be required.

The Black Oak Mine Unified School District plans to accommodate additional growth by expansion of portables and acquisition of three new school sites at Cool-Pilot Hill, Garden

Valley, and Greenwood. Based on school criteria of 500 students per site, this could accommodate 1,500 additional students. Additional school sites would be required to serve projected growth. The existing high school site could accommodate up to 1,000 students with maximum use of portables. By the year 2015, it is believed that an additional high school site would be necessary, probably in the Cool-Pilot Hill area (Pryor, pers. comm.). Gold Trail Union District has proposed four additional school sites by the year 2014 to serve a projected increased enrollment of 2,400 (Herrington, pers. comm.).

Future needs within the El Dorado Union High School District would be met by expansion of other high schools and construction of a new high school. The impact of growth on the schools would depend on the ability to finance needed facilities and other school costs through various funding mechanisms.

Economy. Economic trends and characteristics would be generally the same as described for existing conditions.

SELECTED PLAN

Direct Impacts

Natomas. The direct impacts for this alternative are construction related, as there would be a need for more construction workers. There are a sufficient number of construction workers in the Sacramento metropolitan area to support this demand. Previous Corps construction projects show that 10 percent of the workforce will come from outside of the regional area. This number is not large enough to significantly affect the local economy or generate a substantial need for housing or other services.

Lower American River. Direct impacts are the same as those for Natomas.

Upper American River.

Population. Based on employment projections of 60 nonlocal employees, the project could increase the local population by approximately 150 persons. This increase would be primarily short term and is not considered significant.

Housing. Based on employment projections of 60 nonlocal workers, there would be additional demand on the local housing market for 60 units. Based on current vacancy rates, adequate housing should be available to accommodate this demand. This is considered a short-term impact and, in any case, is not considered significant.

Water Supply. Use of the Ophir Tunnel for water conveyance would not be changed with this plan. Construction activities, including dust suppression, would increase water use onsite. Water use would be substantially greater than with the no-action alternative, but would be short term and is not considered significant.

Sewage System. No impacts are anticipated.

Solid Waste. Considerable amounts of construction debris may be generated by project construction. The landfill serving the Auburn area appears to have adequate capacity to handle the short-term increase. The impact is not considered significant.

Emergency Services. Construction activities may result in work-related accidents. Due to the safety standards required and the availability of medical services, this impact is considered less than significant.

Although most traffic-related activities would be confined to the canyon areas, a number of extra-large trucks would be used for material transport, and construction would be occurring close to developed areas. Construction activities associated with the Highway 49 replacement may also increase the potential for accidents. However, this condition would not create a substantial need for emergency services beyond those forecast under the no-action condition.

Construction activities would increase fire hazard potential compared to no action, but existing firefighting capacity is adequate without a substantial increase in the level of service likely to be attained under the no-action condition.

Schools. The number of school children associated with construction workers' families would be slightly greater than with no action. However, the impacts would be short term and less than significant.

Economy. Construction employment would occur over a 3-year period. Wages generated under this alternative are estimated at approximately $36 million annually, or a total of about $108 million. The projected workforce would total

604 persons annually. Of this, an estimated 121 employees would be blue-collar unskilled, 350 would be blue-collar skilled, and 133 would be designated as construction. Approximately 60 of the workforce would be nonlocal. Mitigation requirements of the selected plan include acquisition of 2,700 acres of land on the South Fork American River. (See end of this chapter for discussion of impacts.)

Indirect Impacts

Natomas. The indirect impacts for Natomas are the same for each alternative once the 100-year flood protection is provided. This was determined because once this amount of protection is provided, development would occur, and added flood protection beyond 100-year would not increase development. The impact in Natomas would be the increase in population, which could have significant impacts on the existing public facilities.

Population. The population for Natomas under this alternative is projected at approximately 94,000 by 2010. This increase (about 70,400 people from the without-project condition) would create a substantial need for additional housing, water supply, sewage service, solid waste disposal, emergency services, and schools.

Housing. An estimated 5,857 acres of land presently in agriculture or open space in Natomas would be converted for use as residential land under this alternative. The future plans for the unincorporated area include a large increase in multifamily dwelling units. The increase is from 1 percent to 57 percent (City of Sacramento). The plan area is expected to maintain about the same composition that currently exists (58 percent single family and 42 percent multifamily). Including south Sutter County, an estimated 38,023 dwelling units will exist in Natomas by 2010. This increase of 24,500 dwelling units from the without-project conditions is considered a significant impact. Homeowners would not be required to purchase flood insurance.

Water Supply. Using the .19 acre-foot per capita annual use estimated for this area, Natomas would require 17,860 acre-feet of water. This is an annual increase of 13,376 acre-feet of water from the without-project conditions and is considered a significant impact. Facilities and transport systems would be required to supply water to the area. This water demand is for three times as much water as is needed under the without-project conditions and could have a significant impact on the water supply. If this alternative is selected, the city would need to implement its plans sooner to expand service to this area.

Sewage System. An average of 350 gallons per day for both multi-family and single-family dwelling unit flows would be used to determine gallon-per-day use for this area. The total gallons per day for this area would be 13,308,050. The commercial/industrial property average use of 2,625 gallons per acre per day would total 1,971,375 for Natomas. This is an increase of 8,575,000 gallons per day for residential and does not include the increase for commercial and industrial land. This is considered a significant impact. With this alternative, the City would need to implement its plans to expand existing sewage treatment facilities for this area.

Solid Waste. The Natomas population will dispose of approximately 400,440 pounds of solid waste per day by 2010 (4.26 pounds per day x 94,000 persons). This is an increase of 299,904 pounds of solid waste per day and is considered a significant impact. The City and County have implemented a recycling program aimed at reducing solid waste and are continuing work to find new landfill sites to accommodate the anticipated increase in disposal.

Emergency Services. An additional 141 police officers and facilities to accommodate these officers would be required to maintain the current police department standard of 2 officers per 1,000 residents. However, the police department at this time is maintaining a standard of 1.7 officers per 1,000 residents, and an additional 120 officers would be required to maintain this ratio. This is considered a significant impact. Additional facilities and personnel would also be required for the local fire districts to maintain current standards.

Schools. The public schools in this area have vacancies at the elementary level that would accommodate some of the expected increase. The high school is already overcrowded by 344 students, and at this time a site has not been purchased to build a new school. Vacancies for 180 students in the high school in Sutter County would accommodate some of the future development. Additional facilities and funding of schools for Natomas would have to be considered to house the elementary and some high school age students. Rapid residential growth would have a significant impact on existing schools.

Economy. The economy in Natomas is growing as the area develops. Future shopping centers and business complexes are planned. Commercial/industrial development projected on 58 acres is expected to help the economy of this area by providing jobs and services for the residents.

Lower American River. The following evaluation of impacts is based on the net effects produced by the selected plan by comparison to the without-project condition. Since it is assumed that growth in most of the lower American River area would be the same with or without the project, the analysis focuses on the Meadowview area of the City where high base flood elevations would make growth infeasible without the project. (See discussion in Chapter 4, Land Use.)

Population. The population of the Meadowview area would increase by about 16,000 to a total of about 48,000 by the year 2010. This would represent about a 22-percent increase in the population growth expected in the lower American River under the without-project condition. The added residents would generate a substantial need for housing, water supply, sewage service, solid waste disposal, emergency services, and schools. Impacts on the socioeconomy of the area would thus be significant.

Housing. Growth in the Meadowview area would add an estimated 6,420 housing units to the stock expected to be built under the without-project condition.

Water Supply. The added residents would require an extra 3,049 acre-feet annually above the without-project demand. Assuming additional facilities are constructed to accommodate development in the remainder of the lower American River area, this increased demand would require the design of these facilities to be enlarged.

Sewage System. The new housing developments in the Meadowview area would create an additional 2,247,000 gallons per day of sewage flows compared to the without-project projections. The City would need to build facilities to accommodate this added flow.

Solid Waste. The added residents in the Meadowview area would increase the solid waste generated in the lower American River area as a whole by 68,373 pounds of solid waste per day. Additional collection services to handle this increase would have to be established. The City would need to consider these added pounds as part of efforts to resolve the problem of solid waste disposal sites which are already at or near capacity.

Emergency Services. An additional 32 police officers would need to be hired in order to maintain the standard of 2 officers per 1,000 residents that the police department desires to maintain. To maintain its existing ratio, the department would require 27 additional officers.

Schools. Additional students from new development would require additional classrooms and facilities. The schools in the Meadowview area are already overcrowded.

Economy. Growth facilitated by the selected plan would benefit Meadowview residents by providing more jobs and services in what has traditionally been a low-income area.

Upper American River Area.

Population. Assuming that access is not facilitated to the El Dorado County side, the project would not affect commute conditions in the area. The project would thus have no impact on population growth, which is expected to be similar to that described for no action.

Housing. Housing demand would be same as with the no-action alternative. The selected plan would not induce additional demand for housing.

Water Supply. Water demand and need for facility expansion would be the same as under the no-action alternative. The selected plan would not induce demand for additional water supplies. The selected plan would neither impede nor advance the supply of additional water for Placer or El Dorado Counties.

Sewage System. Sewer demand and need for facility expansion would be the same as under the no-action alternative. The selected plan would not induce demand for additional sewage service.

Solid Waste. Solid waste volumes and disposal needs would be the same as with the no-action alternative.

Emergency Services. Demand for medical services and police protection would be the same as with the no-action alternative.

Impacts would be similar to those described under no action. The improvements due to the Highway 49 replacement are not anticipated to appreciably reduce accidents and calls for emergency medical service from fire protection districts or agencies.

Schools. Impacts would be the same as those described under no action.

Economy. Economic conditions would be generally as described under existing conditions and the no-action alternative.

400-YEAR ALTERNATIVE

The 400-year alternative would produce the same socioeconomic impacts as the selected plan in the Natomas and lower American River areas. Direct impacts in the upper American River area would be slightly intensified due to the more extensive construction with the larger 400-year dam. As with the selected plan, no indirect impacts are anticipated in the upper American River area.

150-YEAR ALTERNATIVE

The 150-year alternative would produce the same socioeconomic impacts as the selected plan in Natomas and lower American River. Impacts in upper American River would be the same as with the no-action alternative.

100-YEAR (FEMA) LEVEE ALTERNATIVE

The 100-year (FEMA) levee alternative would produce the same socioeconomic impacts as the selected plan in Natomas and lower American River. Impacts in the upper American River area would be the same as with the no-action alternative.

100-YEAR (FEMA) STORAGE ALTERNATIVE

The 100-year (FEMA) storage alternative would produce the same socioeconomic impacts as the selected plan in Natomas and lower American River. Impacts in upper American River would be the same as with no action.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

The 100-year (FEMA) levee/storage and spillway alternative would produce the same socioeconomic impacts as the selected plan in Natomas and lower American River. Impacts in upper American River would the be same as with no action.

MITIGATION

DIRECT IMPACTS

As described in the chapter on transportation, truck routing shall be managed to minimize large trucks used for dam construction and road replacement and relocations from using freeways and major arterials during peak commute hours. Additional signage and safety procedures shall be required to reduce safety hazards associated with traffic detours and road construction.

INDIRECT IMPACTS

Housing and Population. None required.

Water Supply. To provide water to new residents, existing water treatment facilities will have to be expanded and delivery systems constructed.

Sewage System. The City and County will need to expand existing sewage facilities to handle this increased volume.

Solid Waste. The City and County have implemented a recycling program aimed at reducing solid waste and are continuing to search for new landfill sites to accommodate the anticipated increase in disposal.

Emergency Services. The City will have to hire approximately 141 new police officers and construct and staff a new fire station in North Natomas.

Schools. The appropriate number of elementary, junior high, and senior high school sites will have to be incorporated into development plans based on expected student enrollment.

SOCIOECONOMIC IMPACTS OF MITIGATION LAND

The following is a summary description of (1) lands under consideration for mitigation land acquisition and (2) potential impacts on land use and socioeconomic conditions. A detailed discussion of land use throughout the project area is contained in Chapter 4. Refer to the preceding information in this chapter for a detailed discussion of the socioeconomic structure of the project area and anticipated impacts under various alternatives. The proposed land acquisition is based on mitigation required in the selected plan. (The 400-year alternative would require a similar mitigation approach although land requirements would be greater. The remaining alternatives would not affect land use or socioeconomic conditions in the upper American River and therefore would not require a mitigation plan.)

EXISTING CONDITIONS

Acquisition of 5,385 acres of land in El Dorado County is proposed for mitigation. The land is located along the South Fork American River downstream from the town of Lotus. The majority of the lands are in parcels ranging in size from 20 to 640 acres. The mitigation area is characterized by grazing and nonintensive agriculture uses, relatively undisturbed oak woodlands, and a relatively undisturbed riverine corridor. The lands are considered vacant and are not populated.

Most of the land is within the Lotus-Coloma Area Plan boundaries. A small portion of the lands located west of the South Fork American River are within the Cool-Pilot Hill Area Plan. Some properties are in "preserve" under the Williamson Act, which permits only agricultural uses and one single-family unit within each preserve unless special entitlements are granted. The preserves allow tax reductions in exchange for exclusive agricultural use for a minimum 10-year period. Those lands not in the "preserve" are designated and zoned primarily for low-density residential uses. There is substantial development pressure in the general location of the mitigation lands.

Based on a current land value estimate of $31,500,000 for 5,385 acres and a typical assessment of $1.05 per $100, the lands could generate as much as $330,750 in tax revenues annually. However, actual taxes paid for these lands are much lower because taxes are paid on assessed value and not on current land value. Some of the parcels are assessed at a higher ratio than the $1.05 per $100 average; a complete survey would be required to determine the exact amount of taxes assessed on these parcels.

Most of the tax revenue is distributed to the county general fund. However, all of the properties are assessed a small percentage for the school and fire districts in which they are located. Property tax assessments for Williamson Act lands are governed by a complex formula which ties land values primarily to farm income. The assessed value of the remaining non-Williamson Act lands can be expected to increase by 1 to 2 percent annually if the current uses are maintained.

NO ACTION

Without government acquisition, it is estimated that within 20 years most or all of the private lands will be split into smaller parcels for residential development. It is doubtful that all of the parcels would be developed within the 20-year period; however, the pattern of urbanization would be firmly established and probably irreversible. Agricultural uses would change from predominantly grazing to those limited uses typical of "ranchette-type" development. Commercial developments are expected to be primarily recreational and neighborhood-serving. Recreation-oriented commercial uses associated with the South Fork would probably decline as the natural resource values deteriorate due to development. No industrial development is anticipated.

Densities will vary considerably, depending on topography, location, the availability of infrastructure, market demand, and local planning regulations. To obtain a rough estimate of potential land use changes, a factor of one dwelling unit per 20 acres at maximum buildout has been applied. Assuming 5,385 acres of private land available for development, approximately 270 housing units could be constructed within the mitigation study area. Based on an average of 2.5 persons per household, this would generate a population of 675 persons. Conversion to urban uses would substantially increase tax revenues.

Population growth would increase substantially the demand for public services and infrastructure, including extensive road and other transportation improvements; additional school facilities; and expanded emergency services, including police, fire, and medical. The impacts would depend on the adequacy of tax revenues and developer fees and other special assessments to fund the needed improvements.

WITH PROJECT

With acquisition of the mitigation lands, there would be no potential for development of the currently vacant lands. Current land uses, including grazing, would be eliminated to implement the recommended fish and wildlife mitigation measures. Demand for public services would not increase. However, tax revenues, if based on the current estimate of land value, would decrease by upwards of $330,750 annually. The actual amount would depend on market value of the lands at the time of acquisition. This tax revenue shortfall could adversely affect countywide services as well as special districts within the local area. The impacts are considered significantly adverse, but could be mitigated to a less than significant level. To ensure that the impacts are mitigated to a less than significant level, payment of in-lieu taxes or subventions are expected to be paid by the State of California. The loss would also slightly reduce revenues to special districts within the local area. Local revenues and employment may be lost due to conversion of economically productive agricultural lands to wildlife habitat. Because of the low intensity of the existing agricultural uses, this impact is probably less than significant.

MITIGATION

A determination will be made of the property taxes paid for each parcel under existing conditions. The State will then work with El Dorado County to determine an equitable means of compensation for the loss of current tax revenue due to acquisition of mitigation lands.

CHAPTER 16

VISUAL RESOURCES

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

Visual analysis involves a degree of subjective evaluation based on the perception of the observer. Variety in a particular landscape and the relative value of the feature components will differ according to the perceptions of the individual observer. For example, areas with the greatest variety of features (steep slopes; large, sharp exposed ridges; varied vegetation; a large variety of water forms) are commonly considered to have the highest relative value among observers.

In assessing the visual resource impacts of a project, the visual sensitivity of the site must be considered. Areas of high visual sensitivity are highly visible to the general public. Scenic highways, tourist routes, and recreation areas generate sensory reactions and evaluations by the observer. The evaluations of a particular scene will vary depending on the perceptions and values of the observer.

For analysis, the visual resources of the area covered by the project have been divided into three subareas: (1) Natomas, (2) lower American River, and (3) upper American River. Figure 16-1 shows the locations of these subareas within the study area as a whole.

PLANS AND POLICIES RELATED TO VISUAL RESOURCES

Plans and policies covering visual resources reflect the high value that the public attributes to scenic quality and visual resources and is supported by the following Federal and State legislation:

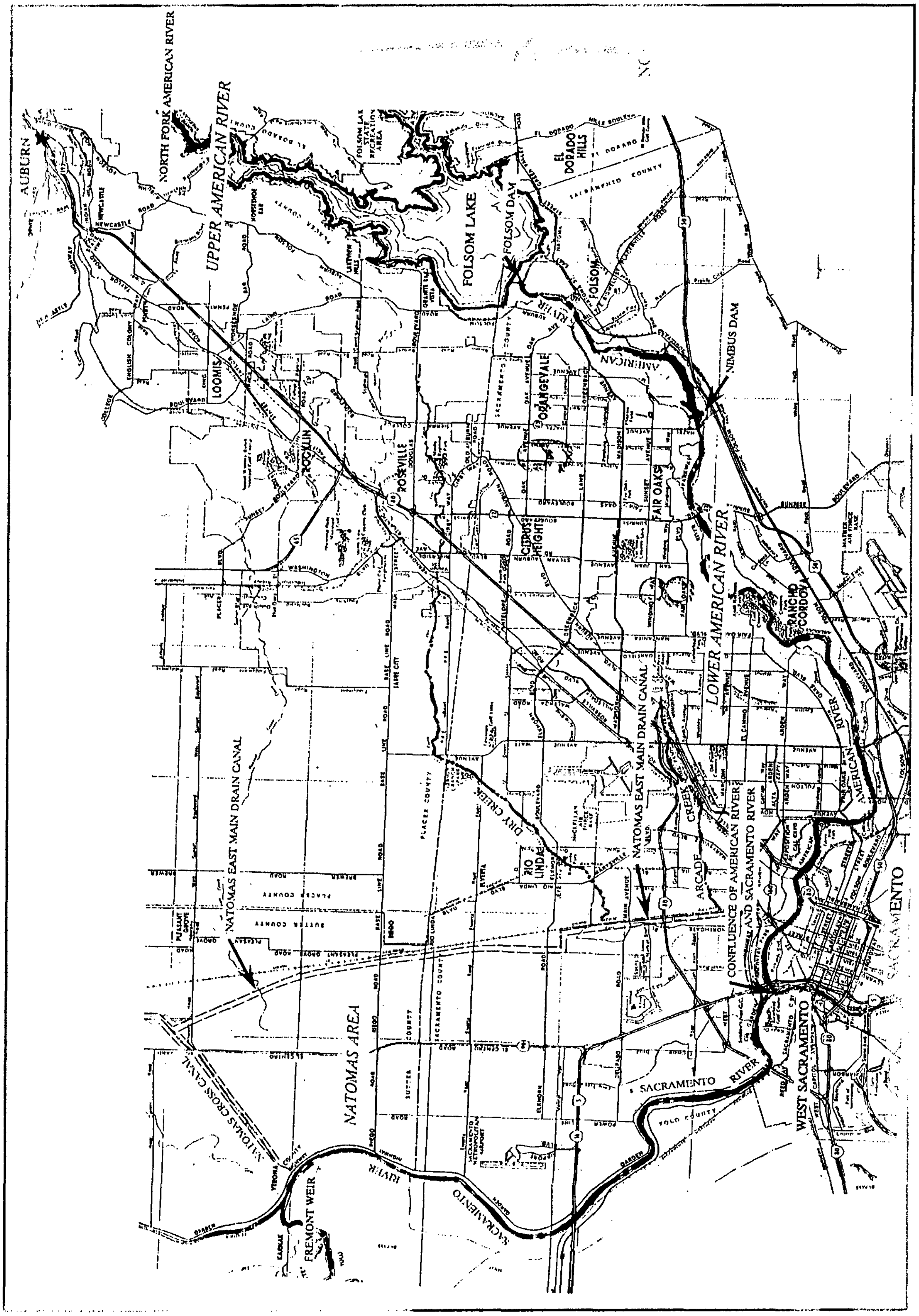


FIGURE 16-1. Study Area

- **National Environmental Policy Act:** "assure(s) for all Americans safe, healthful, productive, and aesthetically and culturally pleasing surroundings."

- **California Environmental Quality Act:** Chapter 1, Section 21000 (b) of CEQA mandates public agencies to "Take all action necessary to provide the people of this State with clean air and water, enjoyment of aesthetic, natural, scenic and historic environmental qualities, and freedom from excessive noise."

- **Local Jurisdictions:** Local jurisdictions share in the support of maintaining visual resources; the value of such resources, however, varies across jurisdictions. The following list summarizes local policies:

  - **City of Sacramento:** Under the General Plan Plan Elements for Open Space and Natural Resource Conservation, it is the policy of the City of Sacramento to establish development standards to enhance the visual amenities of open space.

  - **Sacramento County:** All policies related to visual resources are contained in the County's zoning code. Community development standards require landscaping, tree plantings, and sound walls. Within the Garden Highway Special Planning Area, greater setbacks are mandated. The American River Parkway corridor requires plant screening. There is also a scenic corridor designation for freeways and major arterials that parallel rivers. This also applies to the levees along the Delta.

  - **El Dorado County:** A primary goal of the existing land use plan, as well as the draft plan update, is the preservation of the County's rural character. The draft plan update also contains policies aimed specifically at preserving the visual quality of County highways, important viewsheds, rural communities, ridges, mountains, and the South Fork of the American River (Sedway Cooke Associates, October 1990).

  - **Placer County:** Landscape requirements are contained in the Off-Street Parking ordinance. Projects located within the State highway corridors are subject to a discretionary design review process. This review would apply to the proposed replacement of Highway 49. Normally, the visual impacts of a project are mitigated through the CEQA process.

- **Sutter County:** The only policy related to esthetics is found in the General Plan which encourages the protection of riparian and key wildlife habitats.

EXISTING CONDITIONS

The diverse character of the American River basin ranges from the flat agricultural and urban areas of the Sacramento Valley to the rugged Sierra Nevada foothill canyons of the American River (Figure 16-1). The following sections describe the existing visual conditions of the three subareas of the project study area.

NATOMAS

The Natomas basin is bounded by the NEMDC on the east, NCC on the north, Sacramento River on the west, and American River on the south. Areas outside the basin proper, but which would be affected by one or more project alternatives, include Dry and Arcade Creeks to the east.

The Natomas basin is characterized by agricultural and urban land uses. Agricultural lands comprise approximately 66 percent of the Natomas area and are located primarily in the northern portion of the basin. Typical crops include rice, dry grains, orchards, and vineyards. Pastureland as well as specialized crops are also present. South Natomas, the most urbanized portion of the basin, lies south of I-80. South Natomas is composed of large-scale offices, commercial business parks, and dense residential neighborhoods. Urban development is limited in North Natomas and consists mainly of smaller, older homes and waterfront residences along the Garden Highway. The major commercial development in North Natomas is the Arco Arena and the large business park area north of I-80 and immediately west of the NEMDC.

Undeveloped and uncultivated natural areas in and around the Natomas basin include Fisherman's Lake, the riparian corridor adjacent to the Sacramento River, and areas within and adjacent to the NEMDC.

Native plant communities are confined primarily to the riparian habitat corridor which outlines the boundary of the Natomas area. (See Figure 16-2.) These plant communities include open water, freshwater marshes, riparian forest, riparian scrub shrub, valley oak woodlands, and grassland/savannas.

To the observer, flat agricultural lands broken up by corridors of riparian forest emerge as distinct visual features, providing strong lines and a variety of textures. This relationship between agriculture and riparian corridors is the most important visual element in the Natomas area.

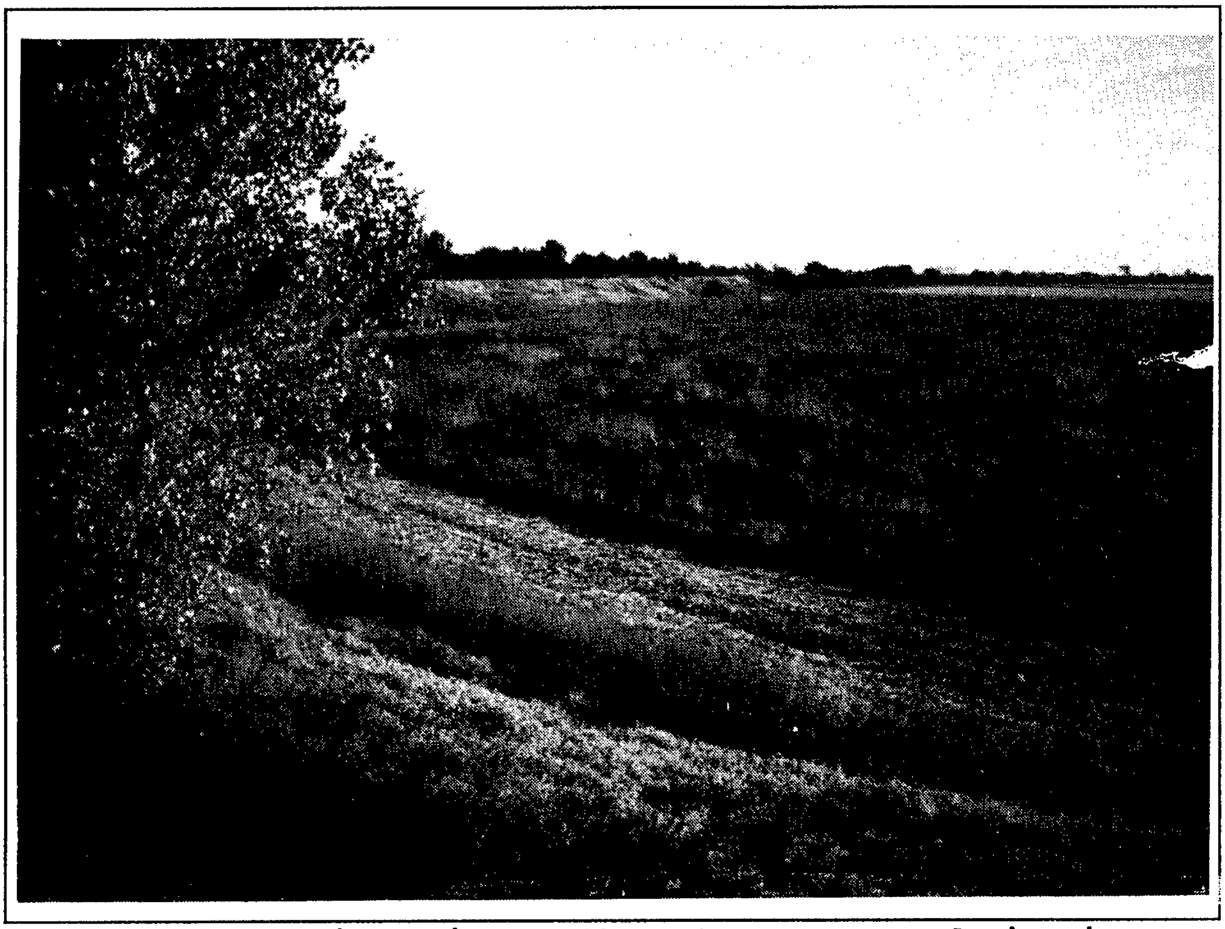


FIGURE 16-2. Typical View of the Natomas Area and Riparian Corridor

LOWER AMERICAN RIVER

The lower American River corridor between Folsom Lake and the confluence with the Sacramento River flows through the core of the urbanized Sacramento area. Lake Natoma, located immediately downstream from Folsom Dam, functions as a reregulating reservoir and is controlled by Nimbus Dam. High, steep natural banks confine the upper portions of the river, while the lower half (downstream from Goethe Park) is contained between levees. The river and its environs are natural in appearance and provide free-flowing water, gravel bars, deep pools, riparian forests, meadowlands, and parklands. (See Figure 16-3.)

FIGURE 16-3. View of the Lower American River

The American River Parkway, which runs 30 miles along this corridor from Discovery Park to Folsom Lake, is part of the State Wild and Scenic River System. It has "recreational" status under that system. Since most of the levees are set back from the river and vegetated with grasses and shrubs, few of the structural flood control features are visible to parkway users. A view of the lower American River is shown in Figure 16-3.

The vegetation within the American River corridor gradually changes from low foothill to valley floor species and represents a rich and diverse mosaic of vegetation. The structure, composition, and successional stages are directly related to channel dynamics, topography, elevation, distance from the river, and frequency of inundation (Watson, 1985; Strahan, 1984).

The valley floor community is characterized by a diverse mix of exclusively deciduous trees including cottonwood, willow, valley oak, alder, box-elder, Oregon ash, and a few sycamore. Moving away from the river toward the uplands, the riparian forest typically gives way to woodland and grassland habitats. In the lower 12 miles of the American River Parkway, vegetation is confined to a narrow band between the river and the manmade levees comprise a significant visual feature. This vegetation in the upper 11 miles of the river occupies a broader expanse within the floodway. The variation of topography supports evergreen hardwoods such as canyon and interior live oaks and digger pine.

This variety of native plant communities greatly enhances the visual quality of the parkway and heightens the interest of parkway users in their natural surroundings. Because it is heavily used, the parkway is a visually sensitive resource: any degradation of the visual quality of the area will affect large numbers of parkway users.

UPPER AMERICAN RIVER

The American River is one of the largest tributaries to the Sacramento River. Two of its three forks join the river above the proposed damsite, while the South Fork joins at Folsom Reservoir (Figure 16-4). The proposed damsite is located on the North Fork, east of the city of Auburn.

This area is characterized by steep canyons covered with broadleaf and coniferous forests and chaparral vegetation. Steep terrain has deterred human development, thereby preserving the natural environment. These strong feature components create a

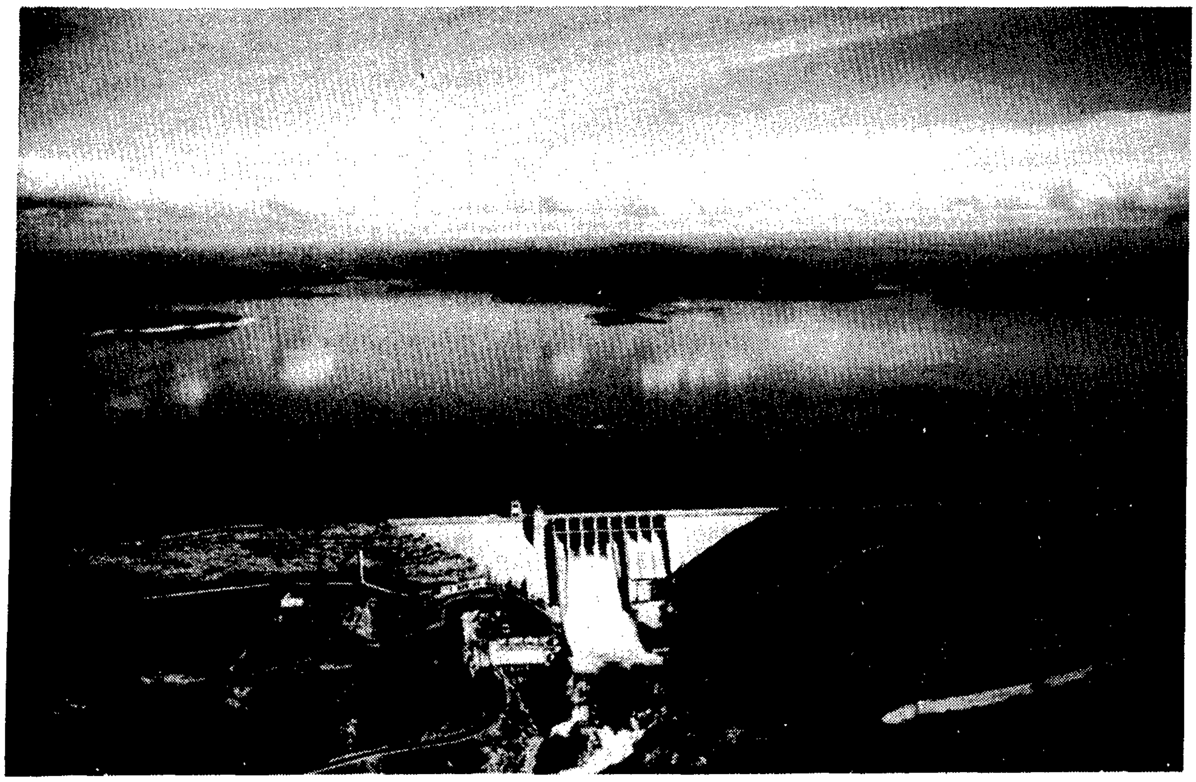


FIGURE 16-4. Folsom Lake and Dam, North and South Forks of the American River

bold landscape of high visual diversity and quality. (See Figure 16-5.)

The Auburn Dam site is characterized by large grading cuts in the canyon walls, gravel excavation sites, and a network of dirt roads used for the construction of the former cofferdam. The construction zone significantly affects the natural integrity and visual quality of the canyon (Figure 16-6). Although it is situated below the city of Auburn, the construction zone is not visible from Auburn.

Old Cool Quarry is located on the south side of the Middle Fork, upstream from the Highway 49 bridge. The esthetic and visual influence is the same as described above. Prominent views of the quarry are available from Highway 49 on the north and

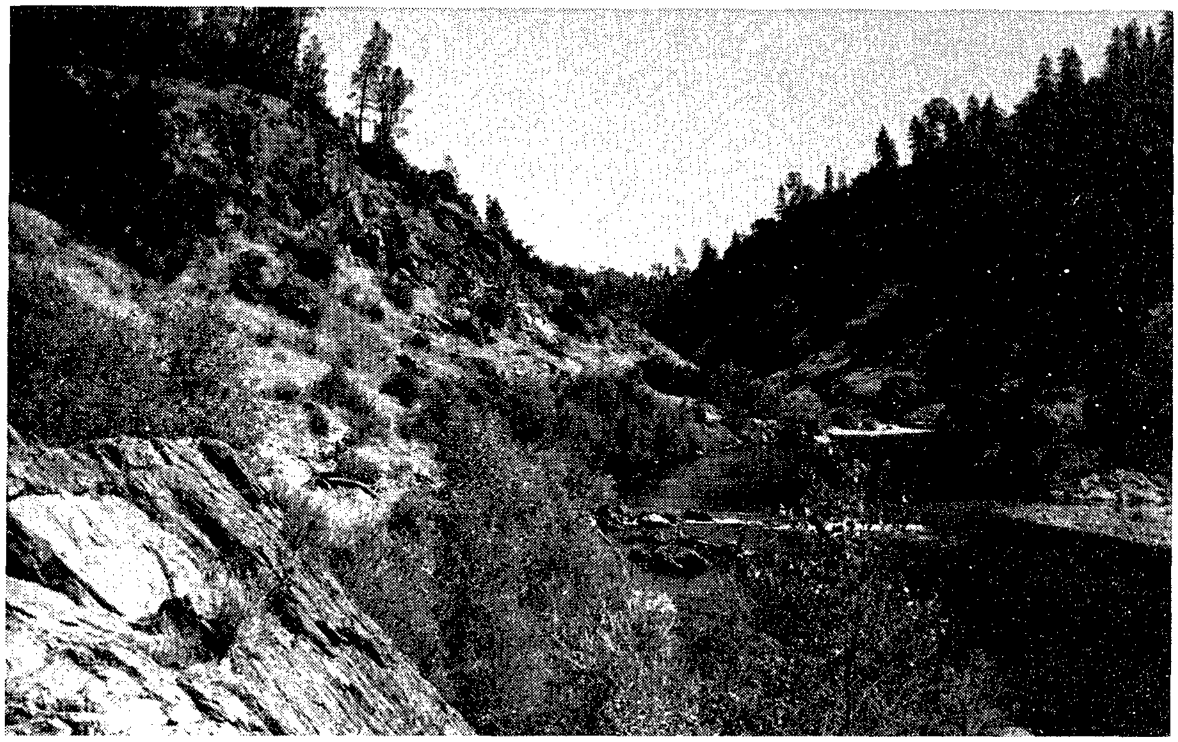


FIGURE 16-5. View of the Middle Fork of the American River

south sides of the Middle Fork, Foresthill Road on the north side, residences within the Auburn Lake Trails subdivision, and from the river canyon floor. An aerial view of the quarry is presented in Figure 16-7. Significant views of the site from the river begin approximately at Kennebeck Bar and continue downstream to Mammoth Bar.

The quarry site has been stripped of all vegetation, accentuating the presence of heavy mining operations. Heavy equipment and trucks operate on the terraced portions of the ridge. The flattened grade of the mining operation, void of vegetation, contrasts sharply with the steep, densely vegetated slopes of the canyon. Figure 16-8 shows existing operations as seen from the Auburn Lake Trails subdivision.

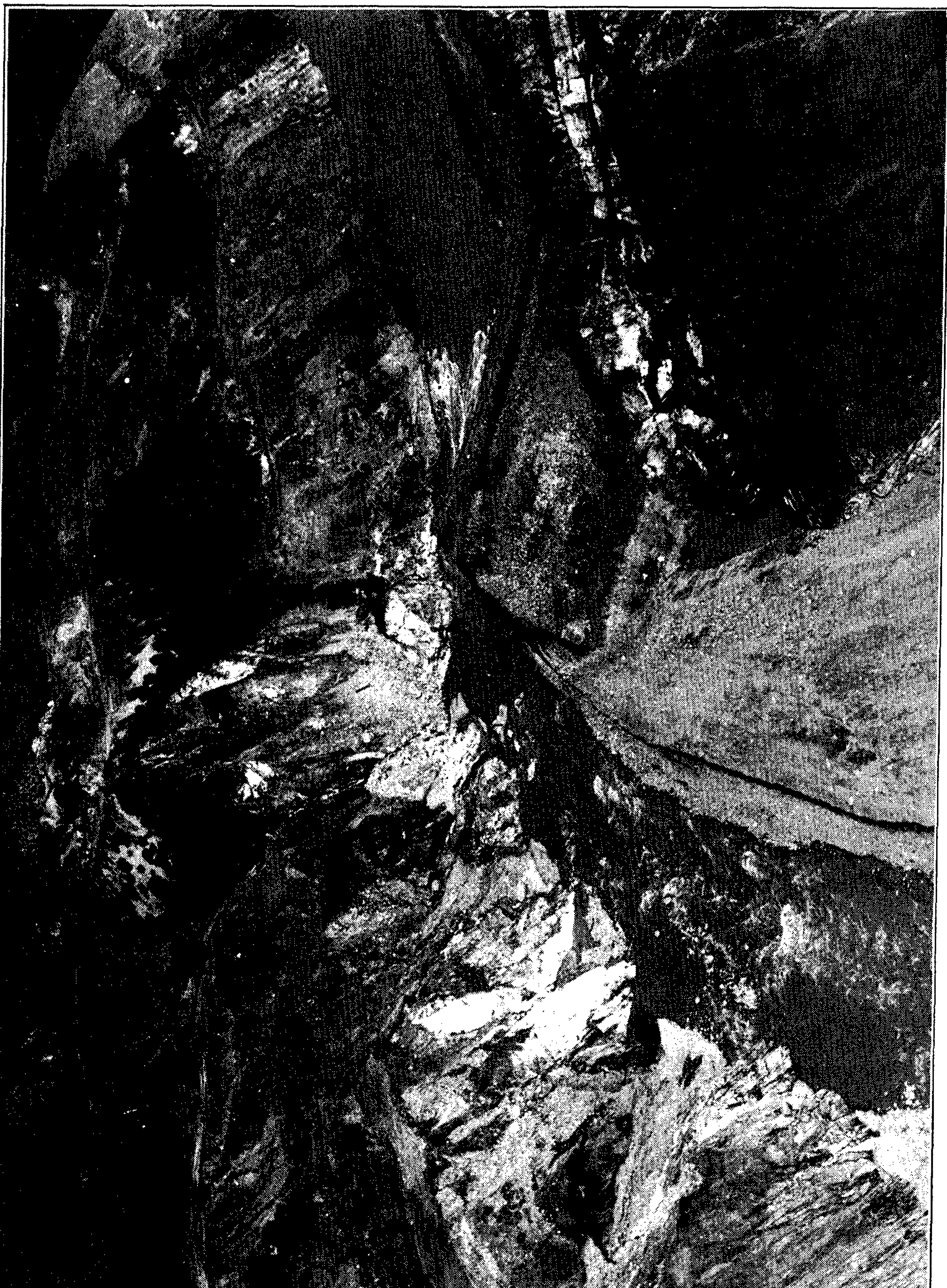


FIGURE 16-6. Aerial View of the Auburn Cofferdam 2 Days After a Controlled Failure in February 1986

FIGURE 16-7. Aerial View of the Old Cool Quarry

FIGURE 16-8. Views of Old Cool Quarry from the Auburn Lake Trails Subdivision

IMPACTS

SIGNIFICANCE CRITERIA

The potential visual impacts of a project are subjective; however, when assessing project impacts, several criteria must be evaluated. These criteria include assessing the visual quality and sensitivity of a scene. Visual quality portrays distinctive viewing components within a scene, and, when viewed together, attracts attention from the viewer. Visual sensitivity depends on the number of viewers; the frequency of viewing; and the angle, direction, and distance of the screening. For instance, if a viewing component is highly visible, with a large number of viewers, the viewing components which make up the scene will be more sensitive to change. Thus, the project feature would visually affect the viewing components by making a noticeable change to the scene.

Visual impacts for the project were determined by evaluating the impact criteria with the following significance criteria:

- For a project component to have a significant impact, the project or features of a project would change the visual quality of sensitive viewing components within the observable scene. A large number of viewers would notice a significant change to the character of an existing setting. Such changes may include a project feature significantly blocking a desirable viewing component, or replacing valuable environmental resources previously regarded as a visual amenity. In cases where the project feature would not be highly sensitive to associated viewers (that is, isolated or minimal existing visual quality), the changes in the view would be less than significant. Significant visual impacts can also be mitigated to less than significant by sensitive architectural and landscape design of project features and by restoring disturbed project areas to their pre-project character.

- Minor changes in the existing setting of a viewing component would be considered an adverse impact. Such occurrences would include changes resulting from a project feature partially blocking or detracting from a desirable viewing component; however, no mitigation would be required.

- o Beneficial impacts caused by project features would result from the enhancement of views or character of the existing setting.

CEQA Appendix G states, "A project will normally have a significant effect on the environment if it will: (a) Conflict with adopted environmental plans and goals of the community where it is located; (b) Have a substantial, demonstrable negative aesthetic effect."

NO-ACTION ALTERNATIVE

Flood-Related Impacts

With the no-action alternative, the existing flood control system would not be expanded in any way. No direct impacts beyond those associated with current levels of flood control (levee maintenance) would occur. Because urbanization would be slowed or halted in some areas if flood protection is not provided, the no-action alternative would involve a beneficial visual impact. That beneficial impact would be somewhat offset by the temporary negative visual impacts associated with periodic flooding (physical disruption of property and strewn flood debris).

Growth-Related Impacts

Natomas. The same development constraints described in the preceding section are in effect in the Natomas basin. Because flood depths in most of Natomas would exceed 5 feet, however, urban development would generally not be feasible there. Most of the visual qualities associated with current agricultural land uses would, therefore, remain intact throughout most of the Natomas basin.

Lower American River. If no action is taken to increase the level of flood protection in the 100-year flood plain in the Sacramento area, FEMA will designate that flood plain as an A-99 zone in October 1992. (See Chapter 4, Land Use.) Under that designation, all new construction will have to meet National Flood Insurance Program flood-proofing specifications, which require that all residential structures be constructed with their ground floors 1 foot above the 100-year base flood level.

Commercial structures can meet the same requirement by structurally flood proofing. Flood-proofed buildings would frequently utilize masonry on lower floors or would be elevated on columns. Parking would be a common use for ground floors. Because flood depths within most of the City of Sacramento (excluding Natomas and portions of the Meadowview and Pocket areas) would not exceed 5 feet in a 100-year flood, additional urbanization would still occur in the few remaining vacant areas within the flood plain. Since these areas are now surrounded by urban land uses, the overall change in visual resources would be minor.

Upper American River. No indirect impacts would occur in the upper American River area.

SELECTED PLAN

The selected plan would entail levee improvements in Natomas, no changes along the lower American River, and the construction of a flood control dam at river mile 20.1 on the North Fork American River, the site of the USBR's authorized multipurpose Auburn Dam project. To prevent the portion of Highway 49, including the North Fork bridge, from being occasionally inundated by the resulting flood control pool, that portion of the highway would be raised and replaced.

Direct Impacts

Natomas. Some of the levee work proposed as part of the selected plan would occur in the already urbanized communities of North Sacramento and Del Paso Heights, outside the Natomas basin. Construction activity, such as the operation of heavy equipment and construction traffic within close proximity to residential areas, would impose temporary visual impacts to the residents of these communities. In addition, views of the levees under construction would impose temporary visual impacts caused by heavy equipment disturbing the established vegetation.

Most of the levee improvements in the urbanized areas of Sacramento would involve increases in levee heights too small to be visually significant once completed. (See Figures 16-9 and 16-10.) There are three exceptions: Hagginwood Park along Arcade Creek in Del Paso Heights, Dry Creek near Claire Avenue in North Sacramento, and Dry Creek at Ascot Avenue.

The existing levee along Arcade Creek at Hagginwood Park would be increased in height by 4 feet. This would require the

FIGURE 16-9. Existing Levee of the Natomas East Main Drainage Canal from the Silver Eagle Overcrossing

FIGURE 16-10. Photo Simulation of Proposed Levee Expansion (Same Location as in Figure 16-9)

removal of turf from the levee during construction, and the area would continue to have a damaged appearance until a healthy replacement stand of turf was in place. This would be an adverse impact. The additional height of the levee would partially block views of the south bank of Arcade Creek from the park. This blockage would be considered an adverse but less than significant visual impact.

A new levee would be constructed along Dry Creek to the north of the residential lots located along Claire Avenue in North Sacramento. The new levee would be less than 5 feet in height. This would obstruct views into the natural appearing Dry Creek flood plain from the Claire Avenue homes and would be considered a significant visual impact for this residential area.

A new levee would also be constructed along Dry Creek south of Ascot Avenue and west of West Second Street. It would then turn north, just to the east of West Second Street. The levee would be slightly over 8 feet high at some points and would block some or all views from the residences north of Ascot Avenue into the Dry Creek flood plain. This would be a significant visual impact for these residents, as the flood plain, which extends south from Ascot Avenue for about half a mile, is an attractive native grassland with many large oaks.

Other levee modifications proposed in this alternative would be made in agricultural areas and would not be visually noticeable once construction is complete. Levee improvements along the southern portion of the NEMDC would result in a short-term disruption of views from adjacent residential areas; however, the long-term impacts from minimal raising of the levee would be less than significant as there would not be a substantial blockage of an existing view or modification of a high-quality visual resource.

Development of the borrow site would alter the existing views of agricultural fields from the Garden Highway. Severe surface disturbance combined with the removal of agricultural land would be a visual distraction to highway travelers. The site is highly visible from the highway, which is on top of the Sacramento River levee and looks down onto the site. This would be considered an adverse short-term impact that could be mitigated through stockpiling topsoil and reclamation of the site following completion of the borrow operation.

The proposed four-lane single-span bridge over the NEMDC and railroad tracks at Main Avenue would be approximately 600 feet long and reach a height of 24 feet on the west approach and

14 feet on the east approach. The required right-of-way to construct the bridge would encroach onto light industrial properties, thereby requiring alterations for access onto Main Avenue. Existing views of the NEMDC and surrounding development from businesses located on Main Avenue would be blocked by the new bridge structure. The structure would become the focal point of the immediate area. Direct views of the proposed bridge would only be from the immediate vicinity while traveling on Main Avenue, Del Paso Road, or East Levee Road. This would be an unavoidable adverse but not significant visual impact to the local area.

The bridge would change the viewing opportunities of the NEMDC and surrounding skyline of development while traveling on East Levee Road. Viewing opportunities of the NEMDC and surrounding areas would increase while crossing the bridge and decrease while in the immediate vicinity. There are no unique visual resources in the immediate area; therefore, changes would not be considered significant and no mitigation would be required.

Installation of the pumping station and control structure would be within the NEMDC channel. Existing residents would not have direct views of the structures. The pumping station and control structure would be in direct view of motorists traveling on East Levee Road. Visual impacts to views would not be significant as this road is not a major travel corridor. The views of homes located on West 6th Street could be visually affected if the pumping facility extended several feet above the height of the levee. Assuming this will be the case, the adverse impact could be mitigated by planting trees to screen the area.

Lower American River. There would be no direct impacts to the lower American River with this alternative. Because Folsom Reservoir would continue to be operated as it is today, the visual quality of the reservoir and the lower American River would not be changed by the project. Releases from Folsom Dam would not exceed 115,000 cfs during storms of 200-year frequency or less. (See Figure 16-11.)

Upper American River. In the first years of the project, the activity of heavy equipment and construction workers would be noticeable in the vicinity of the damsite, along the conveyor route from Old Cool Quarry, and at the Highway 49 and Ponderosa Way replacement sites. Visual disruption would be easily sensed in the vicinity of construction activities.

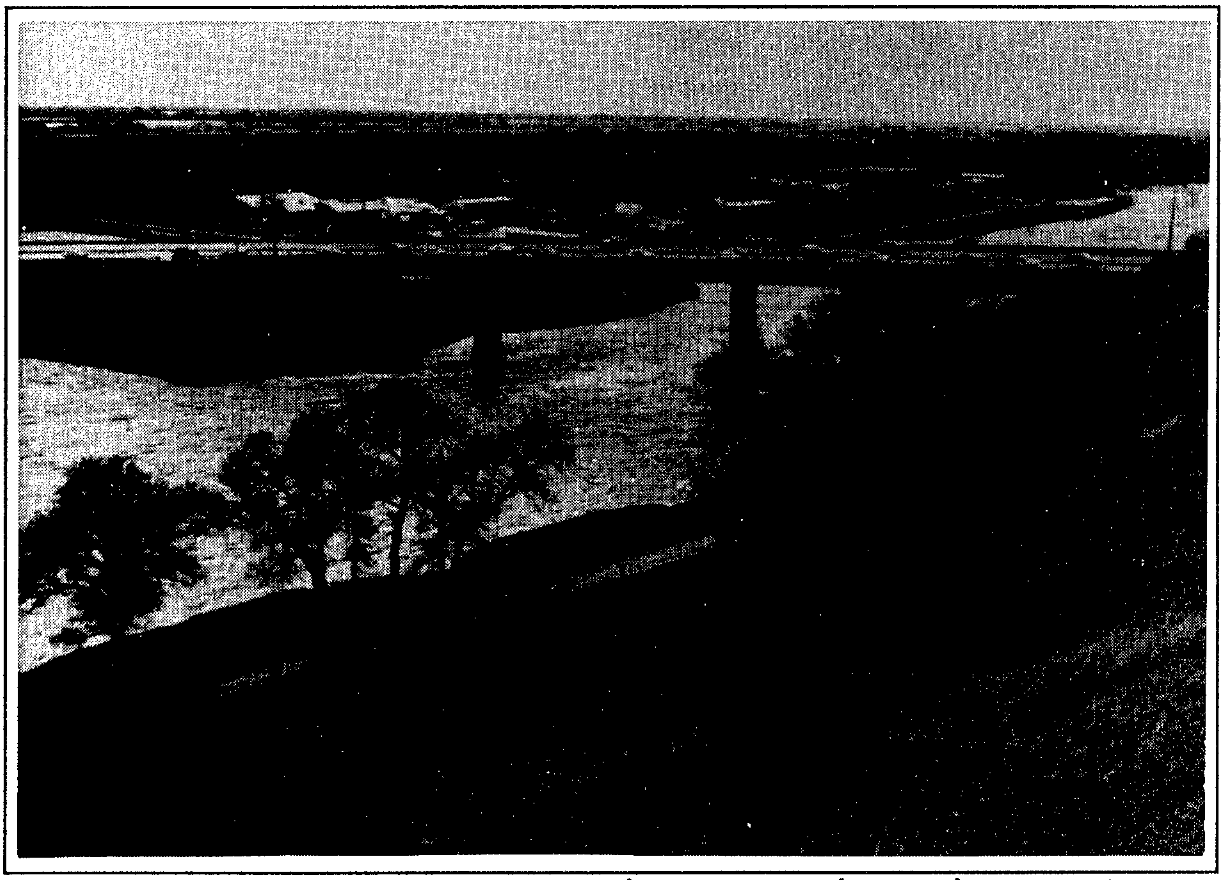


FIGURE 16-11. 115,000-CFS Flow in the American River Upstream from the Hazel Avenue Bridge

The aggregate site for the selected plan is Old Cool Quarry, an existing mining operation. The visual character of the site has already been substantially altered from its original state. Use of this facility for the aggregate supply would require an increase of excavation and processing; however, this increase would only result in incremental changes to the visual quality within the quarry and are not considered significant.

Development of a conveyor and roadway system to get materials from the quarry to the damsite, a distance of 5 miles, would require excavation of a 20-foot right-of-way south of the river. This would require excavation of vegetation along the conveyor route. Although some recovery of natural vegetation could be expected, alteration of the disturbed areas would be visually prominent over the long term. Because the Middle Fork is a high-quality visual resource and a high-use recreational area, these impacts are considered significant.

Views down the canyon past the damsite would become progressively more limited as the flood control dam neared completion. The scale of the structure would appear massive to a nearby observer (see Figures 16-12 and 13), but views of the site from a distance would include the large-scale surrounding landscape, reducing the dominance of the dam.

The manmade form and reflective surface of the dam would provide only a moderate contrast to the existing bare rock and construction damage in the area (Figures 16-14 and 16-15). Revegetating construction-damaged areas could potentially increase this contrast and, thereby, the visual prominence of the dam. This adverse visual effect would be at least partially offset by the beneficial impact of vegetation growth which will shield construction scars from view. Herbaceous vegetation would reach its maximum contrast with the dam as it became green in the spring. The effect would diminish as the annual grasses die and become brown in the summer. Woody plants adjacent to the dam would provide a more consistent contrast, which would increase as the density of tree and shrub cover increased. Although the damsite has already been visually degraded, construction of the dam would have a significant adverse visual impact for some viewers. For other viewers, knowledge of the function of the dam will establish the visual impact as beneficial and necessary for society's needs.

Spoils disposal would occur in locations that have been previously disturbed by construction activities. Visual impacts from this activity are considered to be less than significant, and beneficial impacts could be realized through implementation of a revegetation program.

The replacement of Highway 49 would cause visual changes in the form of a raised bridge and a relocated section of roadway adjacent to the maximum flood control pool. This alignment could change as a result of State route adoption studies. (See Chapter 2, Project Description, and Chapter 17, Cumulative Impacts.) The new bridge would be similar in appearance to the Foresthill bridge (see Figure 16-13), and would have similar visual impacts. Approximately 1 mile of new roadway would be constructed between the bridge and the current roadway on the east side of the river. The necessary grading cuts will result in significant visual impacts to the river canyon.

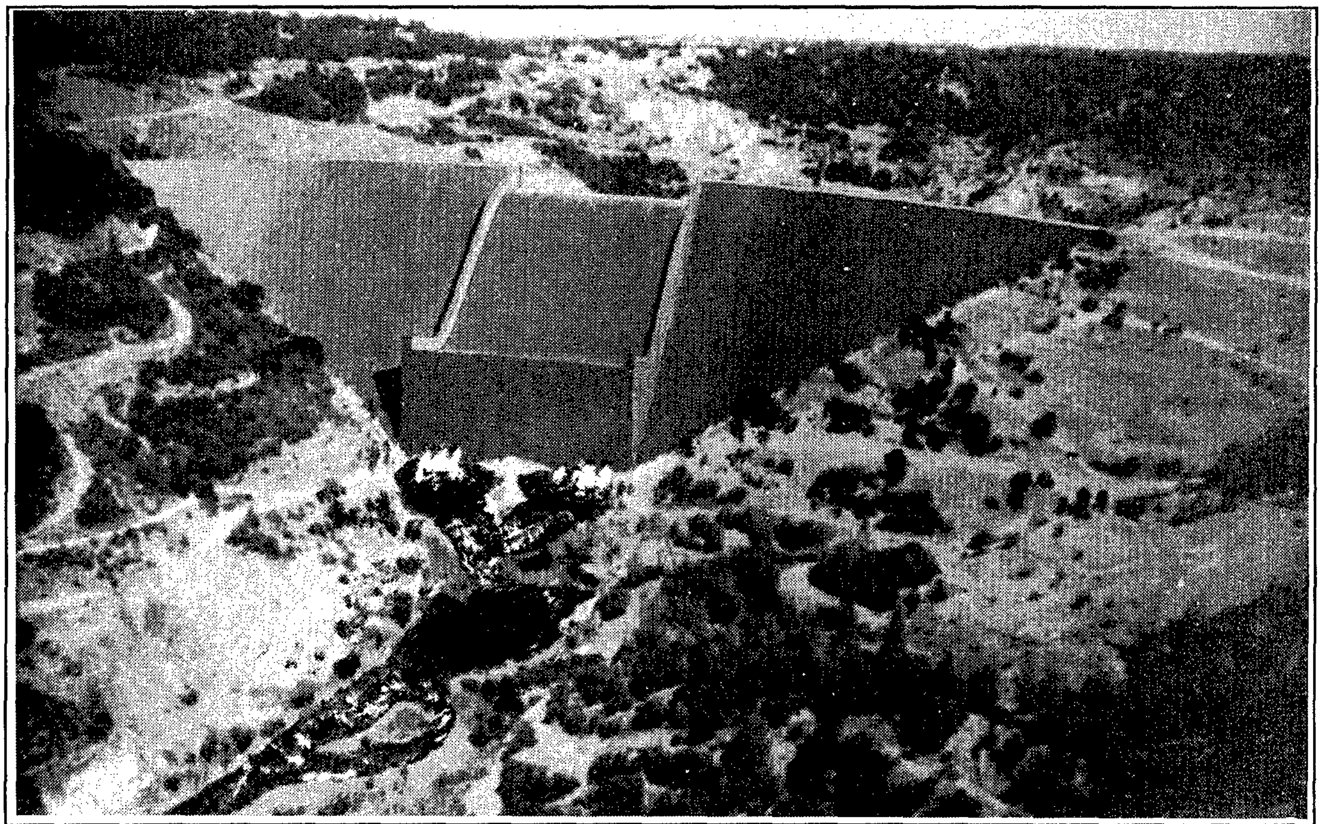


FIGURE 16-12. Photo Simulation of the Proposed 200-Year Flood Control Dam

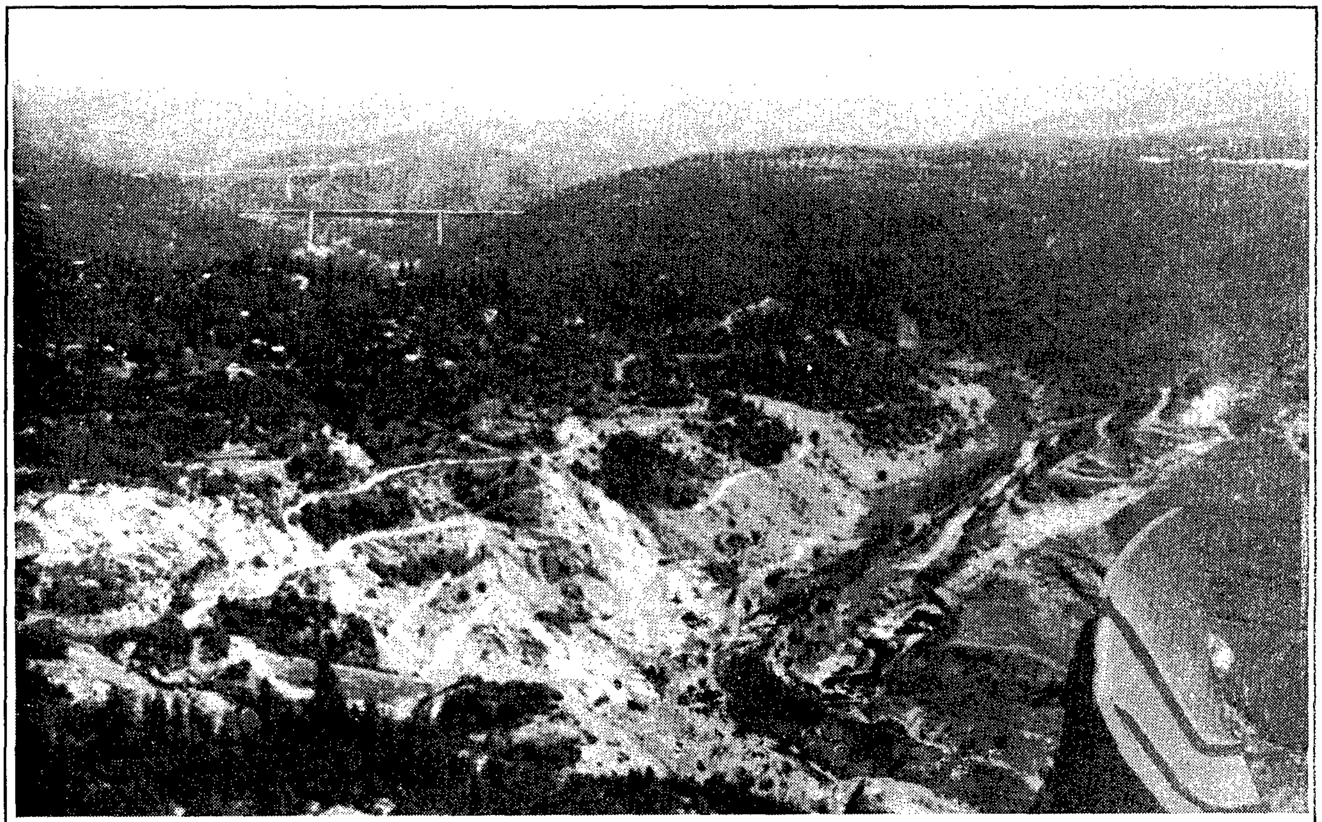


FIGURE 16-13. Photo Simulation of the Proposed 200-Year Structure Viewing the Area Upstream From the Dam

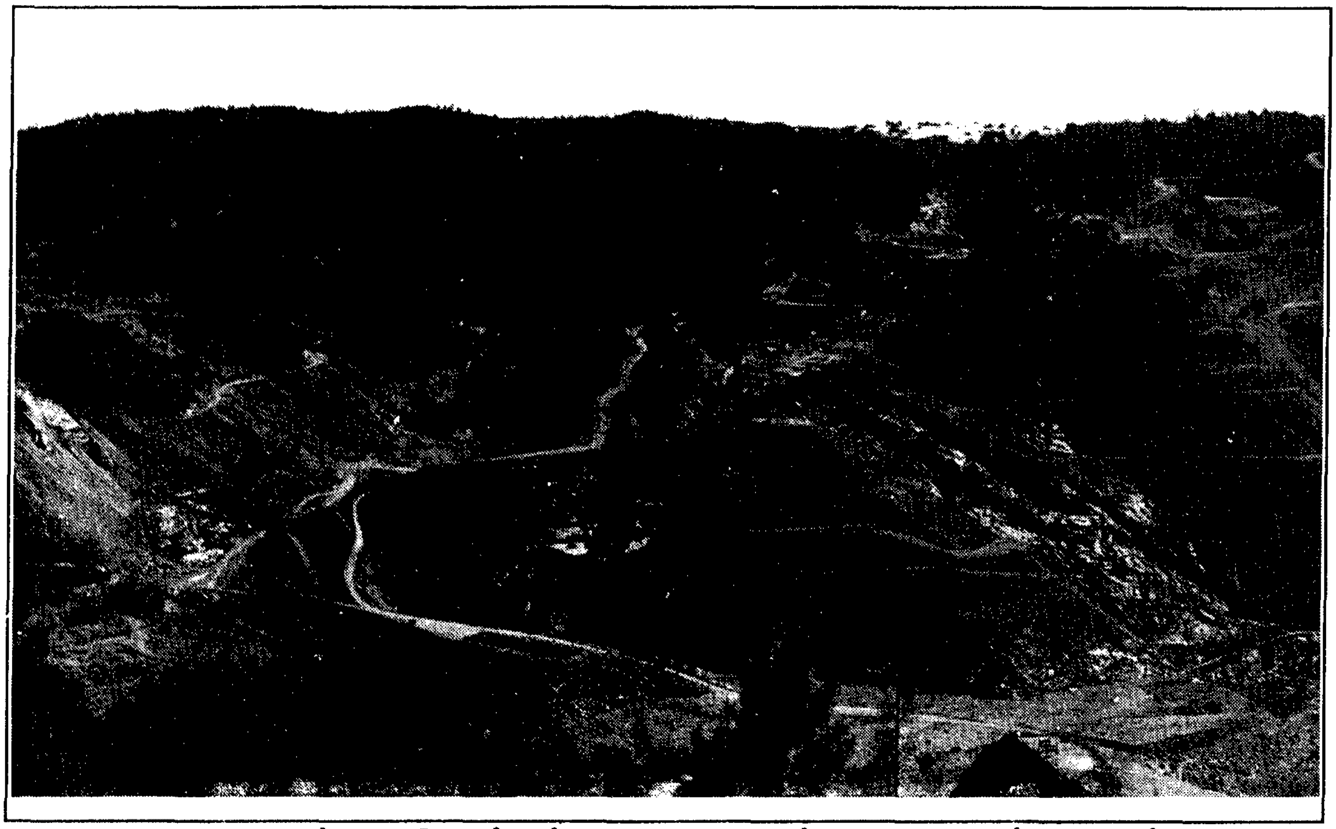


FIGURE 16-14. View of Existing Construction Damage in Damsite Area - Eastern Abutment

FIGURE 16-15. View of Existing Construction Damage in Damsite Area - Western Abutment

Visual impacts from the replacement of Ponderosa Way would be similar to those associated with the Highway 49 replacement. However, these impacts are considered less than significant because of the isolated location and the more limited scale of project improvements.

Visual impacts to the flood control basin behind the dam would be limited to those caused by extremely high precipitation and runoff events. During an event approaching the 200-year frequency level, much of this area would be submerged under sediment-laden floodwater (Figures 16-16, 16-17, and 16-18). The impounded floodwater would recede rapidly, and some sediment and

FIGURE 16-16. Photo Simulation of the Maximum Flood Retention Pool Behind 200-Year Flood Control Dam During a 50-Year Storm

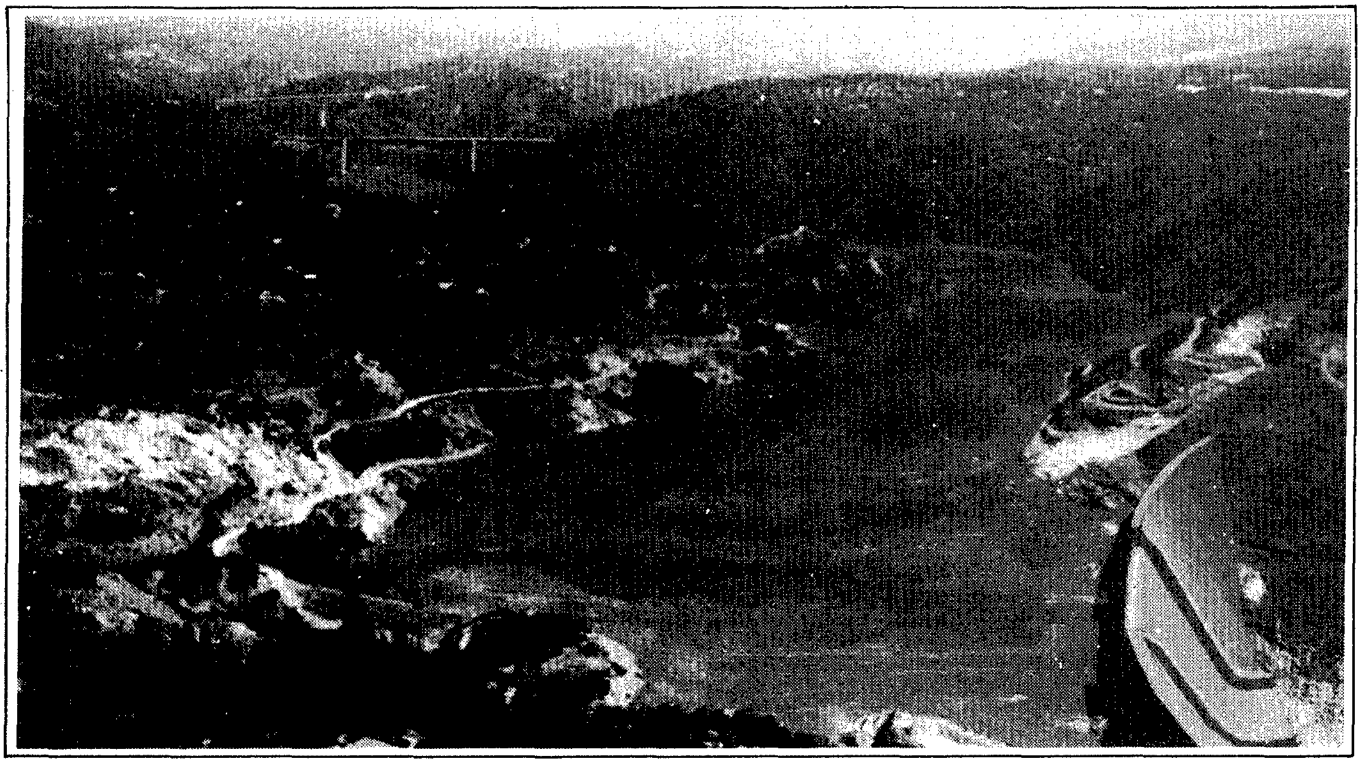


FIGURE 16-17. Photo Simulation of the Maximum Flood Retention Pool Behind 200-Year Flood Control Dam During 100-Year Storm

FIGURE 16-18. Photo Simulation of the Maximum Flood Retention Pool Behind 200-Year Flood Control Dam During 200-Year Storm

floating debris would be deposited upstream from the dam, becoming lodged behind trees, rock outcrops, and other obstacles. Over time, much of this debris would decompose and become covered by vegetation, steadily decreasing its visual prominence.

Landslides could also be expected as the saturated soils of the inundation basin lose the support of floodwater. These slides would occur eventually without flooding, but lowering the impounded water would act as a trigger, causing more slope failures than are likely to occur in a normal year. The Corps identified two areas along the river as having the potential for landslides of a size capable of blocking waterflow in the river. The first is located about 1 mile upstream from the proposed damsite and the second is above Cherokee Flat on the Middle Fork American River. If either slope failed, the visual impacts would be significant. Both slopes have the potential to fail even if they are not affected by the flood control project.

An abnormally high number of smaller slides could be triggered by the temporary impoundment, which, taken together, could strip enough vegetation to be visually significant. It is important to remember, however, that most, if not all, of these slides would occur at some time regardless of the presence of the flood control dam. Natural revegetation would minimize these impacts over time. After several incidents of flooding, the slopes in the inundation basin would tend to be more stable than they would be otherwise. Based on the potential for increased slide activity, infrequent inundation could result in a significant visual impact.

Trees could also be toppled by high winds coinciding with a receding waterline. Digger pines are particularly vulnerable to this process. Some vegetation loss and differing vegetation composition over time are expected to result from periodic, temporary storage of floodflows. However, substantial loss of plant life due to inundation alone is not anticipated because of high probability that flooding would occur during the dormant season of most plants. (See Chapter 7, Fish, Vegetation, and Wildlife.) Owing to elevated soil moisture levels, many plant species are likely to produce heavy spring growth following a flood.

Indirect Impacts

Natomas. The most significant indirect impacts would occur as a result of urban growth made possible by increased flood protection. Much of the agricultural/rural land now prominent in the area would be converted to urban/suburban uses. Views of the riparian corridors would be interrupted by new development, thereby diminishing the visual character of the area. Land use plans guiding the development will be locally approved and consistent with community desires. This impact would be significant.

The scope of the indirect visual impacts associated with the selected plan would broaden if the general plan modifications currently being considered by Sacramento and Sutter Counties are implemented. A discussion of these proposed modifications and their effect on the environment is included in Chapter 18.

Lower American River. Additional urbanization would occur in the few remaining vacant areas adjacent to the American River Parkway. New buildings would not be designed to resist flood damage. Since the future growth areas are now surrounded by urban land uses, the overall change in visual resources would be minor.

Upper American River. Implementation of an in-kind replacement of Highway 49 at river mile 23.0, as proposed in the selected plan, would not significantly alter traffic patterns in the area and would not, therefore, result in any indirect visual impacts. However, the State-required route adoption process which must be undertaken prior to any relocation of the highway could result in a high bridge alignment. Such an alignment would shorten commute times between residences in western El Dorado County and job centers along the I-80 corridor and would thus contribute to regional growth pressures and associated growth-related impacts, including visual impacts. The State route adoption process and potential high bridge alignments are discussed in Chapter 17. The effect on regional growth of adopting one of these alignments is discussed in Chapter 18.

400-YEAR ALTERNATIVE

The Natomas and lower American River components of the 400-year alternative are identical to those called for in the selected plan. In the upper American River, a 498-foot-high dam would be constructed instead of a 425-foot-high dam.

Direct Impacts

The direct visual impacts of the 400-year flood protection plan would be the same for Natomas and the lower American River as those described for the selected plan. The visual impacts of the 400-year dam would be similar to, but more prominent than, those associated with the 73-foot lower 200-year structure. The visual impacts of a 400-year flood control pool would also be similar to those associated with the 200-year pool, but would extend farther up the canyon wall. (See Figures 16-12 through 16-18.)

Indirect Impacts

The indirect visual impacts of the 400-year flood protection plan would be essentially the same as those described for the selected plan.

150-YEAR ALTERNATIVE

The Natomas component of the 150-year alternative is identical in most respects to the corresponding component of the selected plan. To handle increased flows from the American River, however, the Sacramento Weir would be lengthened and levees raised on both sides of the Yolo Bypass. Levees along the lower American River would also have to be raised and reinforced so that sustained flows of up to 180,000 cfs could be safely accommodated. At Folsom Dam, the 150-year alternative calls for lowering the spillway by 15 feet to permit increased releases during high floodflows. At Folsom Reservoir, space allocated to flood control would be increased from 400,000 to 650,000 acre-feet. During the flood season, therefore, the water level in Folsom Reservoir would be significantly lower than it is under existing conditions. The reservoir would also be less likely to fill to capacity following any given flood season. No flood control work would be undertaken upstream from Folsom Reservoir.

Direct Impacts

Natomas. With the exception of areas along Dry and Arcade Creeks, only minor visual changes would occur as a direct result of the levee construction and modification in the Natomas area. Visual impacts would be essentially the same as described for the selected plan.

Lower American River. In this alternative, conservation storage in Folsom Reservoir would be lowered to a minimum of 360,000 acre-feet (the actual level would depend on antecedent moisture conditions in the American River drainage). This is 250,000 acre-feet lower than the existing 610,000-acre-foot minimum level. (See Figures 16-19 and 16-20.) The result would be a significant increase over existing conditions in the amount of exposed reservoir bottom. Most recreational areas would be disassociated from the water during these periods. The lake would be allowed to fill at the close of the flood season, but usually would be much less likely to reach maximum capacity than currently. These low levels would constitute significant visual impacts for lake users and nearby residents. See Figure 16-21 for an indication of the reservoir's recreational value.

An additional visual impact associated with an increase in the amount of exposed reservoir bottom is an increase in the number and severity of duststorms in the area. Such storms would result from high winds picking up dust as they pass over the exposed dry reservoir bed. This impact is potentially significant, given the substantial increase in the amount of exposed bed area in the 150-year alternative.

This alternative also calls for lowering the spillway at Folsom Dam by 15 feet and installing new gates. Demolition and construction on the dam would create loud noises, exhaust fumes, and fugitive dust. The concrete removed from the spillway would be stockpiled below the dam and removed when work was completed, creating short-term adverse visual impacts.

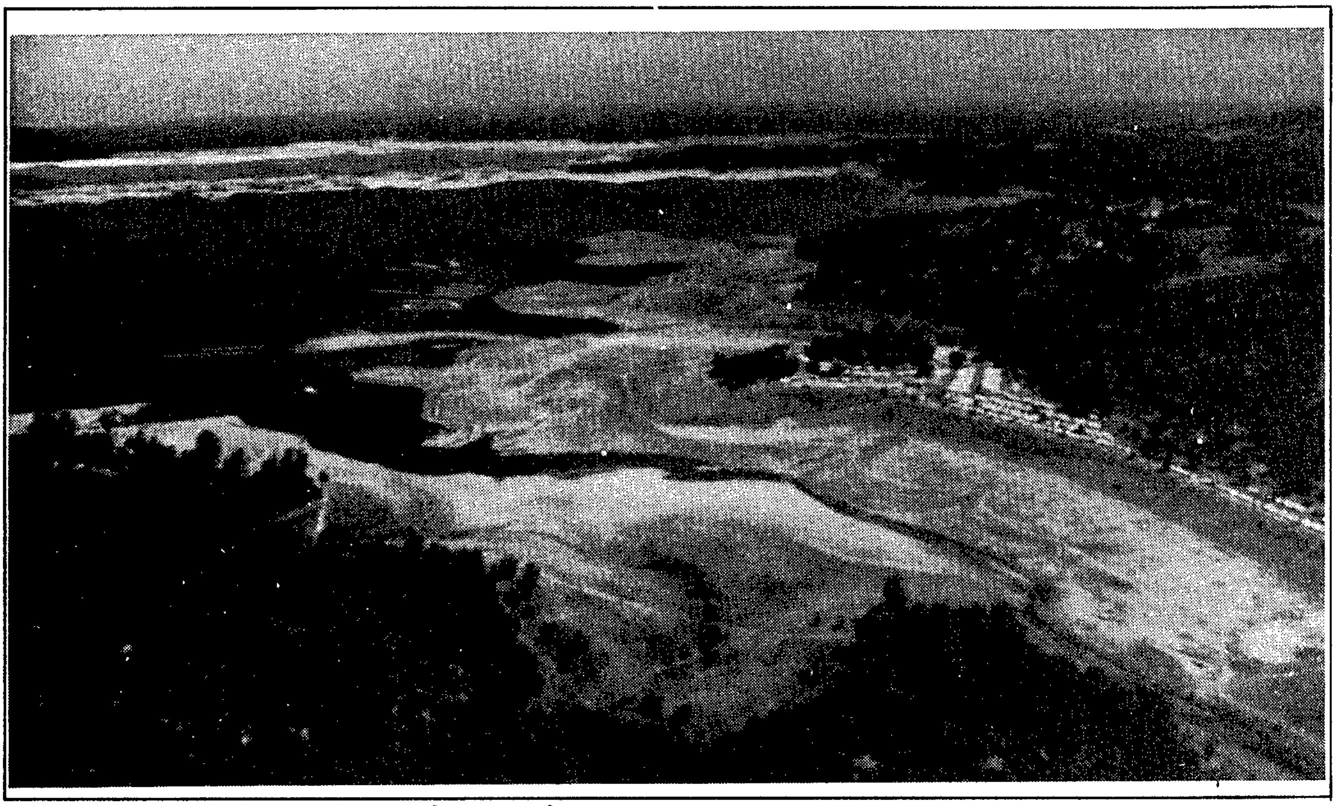


FIGURE 16-19. Photo Simulation of Folsom Lake at 400,000 Acre-Feet - Approximate Drawdown to Accommodate the Maximum Flood Pool

FIGURE 16-20. Photo Simulation of Folsom Lake at 600,000 Acre-Feet - Approximate Drawdown to Current Maximum Flood Control Pool Elevation

FIGURE 16-21. Beals Point Beach in Summer. Photo Courtesy of U.S. Bureau of Reclamation (M.G. Volkoff)

Levee work would begin just below Goethe Park. Levees would be raised on both sides of the river. The work would be performed on the waterside of the levee, and most or all trees within 20 feet to 30 feet of the toe of the levee would probably be removed. Figures 16-22 and 16-23 show the existing levees east of the Watt Avenue bridge and what those levees would look like after construction. The bank on the right (north) side in Figure 16-23 is shown raised with the trees immediately adjacent to the levee removed. The bike path would be relocated as necessary. On the left (south) side in Figure 16-23, the levee is shown raised and reinforced with riprap; any trees located on these areas of the levee would be removed. The rough, hard texture and high reflectivity of the riprap would create a significant visual impact along the parkway.

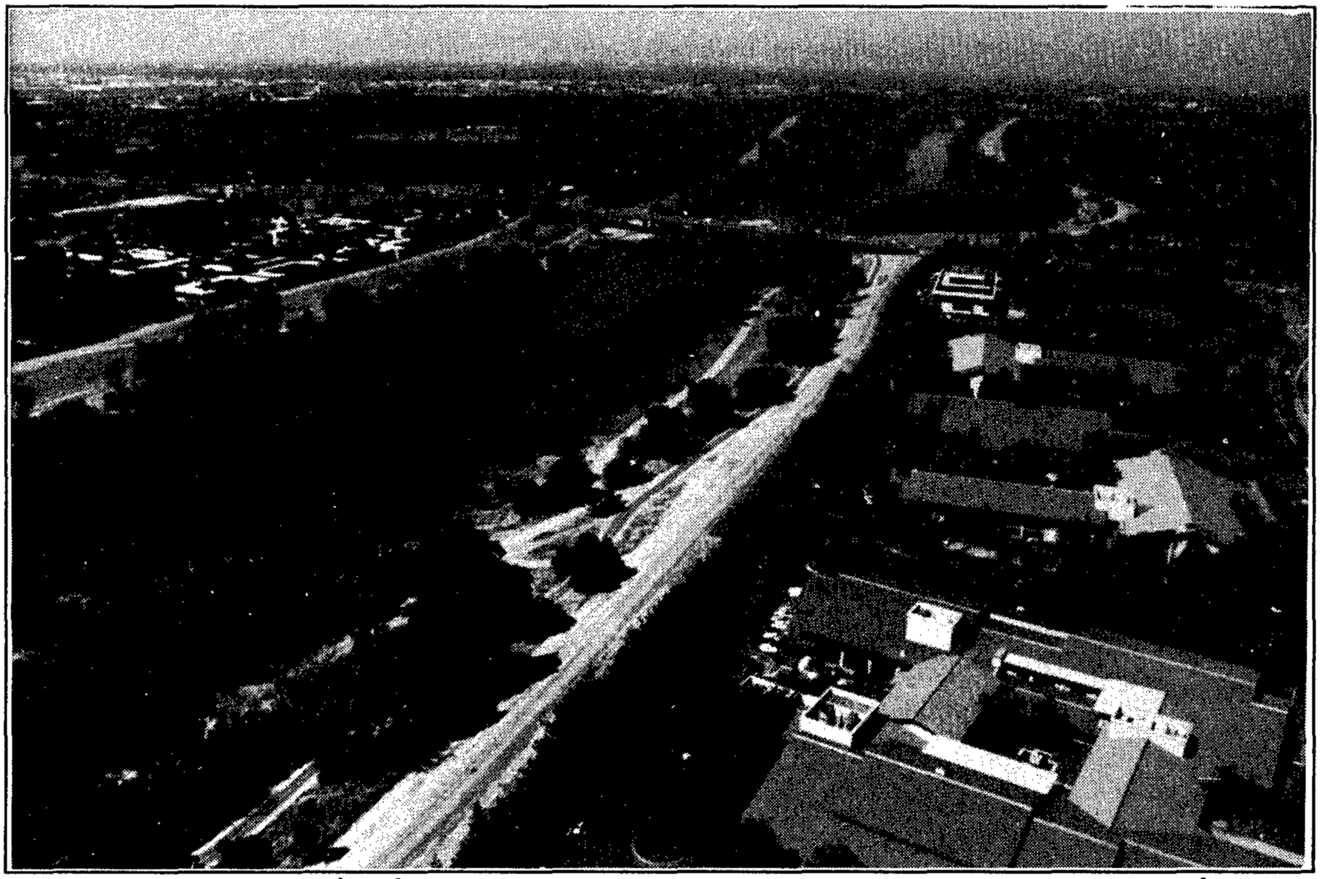


FIGURE 16-22. Existing Levee Upstream From the Watt Avenue Bridge

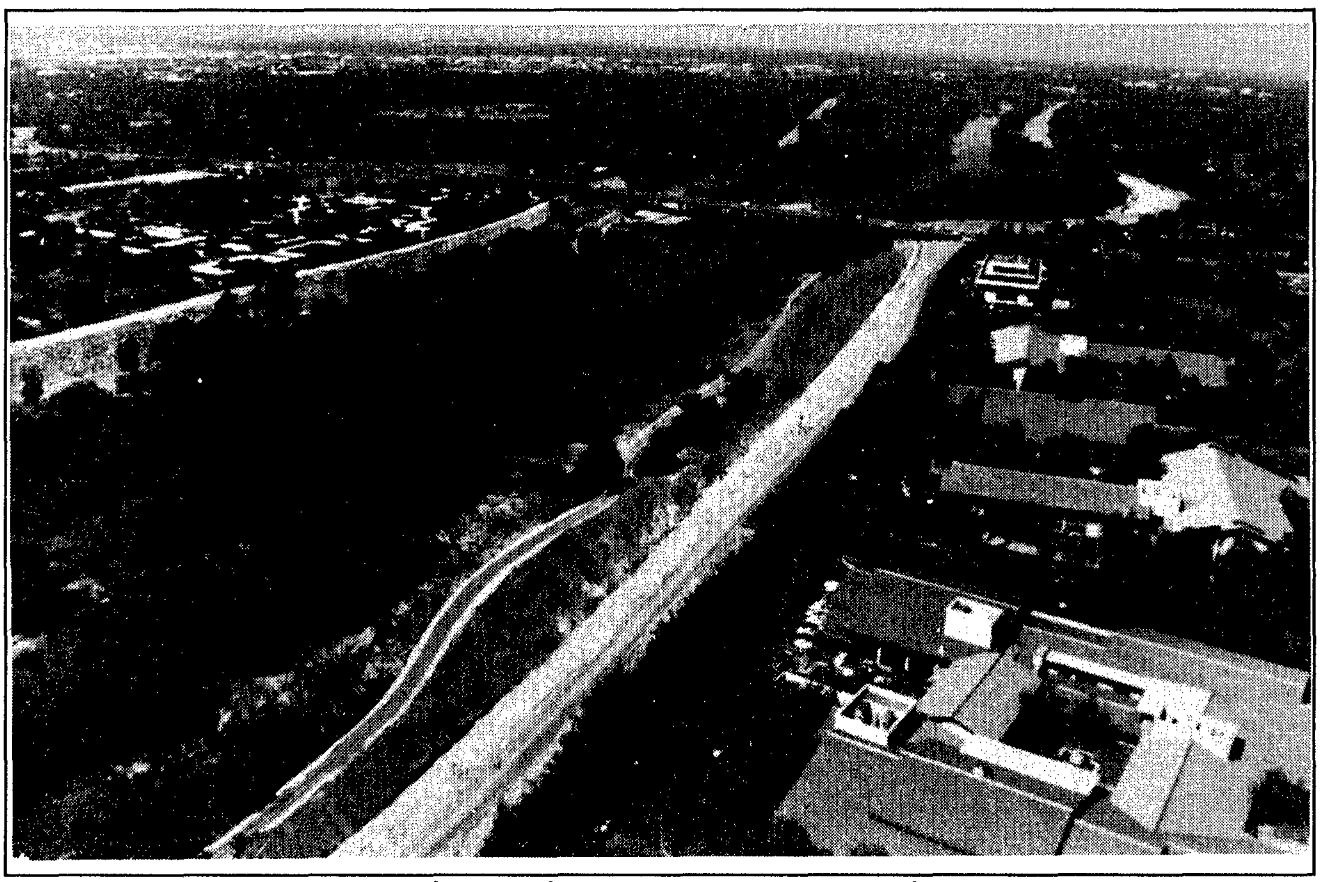


FIGURE 16-23. Photo Simulation of Levee Expansion

The levee would not be raised downstream from Howe Avenue, but would be riprapped to a point just downstream from the H Street bridge. Riprap would also be placed in the vicinity of the I-80 and Highway 160 bridges, requiring the removal of trees and changing the "seminatural" character of the banks to a more manmade appearance. The riverbank at Discovery Park and downstream from the I-5 bridge would also be riprapped.

Much of the construction activity on the levees would be behind residential areas. The temporary loss of plant life on the levees during construction would cause the levees to appear stark until new vegetation is established.

Because of the heavy recreational use of Folsom Lake (see Figure 16-21) and the American River Parkway, most, if not all, of the visual impacts to the lower American River would be very public. While most of the individual impacts are of only moderate significance, they are cumulatively significant. A user of the American River bike trail, for example, would be aware of a major visual change.

The extensive levee modifications required in the Yolo Bypass would constitute an adverse visual impact in that area. Aside from the traffic on the two interstate freeways which cross the bypass (I-80 and I-5), however, very few people ever see (or notice changes to) these levees. Since the Yolo Bypass is not a visually sensitive resource, the impacts of this alternative on the bypass would not be significant.

Upper American River. With the 150-year alternative, no flood control features would be constructed in the upper American River area. Thus, no project-related visual impacts would occur in that area.

Indirect Impacts

The indirect visual impacts of the 150-year alternative in the Natomas area would be the same as the corresponding impacts associated with the selected plan. Urban growth along the lower American River would proceed essentially as described for the selected plan. No indirect visual impacts would occur in the American River canyon.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Direct Impacts

Visual impacts in Natomas would be essentially the same as described for the selected plan.

The levee work along the lower American River required in this alternative is similar to, but less extensive than, that required in the 150-year alternative. Visual impacts would be similar to those described for the 150-year alternative but less severe. Visual impacts to the Yolo Bypass would be the same as described for the 150-year alternative.

With this alternative, no flood control features would be constructed in the upper American River area. Thus, no project-induced visual impacts would occur in that region.

Indirect Impacts

The indirect visual impacts of this alternative in the Natomas area would be the same as the corresponding impacts associated with the selected plan. Urban growth along the lower American River would proceed essentially as described for the selected plan. No indirect visual impacts would occur in the American River canyon.

100-YEAR (FEMA) STORAGE ALTERNATIVE

The Natomas component of this alternative is essentially the same as the corresponding components of the selected plan. At Folsom Reservoir, the flood storage pool would be increased from 400,000 to 590,000 acre-feet. No action would be taken upstream from Folsom Reservoir.

Direct Impacts

Natomas. New levees and levee modifications in the Natomas area would essentially be the same as described for the selected plan, resulting in similar visual impacts.

Lower American River. With this alternative, Folsom Reservoir would be lowered to a minimum of 420,000 acre-feet (the actual level would depend on antecedent moisture conditions in the American River drainage). This is 190,000 acre-feet lower than the existing 610,000-acre-foot minimum level. (See Figures 16-19 and 16-20.) The result would be a noticeable increase over existing conditions in the amount of exposed reservoir bottom. The lake would be allowed to fill at the close of the flood season but usually would be less likely to reach maximum capacity than currently. The extremely low water levels during drought years would impose significant short-term visual impacts on users of the lake.

Like the 150-year alternative, this alternative could result in severe duststorms near Folsom Reservoir. Since the frequency and severity of such storms depend on how much of the reservoir bottom is dry and exposed to the weather, the potential for a significant impact is less with this alternative than with the 150-year alternative.

The levee system downstream from the dam would not be altered in this alternative. Higher than existing flow rates would occur during the fall as the reservoir was lowered, and slightly lowered flows might occur during the spring and summer. Changes in the flow rates are, however, unlikely to be visually apparent and would be within the design limits of the levee system.

Upper American River. In the 100-year storage alternative, no flood control features would be constructed in the upper American River area. No project-related visual impacts would occur in that area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

All components of this alternative are similar to the corresponding components of the 150-year alternative. Since less protection would be provided with this alternative, however, less work would be necessary on levees and weirs and the increase in flood storage space in Folsom Reservoir would be less (470,000 as opposed to 650,000 acre-feet). The levees along the lower American River would be required to convey 130,000 cfs rather than 180,000 cfs.

Direct Impacts

Natomas. New levees and levee modifications in the Natomas area would be essentially the same as described for the selected plan and would result in visual impacts similar to those previously described.

Lower American River. With this alternative, Folsom Reservoir would be lowered to a minimum of 540,000 acre-feet (the actual level would depend on antecedent moisture conditions in the American River drainage). This is 70,000 acre-feet lower than the existing 610,000-acre-foot minimum level. (See Figures 16-19 and 16-20.) The result would be an increase over existing conditions in the amount of exposed reservoir bottom. The lake would be allowed to fill at the close of the flood season, but in dry years it would be less likely to reach maximum capacity than currently. The low water levels during drought years would impose short-term visual impacts on users of the lake.

Like the 150-year and 100-year (FEMA) storage alternatives, this alternative would create conditions that could increase duststorm frequency and intensity near Folsom Reservoir. This visual impact would not likely be significant since the amount of reservoir bed exposed in most years would be only marginally greater than the amount exposed under the current flood storage regime.

Demolition and construction activities associated with lowering the spillway on Folsom Dam would create loud noises, exhaust fumes, and fugitive dust. The concrete removed from the spillway would be stockpiled below the dam and removed when work was completed. This would result in short-term adverse but not significant impacts on visual conditions near the dam.

The levee work along the lower American River required with this alternative is similar to, but less extensive than, that required in the 100-year levee alternative. Thus, the visual impacts associated with this alternative would be similar to those described for the 100-year levee alternative but less severe.

The visual impacts to the Yolo Bypass under this alternative would be the same as those described for the 150-year alternative.

Upper American River. With this alternative, no flood control features would be constructed in the upper American River area. No project-related visual impacts would occur.

Indirect Impacts

Urban growth made possible by increased flood protection would cause significant visual impacts in the Natomas basin. The agricultural/rural nature of the area would be converted to a more urban/suburban condition. Views of the riparian corridors would be interrupted by development and would diminish the existing visual character of the area. This constitutes a significant visual impact.

Urban growth along the lower American River would develop essentially as described for the selected plan. No indirect impacts would occur in the upper American River area.

MITIGATION

DIRECT IMPACTS

Implementation of any of the flood control alternatives would result in significant direct visual impacts. Measures are available to mitigate some of these impacts to less than significant; however, significant unavoidable impacts would still occur for all alternatives. The following sections describe project impacts and appropriate mitigation by project area.

Natomas

Levee improvements required in Natomas would result in significant visual impacts along the north and south Dry Creek levee alignments and in the vicinity of Hagginwood Park. No mitigation is available to reduce these impacts to less than significant.

Significant impacts from establishment of a borrow site along the Garden Highway would be mitigated as follows:

- o Implement a reclamation plan to reestablish agricultural activities at the borrow site. This would include stockpiling topsoil during borrow operations.

To reduce the visual impacts of the pumping station, the following mitigation measure would be implemented:

- o Install landscape screening such as groupings of trees and tall shrubs to screen the pumping station and control structure from residences located on West 6th Avenue and from motorists traveling on East Levee Road.

The following mitigation would be implemented in all areas requiring levee improvements to incrementally reduce adverse impacts:

- o Restore vegetation on modified levees and establish vegetation on new levees in accordance with flood control and levee design requirements.

Impacts and mitigation in the Natomas area would be the same for all project alternatives.

<u>**Lower American River**</u>

Implementation of the 150-year and 100-year (FEMA) storage alternatives would have a significant impact on the visual quality of Folsom Reservoir. There is no feasible mitigation to reduce this impact.

Implementation of the 150-year, 100-year (FEMA) levee, and 100-year (FEMA) levee/storage and spillway alternatives would have a significant impact on the visual quality of the American River Parkway as a result of substantial levee work. This impact could be partially mitigated through implementation of the following measures; however, the residual impact would still be significant.

- o Establish a revegetation program for the affected areas along the American River Parkway. The construction scars would be seeded with an erosion-controlling grass mix as a normal procedure of levee construction. One 15-gallon oak tree (interior live oak or valley oak) should be planted for each caliper inch of native oaks removed. Other native riparian trees and shrubs should also be planted. All plantings should be made from containers rather than seed and must be irrigated for at least 2 years after planting.

- o Choose darker type rocks for riprap. Use a mix of minimum size and larger rock to give the reinforced banks a somewhat more natural appearance.

The selected plan and 400-year alternative would not require improvements in the lower American River; consequently, no mitigation is required.

<u>**Upper American River**</u>

With the selected plan and 400-year alternative, the Highway 49 replacement and the dam itself would result in significant visual impacts. There is no feasible mitigation to reduce these impacts to less than significant.

The infrequent inundation of the canyon during high-flow events would increase the likelihood of slope failure and would result in the temporary deposit of some debris upstream from the dam. This impact would be mitigated by natural processes (that is, revegetation and flushing from rains).

Development of a conveyor system and access roads to move aggregate from the Old Cool Quarry to the damsite would result in a significant visual impact. The following mitigation would reduce this impact to less than significant.

- o Remove the conveyor system when construction is complete and restore vegetation in disturbed areas.

The following mitigation would be implemented for all upper American River project components requiring disturbance of natural vegetation. This mitigation would incrementally reduce significant impacts and fully mitigate adverse impacts associated with construction activities.

- o Develop a comprehensive reclamation/revegetation plan for all areas disturbed during project implementation. In the area of the dam itself, construction scars shall be covered with soil pockets so that native vegetation can be seeded wherever a sufficient quantity of soil exists. Because the visual prominence of the light-colored dam is exacerbated by the darker green of dense tree stands, revegetation efforts should focus on species selection and clustering shrubs and trees among wild grasses which will tend to blend with adjacent vegetation.

- o Road cuts created by the replacements of Highway 49 and Ponderosa Way and establishment of access roads could be too rocky for revegetation. In such cases, the cuts could be made less visually prominent by leaving an irregular rock surface rather than cutting on a single plane. Revegetation will also be implemented where possible, and architectural design practices will be applied to limit adverse impacts to the minimum extent practicable.

The 150-year and 100-year (FEMA) levee, storage, and levee/storage and spillway alternatives do not include upper American River features; consequently, no mitigation would be required.

INDIRECT IMPACTS

Indirect visual impacts would be primarily attributable to increased urbanization resulting from improved flood protection. These impacts would be less pronounced in the Greenhaven and Pocket areas as these areas are already urbanized and infill would not substantially change the visual character. In Natomas, however, implementation of a flood protection project would allow development of large areas devoted to agriculture. This loss of open space in close proximity to a largely urbanized area would be considered a significant impact. This impact would be partially mitigated by preserving open space, protecting view corridors, and requiring strict review of new development as the area becomes urbanized. However, even with implementation of the above mitigation, the conversion of large tracts of open space/agricultural lands to urban uses would constitute a significant unavoidable impact.

CHAPTER 17

CUMULATIVE IMPACTS

BACKGROUND

The National Environmental Policy Act (NEPA) implementation regulations require a discussion of project impacts that, when combined with the impacts of other projects, result in significant cumulative effects (40 CFR 1508.25). The regulations define a cumulative impact as:

> The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taken over a period of time (40 CFR 1508.7).

The California Environmental Quality Act Guidelines require that an EIR discuss cumulative impacts "when they are significant" (Guidelines Section 15130, subd.[a]). CEQA Guidelines define cumulative impacts as "two or more individual effects which, when considered together, are considerable or which compound or increase other environmental impacts" (Guidelines Section 15355; see also California Public Resources Code; Section 21083, subd.[b]). The guidelines also state "The individual effects may be changes resulting from a single project or a number of separate projects" (Guidelines Section 15355, subd.[a]). "The cumulative impacts from several projects is [defined as] the change in the environment which results from the incremental impact of the project when added to other closely related past, present and reasonably foreseeable probable future projects. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period of time" (Guidelines Section 15355, subd.[b]).

The requirement to discuss cumulative impacts is intended to prevent agencies from taking a "serial, one-plan-at-a-time" approach to environmental analysis (Libeu v. Johnson (1st Dist. 1987) 1985 Cal. App. 3d 517, 526 [240 Cal. Rptr., 776, 780]). Unless cumulative impacts are analyzed, resources can be committed to a course of action before long-term impacts can be evaluated.

The discussion of cumulative impacts must reflect the severity of the impacts and their likelihood of occurrence; however, the discussion need not evaluate cumulative impacts to the degree of specificity required for project-specific impact analysis. "The [cumulative impact] discussion should be guided by standards of practicality and reasonableness" (Guidelines Section 15130, subd.[b]).

To be adequate, a discussion of cumulative effects must include the following elements (Guidelines Section 15130, subd.[b]):

- Either (a) a list of past, present, and reasonably anticipated future projects, including those outside the agency's control, that have produced, or are likely to produce, related or cumulative impacts or (b) a summary of projections contained in an adopted general plan or related planning document that is designed to evaluate regional or area-wide conditions. Such documents should be referenced and made available for public inspection at a specified location.

- A summary of the expected environmental effects of the individual projects, with specific reference to additional information stating where such information is available.

- A reasonable analysis of all of the relevant projects' cumulative impacts, with an examination of reasonable options for mitigating or avoiding such effects.

As used above, the terms "past, present, and reasonably anticipated future projects" include not only projects currently under construction and approved related projects not yet under construction but also related "unapproved projects currently under environmental review with related impacts or which result in significant cumulative impacts" ("Discussion" following Guidelines Section 15130).

The lead agency must use ". . . reasonable efforts to discover, disclose and discuss" related past, present, and future projects, even if under review by other agencies. Such related projects must be analyzed regardless of whether they required EIR's, negative declarations, or were exempted from CEQA ("Discussion" following Guidelines Section 15130).

In this report, cumulative impacts were assessed by listing the projects which, in addition to the selected plan, could produce similar or significant cumulative impacts in the upper American River area, along the lower Sacramento and American Rivers and their tributaries, and in the Natomas basin. The individual project impacts occur in two general types. First are the direct impacts of water resources projects that provide flood protection or water supply to the residents and adversely affect the remaining natural habitats in the study area. Also included are newer environmental projects that are designed to restore wetland and other natural functions of some portions of the study areas. Second are the indirect impacts of increased development encouraged by the water resources projects in combination with political zoning decisions and construction of infrastructure projects required to support growth.

The following sections briefly describe the potential impacts of these projects, identify the individual mitigation plans proposed to compensate for the losses, and summarize the cumulative impacts of the projects.

With respect to flood control project impacts, this chapter lists and describes the projects currently contemplated along the Sacramento and American Rivers and their tributaries which would significantly affect the operation of the flood control system protecting the Sacramento area. This list includes the projects being undertaken to repair and upgrade the Sacramento River Flood Control Project, the projects being undertaken to address local flooding problems not resolved by the selected plan, and the projects being undertaken to meet FEMA's adequate-progress guidelines. Cumulatively, these projects would have a long-term beneficial effect on the environment by raising the level of flood protection provided to the Sacramento area and reducing the risk of adverse impacts related to flooding. In the short term, these individual projects have direct impacts to natural ecosystems, which added together significantly reduce the small remaining wetland and riparian ecosystems found along the project area rivers. These impacts are generally mitigated, resulting in no net loss of the values of these resources, but resulting in changes in the specific types, quantities, and locations of these habitats.

With respect to growth, the potential replacement of Highway 49 by the State of California and potential construction of a multipurpose dam at the Auburn site would have far-reaching impacts on the canyons of the North and Middle Forks of the American River and would remove significant constraints to growth in the upper American River area. In the lower American River and Natomas areas, a series of infrastructural projects in combination with the selected plan would facilitate growth throughout the flood plain. These upper and lower American River projects and the direct environmental effects associated with them are described in this chapter. However, the cumulative impacts related to growth in the study area have been analyzed elsewhere in this document. Impacts resulting from development in the Natomas, Meadowview, and Pocket areas of the City are discussed by issue area in the main body of this EIR/EIS. Growth impacts in the unincorporated areas of the Natomas basin and in northwestern El Dorado County are presented in Chapter 18, Growth-Inducing Impacts.

SACRAMENTO AND AMERICAN RIVER FLOOD CONTROL PROJECTS

SACRAMENTO RIVER FLOOD CONTROL PROJECT

The Central Valley of California is 450 miles long and 40 miles wide and drains approximately 57,000 square miles. The Sacramento Valley occupies the northern half of this drainage and drains approximately 27,000 square miles of basin. Prior to the reclamation of valley lands for agricultural development, a large part of the Sacramento Valley, including the delta lands south of Sacramento and the basin lands between the river and the uplands, were subject to annual or periodic overflow. The potential flood plain, irregular in outline, varied in width from about 2 to 30 miles and extended from Red Bluff to the mouth of the Sacramento River, a distance of 250 miles, and comprised an area in excess of 1 million acres.

The flood control system along the Sacramento River and its tributaries has evolved since the mid-1800's when levees were first constructed to control seasonal flooding. The present system consists of the network of dams, levees, weirs, and bypasses which collectively comprises the Sacramento River Flood Control Project. Shasta Dam, located near the headwaters of the Sacramento River, provides large volumes of storage for Sacramento River water originating in the upper Sacramento basin. Oroville Dam on the Feather River, a tributary to the Sacramento River, provides initial control over these floodwaters. On the Yuba River, a major tributary to the Feather River, New Bullards Bar Dam provides flood protection against floodwaters originating in the upper watershed of the Yuba River. On the American River, Folsom Reservoir provides flood control storage for waters originating in the upper basin of the American River. During major floods the containment of floodflows in leveed channels on the valley floor is possible because the initial surges of runoff are detained in these reservoirs. Reservoir operations are coordinated among the various storage projects in order to ensure maximum utilization of downstream channel and floodway carrying capacities.

Below Shasta Reservoir, floodwaters in the Sacramento River are controlled through a system of levees, weirs, and channel bypasses. During most floods, releases out of Shasta Reservoir are confined within the leveed channel of the Sacramento River. However, when flood releases become excessive and the river channel capacity is exceeded, water is diverted into the Sutter Bypass near the City of Colusa. This bypass channel conveys these excess waters through a confined channel along the eastern boundary of the Sacramento Valley. These flows are then carried southward to the confluence of the Feather and Sacramento Rivers near Verona. There they are diverted over the Fremont weir and into the Yolo Bypass. The bypass in turn conveys these floodwaters to the west of Sacramento and eventually discharges them into the San Joaquin Delta near Rio Vista.

A critical juncture in the flood control system is at the confluence of the Sacramento and American Rivers. Here, just west of Sacramento, major storms in both the Sacramento and American River basins can cause significant combinations of flood volumes. Much of this combined flow is diverted over the Sacramento weir, through the Sacramento Bypass, and into the Yolo Bypass. Nevertheless, given the limited capacity of the river channels at the confluence, water surface levels within the channels may rise to the point where floodwaters begin to back up into tributary streams and drainages within the area. This backwater effect in turn strains the levees and drainage canals which have been provided in these tributary areas to prevent flooding.

Riparian vegetation was directly affected by this project and largely unmitigated because at that time there were no provisions in the project authorizations requiring either an environmental impact analysis or mitigation. Indirect impacts to riparian vegetation also occurred due to an increase in private development as a result of increased flood control. These impacts were also unmitigated. However, positive socioeconomic benefits have accrued due to greatly reduced flood damages.

Various studies of the historical and present extent of riparian vegetation along the Sacramento River and tributaries agree that less than 2 to 3 percent of historical woody riparian habitat area remains. It is assumed that cumulative effects on wildlife, fisheries, and plant species dependent on riparian habitats (terrestrial and aquatic) are directly correlated with the reductions in natural riverbank and riparian vegetation. Given the importance and value of this vegetation to wildlife and fisheries and the reduction to date, any further reduction must be considered a significant adverse impact.

As a result of the 1986 flood, various problems, including levee instability and lack of system capacity, were identified within this integrated flood control system. Accordingly, the Corps has initiated various investigations to identify and address these problems. These studies are listed below and their interrelationships are described.

AMERICAN RIVER WATERSHED INVESTIGATION

Impacts associated with the selected plan are discussed in Chapters 4 though 16 of this document. Indirect impacts from development of the incorporated portion of Natomas and the Meadowview and Pocket areas that are currently subject to substantial inundation during a 100-year flood are discussed by issue area in the main body of this EIR/EIS. Growth-inducing impacts in unincorporated areas of the Natomas basin and northwestern El Dorado County are presented in Chapter 18. Mitigation for project-induced impacts is discussed in Chapter 22.

SACRAMENTO RIVER FLOOD CONTROL SYSTEM EVALUATION

This study reexamines the integrity of the Sacramento River Flood Control Project based on the events of the 1986 flood. The system includes 980 miles of levees and is designed to provide varying degrees of flood protection to lands adjacent to the Sacramento River from Chico Landing near Red Bluff south to Collinsville in the Sacramento-San Joaquin Delta, and the lower reaches of several tributaries including the American River. The study will determine if the system is functioning as designed or if remedial work is required to restore levees to their previously established design and functions. Many of the project levees were built in the late 1800's and early 1900's by landowners and local reclamation districts. These levees were later improved and incorporated into the Sacramento River Flood Control Project by 1960. Because of the size and complexity of this system, this reevaluation is being conducted in five phases.

Phase 1 consists of the Sacramento Urban Area Levee Reconstruction Project which is designed to stabilize the east and west levees of the Sacramento River protecting Natomas, the Greenhaven-Pocket area of the City of Sacramento, and the City of West Sacramento. These levees are currently too porous in some areas to meet design specifications. This problem will be corrected by inserting a bentonite and soil slurry wall to form an impervious core in the east levee between Freeport and the I-5 crossing and the west levee below the Sacramento-American River confluence. The east levee above the I-5 crossing will be stabilized through the placement of a new berm along the landside toe of the levee. Construction began in August 1990 and is expected to be completed by the end of 1992.

The levees are being strengthened but not raised beyond their original design elevation; therefore, no indirect impacts due to increased development are expected to occur. Construction will take place on the landward side of the levees, thereby minimizing environmental impacts. However, 70 acres of upland/riparian vegetation and 44 acres of open water/emergent marsh will be removed or covered by construction. These losses will be fully mitigated through the acquisition and development of a 114-acre mitigation site south of I-5 and west of the river, creating a small lake, and planting the area with native wetland and riparian species (including elderberry shrubs). Details on the environmental analysis can be found in the Finding of No Significant Impact/Negative Declaration for the "Sacramento Urban Area Levee Reconstruction Project, Sacramento, California," completed in July 1990.

Phase 2 focuses on the levee systems along the Feather and Yuba Rivers in the Cities of Marysville and Yuba City. The initial appraisal report for this phase identified work consisting of raising 10.7 miles of levees to their authorized height and providing 19.5 miles of toe drains for levee stabilization.

Phase 3 focuses on the mid-valley area between Sacramento, Marysville-Yuba City, and the Yolo Bypass from Fremont Weir to south of Putah Creek. The initial appraisal of the levees was completed in 1990. Recommended work includes 22.3 miles of levee raising, 4.9 miles of stabilizing berms, and 9.1 miles of slurry wall.

Phase 4 focuses on the levees in the delta from Sacramento through Collinsville. Phase 5 concentrates on the levees of the upper Sacramento River north to Chico Landing. Initial appraisal reports for phases 4 and 5 are under preparation. Similar types of work can be expected for these areas if found to be needed.

The improvements identified in phases 2 through 5 may result in unavoidable losses of wildlife habitat. Mitigation for this construction-related impact will likely consist of management of project lands to compensate for the lost habitat values. A programmatic EIS for the "Sacramento River Flood Control System Evaluation, Phases II-V" is expected to be completed in December 1991. Further environmental documentation will be completed for each phase as plans are finalized and after system-wide economic analyses are completed.

SACRAMENTO METROPOLITAN AREA INVESTIGATION

This study examines ways to increase flood protection for portions of South Sacramento and the City of West Sacramento. The study includes developed areas along the Sacramento River and Yolo Bypass from the Fremont Weir downstream to an area just south of Freeport. The draft feasibility study was completed in September 1991. The selected plan calls for raising the south levee of the Sacramento Bypass and the east levee of the Yolo Bypass below the Sacramento Bypass. By itself, this project would provide more than 100-year protection to the City of West Sacramento. In conjunction with the American River Watershed Investigation, West Sacramento would achieve greater than a 200-year level of flood protection.

A total of 52.5 acres will be directly affected: 39.4 acres of wetlands and 13.1 acres of uplands. These acres will be fully mitigated for through the acquisition and development of a 52.5-acre mitigation site. The tentatively selected mitigation site is within the Yolo Bypass near the east levees that are to be improved. Wetlands and uplands would be developed adjacent to a strip of riparian forest that parallels the waterside of the levee. The site is 70 acres in area. Impacts which may result from development in the future will be mitigated for in accordance with a plan being developed by the non-Federal sponsors to comply with existing Federal, State, and local laws, regulations, and policies, and implemented through the local land use entitlement process by the entity responsible for the impact in the future. Details of the impact analysis and mitigation plan can be found in the Draft Feasibility Report and Draft Environmental Impact Statement/Report for the Sacramento Metropolitan Area, California, which was made available in November 1991.

WESTSIDE YOLO BYPASS LEVEE STUDY

This reconnaissance-level study covers the levee systems along the west side of the Yolo Bypass from the Fremont Weir to an area below Putah Creek and includes the tributary streams of Cache and Putah Creeks and Willow Slough. The study examines possible ways to increase flood protection for portions of Yolo County west of and adjacent to the bypass. The non-Federal sponsor, The Reclamation Board, recently requested that the Corps also analyze measures to provide increased flood protection for the Elkhorn area. Expected types of work would most likely include levee raising in low levee reaches. A reconnaissance report and environmental evaluation will be available in mid-1992.

CACHE CREEK SETTLING BASIN RECONSTRUCTION PROJECT

This project will raise the existing settling basin levees and weir to again trap the large volume of sediment flowing down Cache Creek before the creek enters the Yolo Bypass. By retaining the sediment in the settling basin, the capacity and effectiveness of the Yolo Bypass to provide flood protection are maintained. Construction began in late 1990. Coordination with interested agencies has confirmed that no adverse environmental impacts are expected; therefore, no mitigation plan has been developed.

SACRAMENTO RIVER BANK PROTECTION PROJECT

This project is a long-term program that allows the Corps to use erosion control and setback levees to maintain the integrity of the Sacramento River Flood Control Project. Erosion control includes various forms of bank protection, but primarily consists of placing rock riprap to protect the levees. Setback levees involve moving existing levees farther from the river. The project area encompasses the 980 miles of levees along the east and west banks of the Sacramento River from Collinsville to Chico Landing; distributaries such as Steamboat Slough; and along the Feather, Bear, Yuba, and American Rivers; Sutter and Yolo Bypass; and smaller tributary streams.

First Phase. Construction, consisting of 430,000 lineal feet of levee riprapping, was completed from 1960 to 1975 between Collinsville (river mile 0) and the ends of the project levees (river mile 176 east bank and river mile 184 west bank). Some revetment was also placed on sloughs in the Sacramento Delta below river mile 40 and on lower tributaries such as the American, Bear, and Feather Rivers.

At the time of construction, no provisions existed within the project authorization to require mitigation. Initially, construction activities were conducted to minimize impacts to the extent possible, and in 1986 the Corps was authorized to provide mitigation to compensate for habitat affected during the first phase of construction.

Subsequent to construction, the U.S. Fish and Wildlife Servicce (FWS) prepared a report entitled "Fish and Wildlife Management Plan for Sacramento River Bank Protection Project, California" which listed project impacts as follows: loss of 180 acres of riparian habitat; alteration of 456 acres of riparian habitat due to construction; loss of 3,700 acres of agricultural land adjacent to construction; loss of 80 miles of streambank habitat for aquatic mammals and fish; and unquantified habitat losses for several endangered or rare species. The FWS concluded that acquisition and replanting of 668 acres of riparian vegetation were required to mitigate for first phase impacts. Following a comparative analysis of without-project and with-project conditions, the Corps, although supporting the concept of providing the 668 acres, identified only 260 acres which were justified as mitigation. The remaining 408 acres were classified as enhancement as they existed in areas where Federal and State regulations required vegetation removal under normal maintenance of the levee system.

With close cooperation of the FWS and The Nature Conservancy, acquisition and riparian vegetation plantings on the 260-acre linear riparian vegetation recovery corridor were initiated in 1990 and remain under way. The first parcel, located in the vicinity of river mile 192.4, was purchased by The Nature Conservancy and totaled 100+ acres. Scheduled for planting in the spring of 1991, the project completion date is 1997, including the 3-year maintenance period.

Second Phase. The second phase of the project was authorized in 1974 and allowed for construction of 405,000 lineal feet of bank protection work within the Sacramento River and its sloughs and tributaries. This act also provided that an estimated 10 percent of total construction costs be spent on measures to mitigate adverse environmental impacts.

About 320,000 linear feet was constructed or under construction on August 4, 1989, when the emergency rule of the National Marine Fisheries Service (NMFS) listing the winter-run

Chinook salmon as a threatened species was published in the Federal Register. At that time, further construction was delayed pending the outcome of State and Federal endangered species consultations.

Part 1 of the Sacramento River Bank Protection Project Second Phase provided approximately 180,000 linear feet of rock revetment. Although a specific acreage target was not developed by the FWS for environmental mitigation within Second Phase Part 1, the resource agencies recommended the 10 percent of construction costs be spent (1) to protect as many acres of riparian vegetation as possible using Right 8 easements or (2) to save as many trees as possible using rockfill instead of bank cutting in preparing the revetment slope. As a result of these measures, 77 acres of berm was protected by rockfill, and 231 acres of easements were acquired.

An additional 225,000 linear feet of bank protection is proposed for Part 2 of the second phase of the bank protection project. The first contracts within the Second Phase Part 2 followed the outline of Part 1, 10 percent construction costs to be spent for providing easements and rockfill as mitigation techniques. Subsequent contracts provide mitigation on the basis of habitat-based analysis and provide for mitigative features including fish groins; experimental bank swallow habitat; riparian vegetation replanting; construction of berms and/or dredged berms; acquisition of easements and/or fee title; and the development of wetland habitats. To date, over 250 acres have been acquired as easements, and approximately 70 acres have been purchased in fee.

Third Phase. This project is currently in the planning phase and has not been authorized for construction. It is anticipated that environmental documentation could be completed as early as the end of 1992 and construction could begin in 1996. To date, an estimated 215,000 lineal feet of riprapping is planned, including reconstruction of 65,000 lineal feet and new construction of 150,000 lineal feet. The assessment of environmental impacts is currently under investigation.

YUBA RIVER BASIN INVESTIGATION

The reconnaissance study was completed in March 1990. Of the proposed alternatives investigated in the reconnaissance study, levee raising along the Feather and Yuba Rivers to provide at least a 150-year level of flood protection was found to be feasible. Detailed feasibility-level studies were initiated in

September 1991. A draft feasibility report and EIS are expected to be completed in late 1993. Levee raising, if authorized, would take place primarily on the landward side of the levees, affecting primarily agricultural and grassland habitats. Detailed environmental analysis and mitigation studies will be conducted for the EIS.

These enhancements would provide the Yuba River study area with protection in excess of the current design of the system. As a result, floodwaters which might otherwise cause levee failure and extensive flooding in the study area will be contained within the system and conveyed downstream. To the extent that these downstream flows would compromise the integrity of the existing system below the study area, these adverse hydraulic impacts would have to be addressed to determine if mitigation would be required as part of the project.

For example, it is currently believed that the Sacramento metropolitan area could withstand a 200-year storm on the Sacramento River because projected levee failures in the Yuba and Feather Rivers area would allow massive volumes of floodwater to leave the system, thereby reducing the stage of the flood at the Sacramento-Feather River confluence and allowing the peak flow of the storm to pass by Sacramento without any levee failure. (See discussion in Appendix K, Hydrology.) If the levee work contemplated as part of the Yuba River Basin Investigation results in 200-year flows being contained within the system, then these flows could raise the stage of the flood at the Sacramento-Feather River confluence enough to cause levee failure along a portion of the system protecting metropolitan Sacramento.

LOCAL TRIBUTARY PROJECTS

Portions of the Sacramento urban area are subject to flooding not only from the Sacramento and American River channels, but also from a series of tributary streams which form their own distinct flood plains. The three principal streams of concern in this regard are (1) the Morrison Creek Stream Group, which threatens portions of south Sacramento; (2) Magpie Creek, which is capable of flooding areas of north Sacramento; and (3) Dry Creek, which threatens the town of Rio Linda and the Cherry Island area of Sacramento County. To address these flood problems, a series of local tributary projects is contemplated.

South Sacramento Urban Levees and Tributaries Project

The South Sacramento Urban Levees and Tributaries project would provide increased flood protection to people and property subject to flooding from the Morrison Creek Stream Group. This group of waterways includes Morrison, Laguna, Unionhouse, and Elder Creeks. Morrison Creek drains an area of about 100 square miles upstream of its confluence with Laguna Creek. The creek has an extensive flood plain both upstream and downstream of this confluence. The creek is confined by levees and occupies a broad floodway as it flows through the bufferlands surrounding the Sacramento Regional Wastewater Treatment Plant. Morrison Creek then flows south into Beach, North Stone, and South Stone Lakes before entering the Sacramento-San Joaquin Delta through Snodgrass Slough and the Mokelumne River. Morrison Creek flows year-round and supports riparian vegetation, wildlife, and a warmwater fishery.

Laguna Creek drains an area of 47 square miles above its confluence with Morrison Creek in the bufferlands around the wastewater treatment plant.

Elder Creek runs generally parallel to the upper reaches of Morrison Creek. Elder Creek is tributary to Morrison Creek in its lower reaches. Much of the Morrison Creek flood plain is at a lower elevation than the Sacramento River. Two pump stations remove floodflows and summer low flows from the flood plain and discharge them to the Sacramento River. This prevents excessive buildup of floodwaters and also allows seasonal agricultural use of the flood plain lands.

Continued development in areas drained by the stream group may exacerbate existing flood problems in urbanized portions of the stream group flood plain, including much of southwest Sacramento and the Pocket area of the City. The City and County of Sacramento are negotiating a Memorandum of Agreement that would encourage new development in the flood plain to control runoff and eliminate further worsening of flood problems in the future. The City envisions three projects to increase the level of flood protection afforded to property in these areas from existing flooding conditions:

- o <u>Immediate Urban Levees Project</u>. This project would include stabilization and raising of the west/north Morrison Creek levees and would provide protection to southwest Sacramento and the Pocket area. It is anticipated that this project will be completed prior to construction of the selected plan. This work will be done as maintenance of the existing levees on the landward side. Most of the work will be accomplished on top of existing levees or landside stabilizing berms. A report on this work is being prepared by the City and is expected to be available in early 1992.

- Elder and Unionhouse Creeks, California, Section 205. Under this project, channel and levee improvements would be made on Elder, Unionhouse, and lower Morrison Creeks, with Corps, State, and local funding. The Corps is currently studying this project under its Section 205 continuing authorities program. A reconnaissance report for this study will be completed in early 1992. Final alternative plans and mitigation have not been completed at this time.

- Morrison Creek Stream Group, California. The City has also requested that a new general investigations study of the rest of the Morrison Creek Stream Group, including Elder, Unionhouse, Strawberry, and Florin Creeks, be conducted by the Corps under the Northern California Streams authority. These studies have not yet been authorized.

With these projects, raising or constructing levees and modifying channels to improve flow of floodwaters is anticipated. Exact areas of impact have not been identified. Some losses of riparian and wetland habitats will be inevitable in these types of projects. However, all three projects are being conducted in accordance with NEPA or CEQA guidelines and will seek to minimize impacts or fully mitigate unavoidable losses of habitat.

Magpie Creek Diversion Channel Improvement Project

This project would control flooding in the north Sacramento area of the City and portions of McClellan Air Force Base. Magpie and Don Julio Creeks are intermittent streams which originate east of McClellan in Sacramento County. Both Magpie and Don Julio Creeks originate north of I-80. The two creeks flow westerly through McClellan and presently join upstream from the Magpie Creek Diversion Channel. The combined flows are conveyed through the diversion channel to Robla Creek, which is tributary to Dry Creek, and thence into NEMDC. On McClellan, a lateral canal between the two creeks permits some equalization of flows in the two creeks and forms a common flood plain.

Urban development in the watershed, including development and channelization within McClellan, has increased peak runoff and flood volume to Magpie Creek and the existing diversion channel, thereby increasing the flood hazard to the area. Increases in runoff are due to the decrease in the amount of land available to store floodwater and to absorb rainfall and runoff resulting from urbanization.

The Corps is preparing a reconnaissance report for Magpie Creek under the Section 205 authority. The potential plan for this area involves channel modifications and levee construction from the confluence of the existing Magpie Creek Diversion Channel and Robla Creek near Vinci Avenue. A new flood control channel would be constructed from that point to connect to Magpie Creek at Patrol Road on McClellan. Additional flow deflectors would be constructed on the levee. A detention basin plan on McClellan will also be addressed during feasibility study.

Potential impacts include the loss and/or degradation of riparian and freshwater marsh, vegetation, grassland habitat, woody riparian habitat, and herbaceous riparian vegetation within the project area. These losses could affect roosting and nesting practices and breeding, feeding, and resting habitat for birds, small mammals, amphibians, and reptiles. However, vernal pools that lie near the proposed project area will be protected from impacts during channel and access road construction. In addition, the "Proposed Project" may affect cultural resources through disturbance of a cultural resource site during excavation. Mitigation for disturbed habitats would be provided by developed wildlife habitat on portions of McClellan. The reconnaissance report should be available by March 1992, after which feasibility level studies would be conducted.

Dry Creek Flood Control Project

This project would control flooding in the Dry Creek flood plain. The town of Rio Linda, as well as other areas along Dry Creek, is subject to frequent flooding because Dry Creek lacks adequate channel capacity to convey large floodflows. Hydrologic and hydraulic studies completed by the Corps have determined that Dry Creek is capable of carrying the runoff of about a 5-year frequency storm event. During the February 1986 flood, approximately 2,000 acres of the Dry Creek flood plain below the Sacramento County line experienced extensive flooding.

This flood problem is complicated by the fact that Dry Creek splits into two small branches above Rio Linda. When flows exceed the existing channel capacity, the total area between these branches becomes inundated. This area is referred to as Cherry Island. Numerous residential, commercial, and industrial structures are located in the Dry Creek flood plain along with several bridges and streets which become impassable during flood events. Flooding thus causes disruption to businesses and residences for periods of time lasting up to several days and results in flood damages. The reach of Dry Creek which is subject to the most severe flood damages is about 3 miles long and extends from Marysville-Rio Linda Boulevard to north of Dry Creek Road.

SAFCA is investigating alternatives to provide adequate protection (100-year flood protection) to people and property located in the Dry Creek flood plain. Based on preliminary engineering analysis and study, SAFCA developed a concept plan that includes a new leveed channel that bisects the existing flood plain which could protect the town of Rio Linda and its main transportation arteries (Elkhorn Boulevard and Dry Creek Road) from being inundated during a 100-year flood event. The new channel and levees would extend in length about 2 miles and would consist of an earthen trapezoidal channel having a bottom width of about 200 feet and an average depth of 15 feet. The levee would have a top width of 20 feet with side slopes of 2 to 1 on the landside and 3 to 1 on the waterside. The channel and levees would be located to avoid or minimize removal of any vegetation, particularly mature stands of trees. New bridges would be required at Dry Creek Road and Elkhorn Boulevard. Formal studies on this area should be conducted during the 1993-95 timeframe. Environmental clearance in accordance with CEQA will be obtained prior to construction.

PROJECTS DESIGNED TO MEET FEMA'S ADEQUATE FLOOD CONTROL PROGRESS GUIDELINES

Background

Prior to 1986, the Sacramento area, including the Natomas basin, was considered to have in excess of 100-year protection. After the 1986 storm of record, the Corps, at the request of FEMA, remapped the 100-year flood plain using the additional hydrologic data gathered since the last mapping, including the 1986 event. This resulted in the 100-year flood plain encompassing a significant portion of the urbanized Sacramento area which was previously thought to have more than 100-year protection.

Special legislation was passed by Congress which prohibited FEMA from promulgating new maps showing base flood elevations for the revised 100-year event. This moratorium on enforcing FEMA regulations provided for a 4-year period ending November 7, 1992. During this period, local governments must demonstrate progress towards addressing the region's flood control problems. In consideration of this legislation, FEMA has designated the new 100-year flood plain as an A-99 zone, which essentially means that the affected area is in the process of achieving a minimum 100-year level of flood protection. Under this zone designation, development may proceed without adjusting for base flood elevations. However, upon expiration of the moratorium, if sufficient evidence of increased flood protection is not shown, new structures built during this time would be subject to higher flood insurance rates, and other restrictions mandated by FEMA would be enforced on future development.

FEMA will review Sacramento's efforts prior to November 1992 to determine if "adequate progress" is being made to allow extension of the A-99 zone designation until all necessary flood control improvements are complete and the area is removed from the 100-year flood plain. SAFCA, in coordination with FEMA, has identified four actions which non-Federal interests are pursuing to obtain a positive finding in this regard: (1) completion of the necessary stabilization work on the Sacramento River levee, (2) authorization of a project providing comprehensive long-term flood protection along the main stem of the American River, (3) initiation of the levee improvements needed in Natomas on an expedited basis, and (4) reoperation of Folsom Reservoir to provide interim 100-year flood protection until permanent protection is in place along the American River.

The first condition is being addressed as phase 1 of the Sacramento River Flood Control System Evaluation discussed above. The second condition would be met through authorization of the American River Watershed Investigation selected plan. The third condition could be satisfied by means of the local project proposed by SAFCA. The fourth condition could be satisfied by temporarily increasing the space at Folsom which is seasonally allocated to flood control from 400,000 acre-feet to 590,000 acre-feet. The following section describes SAFCA's proposed local project and outlines the impacts associated with reoperating Folsom Reservoir on a temporary basis.

SAFCA Local Project

Because of the high flood risk in the Natomas area, SAFCA has proposed expediting construction of the Natomas levee improvements portion of the selected plan while the Corps completes detailed designs of the flood control dam.

Project Modifications. SAFCA has produced a report which describes the proposed local project. The report, "Natomas Area Flood Control Improvements," will be available in early 1992. A number of the features identified as part of the American River Watershed Investigation have been enhanced and/or modified by SAFCA for several reasons. (See Table 17-1.)

Topographic Information. The improvements proposed under the American River Watershed Investigation were based on the best available topographic information. Field survey verification is not generally included in a feasibility-level study. However, in anticipation of preliminary design leading to developing plans and specifications suitable for bidding and construction, SAFCA has conducted field survey work to verify existing levee elevations, bridge deck and abutments, and other topographic information to better define the scope of the project. Based on these new data, project modifications which better reflect existing field conditions have been incorporated in SAFCA's report.

Advanced Feasibility. As with any engineering project, feasibility-level designs are subject to change during final design and construction. Therefore, SAFCA's local project report recommends some modifications to the Corps' feasibility level project elements based on more thorough value engineering analysis, additional technical analysis, and coordination with local government. This process, which would otherwise have been undertaken in the preliminary engineering and design phase of the American River Watershed Investigation, has been expedited by SAFCA's early anticipated construction schedule. These modifications, therefore, are not necessarily in conflict with the American River Watershed Investigation.

Revised Design Flows. In designing the Natomas elements of the local project, SAFCA is using design flows in Dry Creek and the NEMDC which are different than those identified by the Corps for purposes of this investigation. The design flows used by SAFCA are substantially higher for two reasons:

- The Corps used 100-year peak flows from tributary streams downstream of Folsom Dam (including Dry Creek) in the design of the American River Watershed Investigation improvements. SAFCA proposes to use 200-year peak flows in the design of the local project.

TABLE 17-1. Comparison of Natomas Area Levee Improvements Proposed by the ARWI and SAFCA

FEATURE/IMPROVEMENT	ARWI	SAFCA	PRINCIPAL DIFFERENCE
1. NEMDC			
A. Raise portions of the east and west levees.	• West levee: Raise 13,500 lineal feet between West El Camino and Main Avenue 0.5 foot. • East levee: Raise 7,600 lineal feet between Arcade Creek and Main Avenue 0.5 foot.	• West levee: Raise 13,500 lineal feet between West El Camino and Main Avenue 2 to 3 feet. • East levee: Raise approximately 7,900 lineal feet between Arcade Creek and the south Dry-Robla Creek levee; modify stoplog structures at Main Avenue and the railroad.	• Finished height of levees under the SAFCA proposal would be 1.5 to 2.5 feet higher than COE, and the east levee would extend approximately 300 feet farther north past Main Avenue to tie into the existing South Dry-Robla Creek levee. Also, modifications to existing stoplog structures at Main Avenue and the railroad are not identified in the COE proposal, although it is believed these improvements would be necessary to implement the COE project.
B. Construct a new high-level bridge at Main Avenue.	• Replace the existing structure with two-lane, high-level-grade separated bridge.	• Replace the existing structure with a four-lane, 72-foot-wide, 650-foot-long, high-level-grade separated bridge with retained earth approach embankments spanning East Levee Road, NEMDC, and the railroad.	• The SAFCA proposal contains more specific details; however, bridge construction alternatives are limited at this location due to site-specific engineering constraints.

TABLE 17-1. Comparison of Natomas Area Levee Improvements Proposed by the ARWI and SAFCA (Continued)

FEATURE/IMPROVEMENT	ARWI	SAFCA	PRINCIPAL DIFFERENCE
1. NEMDC (CONTINUED)			
C. Construct a 700-cfs pump station and gated control structure across the NEMDC north of Dry Creek.	• Site the pump station at the west end of Ascot Avenue between East Levee Road and the railroad.	• Site the pump station approximately 650 feet north of Ascot Avenue between East Levee Road and the railroad.	• Pump station location. • The SAFCA proposal is based upon four equal size units with diesel motors, while the ARWI proposal is for three larger units with diesel motors and two small pumps with electric motors. • The SAFCA plant uses one set of stoplogs for dewatering the pump bays, while the ARWI plant uses eight 5-foot by 6-foot sluice gates (two per bay) to isolate the pumps. • The ARWI plant uses a catenary trash racking system and a single dual-purpose service deck, while the SAFCA plant uses a traveling rack, much shorter trashracks, and a separate (lower) trashrack service deck. • The bypass channel is controlled by a single radial gate (SAFCA) rather than two smaller sluice gates (ARWI).

TABLE 17-1. Comparison of Natomas Area Levee Improvements Proposed by the ARWI and SAFCA (Continued)

FEATURE/IMPROVEMENT	ARWI	SAFCA	PRINCIPAL DIFFERENCE
2. <u>ARCADE CREEK</u>			
A. Raise the north and south levees between Rio Linda Boulevard and Marysville Boulevard.	• North levee: Construct 2,400 feet of new levee about 3 feet high with a 20-foot top and 50-foot base on the north of Arcade Creek through Hagginwood Park downstream from Marysville Boulevard. • South levee: Raise 1,200 lineal feet of existing levee on the south side of Arcade Creek approximately 1 foot.	• Details unknown at this time.	• Both improvement proposals at this location are assumed to be similar, with the exception that SAFCA levees will be higher to provide a higher level of protection.
3. <u>DRY CREEK</u>			
A. Construct a new north Dry Creek levee.	• Construct approximately 4,600 lineal feet of new levee about 6 feet high with a 20-foot top and 50-foot base width extending along the north side of Dry Creek from the proposed pumping station at the NEMDC to high ground near West 2nd Stret and Ascot Avenue.	• Construct approximately 5,000 feet of new levee with a crest elevation of approximatley 42 feet m.s.l. adjacent to and along the east side (right-of-way) of the Union Pacific Railroad (UPRR), along the south side of Ascot Avenue west of West 2nd Street, and within the existing Ascot Avenue right-of-way, approximately 1,500 feet east of West 2nd Street.	• The SAFCA proposal includes slightly higher levee top finish elevation, longer overall reach, and different alignment on the west and east ends. • The SAFCA proposal maintains the eastern alignment within the Ascot Avenue right-of-way (east end), whereas the ARWI alignment extends northeast to high ground between 2nd Street and West 2nd Street.

TABLE 17-1. Comparison of Natomas Area Levee Improvements Proposed by the ARWI and SAFCA (Continued)

FEATURE/IMPROVEMENT	ARWI	SAFCA	PRINCIPAL DIFFERENCE
3. <u>DRY CREEK (CONTINUED)</u> A. (CONTINUED)			• On the west end, the SAFCA alignment heads north at the UPRR to tie into the SAFCA-proposed pump station site, whereas the ARWI alignment terminates at the UPRR at the ARWI-proposed pump station site. • The SAFCA proposal also provides details of interior drainage features. However, it is assumed that the ARWI proposal would require drainage features.
B. Construct a new South Dry-Robla Creek levee.	• Extend the existing south Dry Creek levee 2,400 feet with a 20-foot top and 40-foot base width along a northeasterly alignment to high ground at Rio Linda Boulevard.	• Construct approximately 1,500 lineal feet of new levee with a crest elevation of approximately 42.5 feet m.s.l. from the eastern terminus of the existing Dry-Robla Creek levee following an east-west alignment located approximately 350 feet north of Claire Avenue heading directly east to Marysville Boulevard.	• The SAFCA proposal includes slightly higher levee top finish elevation and an alignment located south of the ARWI's proposal. The SAFCA proposal also provides details of interior drainage features. However, it is assumed that the Corps' proposal would require similar drainage features.
4. <u>SANKEY ROAD</u> A. Raise existing levees and roads at the intersection of the Pleasant Grove Creek canal and Sankey Road.	• Raise 3,000 lineal feet of Natomas Road from Sankey Road to the south along the Pleasant Grove Creek canal approximately 4 feet with a finished 30-foot top and 60-foot base width. Raise the approaches to Sankey Road.	• Raise approximately 50 lineal feet of Natomas Road at the Sankey Road/Natomas Road intersection to approximately 45 feet m.s.l. Raise Sankey Road between the UPRR on the east and Natomas Road on the west to 3 feet above Pleasant Grove flood levels.	• SAFCA proposes to raise Natomas Road only at its intersection with Sankey Road, whereas COE proposes to raise Natomas Road an additional 2,950 lineal feet to the south. Also, SAFCA proposes to raise Sankey Road between the railroad and Natomas Road.

TABLE 17-1. Comparison of Natomas Area Levee Improvements Proposed by the ARWI and SAFCA (Continued)

FEATURE/IMPROVEMENT	ARWI	SAFCA	PRINCIPAL DIFFERENCE
4. <u>SANKEY ROAD (CONTINUED)</u>			
B. Construct a new drainage channel and necessary culverts from Sankey Road to the NEMDC.	• Construct a 3,000-foot-long, 3,000-cfs channel along the south side of Sankey Road and the east side of the UPRR, including a 3,000-cfs culvert to convey drainage waters under the existing railroad spur.	• Construct a 3,500-foot channel from just north of Sankey Road to the NEMDC, including a box culvert to convey drainage waters under Sankey Road. The channel alignment also requires relocation of the existing railroad spur and loading ramp located south of Sankey Road to the east side of the channel.	• The SAFCA drainage channel alignment is west of the ARWI alignment and 500 lineal feet longer. SAFCA proposes to raise Sankey Road between the railroad and Natomas Road and control flows into the NEMDC via a gated box culvert under Sankey Road. The ARWI proposes to raise only the Sankey Road approaches to Natomas Rod and use the remainder of Sankey Road between Natomas Road and the railroad as the hydrologic control.
5. <u>PLEASANT GROVE CREEK CANAL (PGCC)</u>			
A. Raise the west levee along the Pleasant Grove Creek canal at Fifield Road.	• Raise 500 lineal feet of the PGCC west levee at Fifield Road 1 foot.	• Raise approximately 220 lineal feet of the PGCC west levee 1.3 feet; raise approximately 350 feet of Fifield Road from 1.3 feet and 100 feet of the bridge deck 0.8 feet.	• SAFCA and ARWI improvements at this location are the same with the exception of proposed levee-raising lengths. The SAFCA proposal, however, provides better detail regarding improvements to Fifield Road and bridge.
B. Raise the west levee along the Pleasant Grove Creek canal at Howsley Road.	• No improvements proposed at this location.	• Raise approximately 230 lineal feet of the PGCC west levee 3 feet; raise 300 lineal feet of Howsley Road 1.5 feet; raise the existing concrete bridge at Howsley and the PGCC by increasing the asphalt surfacing by 0.5 foot on the west half.	• No COE improvements proposed at this location.

TABLE 17-1. Comparison of Natomas Area Levee Improvements Proposed by the ARWI and SAFCA (Continued)

FEATURE/IMPROVEMENT	ARWI	SAFCA	PRINCIPAL DIFFERENCE
6. <u>NATOMAS CROSS CANAL (NCC)</u> A. Raise the NCC south levee at selected locations.	• Raise 2,000 lineal feet near the Sacramento River about 0.5 foot; 2,500 lineal feet near Highway 99 about 1 foot; and raise 2,500 lineal feet near Cross Canal Milepost 2 about 1 foot.	• Construct 2-foot retaining walls and backfill the westerly Highway 99 bridge parapet wall across the end of the levee road and between the south bridge abutments.	• None of the Corps-proposed NCC improvements are included in the SAFCA proposal. SAFCA field surveys indicated that recent levee work has eliminated the need for levee raising.

- Sacramento and Placer Counties have contracted with the consulting firm of James M. Montgomery to perform hydrologic studies of the Dry Creek watershed. The design flows recommended by Montgomery are substantially higher than those used by the Corps. This flow-rate variation results mainly from differing modeling techniques adopted in analyzing the existing land use and topographic conditions. Because of uncertainty in future conditions and potential hydrologic changes as additional years of rainfall data are analyzed, SAFCA proposes to use the higher, more conservative flows recommended by Montgomery in design of the local project.

Using the higher flows will raise the design profiles of the NEMDC levees south of the Dry Creek confluence and the proposed Dry Creek levees east of the NEMDC. In addition, new levees not identified as part of the American River Watershed Investigation will be required along Dry Creek to contain the higher flows.

Schedule. As summarized in Table 17-1, the various elements to be constructed by SAFCA as part of the local project include levee work on NEMDC and Dry and Arcade Creeks; Main Avenue bridge reconstruction; NEMDC pump plant construction; extension of NEMDC to Sankey Road; the work at Fifield and Howsley Roads; and work on the Cross Canal. This work could be completed in approximately a 3-year timeframe, thereby providing an increased level of flood protection for the Natomas basin by around 1996. Interim measures such as stoplog structures may be proposed to achieve the desired flood protection even sooner than this.

Environmental Documentation. In order to meet the above schedule, SAFCA intends to circulate a draft EIR on the local project in January 1992. A final EIR is scheduled to be issued and certified at the end of June. This document will provide a detailed assessment of the direct impacts of the local project. These impacts will be similar to the impacts discussed elsewhere in this EIS/EIR.

Folsom Reoperation Study

This study examines the reoperation of Folsom Dam and Reservoir as a short-term measure to achieve FEMA-level flood protection for the Sacramento area during construction of permanent increased flood protection measures for the Sacramento area. The permanent flood protection plan could be in place within 10 years. Additional flood control space would be reserved in the reservoir during winter and spring to manage stormflows. Initiated in November 1988, a special study report was completed in early 1991. A decision document and EIS is scheduled for completion in mid-1992.

The special study report is under review at the Corps' Washington offices. Upon approval, the report will be forwarded to Congress and the public for information. The special study identified potential impacts within the American River Watershed. These included reductions in available water supply and hydropower from the USBR Central Valley Project (CVP), increased costs to water users of Folsom Reservoir for pumping water greater distances, and a reduction in recreation opportunities due to lower reservoir levels and changed flows in the lower American River. Potential adverse impacts could occur to riparian vegetation within the American River Parkway and to fall-run Chinook salmon due to higher water temperatures.

Because Folsom Dam and Reservoir are part of the CVP, operational changes at this reservoir will have operational impacts at other portions of the CVP, which extends from Lake Shasta to the delta pumping plants. Changes in the CVP operations could also affect operations within the State Water Project. These potential impacts are being addressed in the Decision Document and EIS scheduled to be completed in mid-1992. Impacts to other portions of the CVP are not expected to be as severe as in the American River Watershed. However, significant impacts to endangered winter-run Chinook salmon and delta smelt are possible.

POTENTIAL GROWTH-INDUCING PROJECTS

LOCAL INFRASTRUCTURE PROJECTS

The selected plan would remove flood-related restraints to growth in undeveloped portions of the Natomas, Meadowview, and Pocket areas of the City and County of Sacramento, as well as south Sutter County. However, the selected plan alone would not be sufficient to produce growth in these areas. In addition, there must be a series of local projects aimed at overcoming infrastructural obstacles other than flooding, such as controlling drainage, providing water, sewer, and other utilities, and improving transportation flow. Discussion of required projects can be found in the following local capital improvement plans and related planning documents.

- County of Sacramento, Five Year Capital Improvement Plan; 1989-90.

- o City of Sacramento, Capital Improvement Budget; 1989-1994.
- o Sacramento Area Council of Governments, Memorandum concerning CTC staff recommendations for 1990 State Transportation Improvement Program.

The growth-related impacts and mitigation associated with these infrastructural projects are discussed under each impact category in the main report as well as in Chapter 18.

HIGHWAY 49

Background

Construction of a flood control dam near Auburn would cause periodic flooding of Highway 49 along its present alignment where it crosses the North Fork of the American River canyon. It is estimated that the highway would be out of service a half day for a 2- to 3-year event, 10 days for a 10-year event, and 34 days for a 200-year event. The closure of the highway would result in rerouting traffic to local County roads. The current average daily traffic load between Cool and Auburn is approximately 6,000 to 7,000 vehicle trips. Travel times from Cool to Auburn would increase from the current 15 minutes to approximately 1 hour and 15 minutes for travel around the western end of Folsom Lake. There may also be increased traffic-related problems on alternate County roads, including increased deterioration on the roads and increased threat to public health and safety.

To avoid the impacts of inundating Highway 49, the selected plan includes replacing the highway above the maximum elevation of the detention pool created by the flood control dam. That portion of the highway will follow the existing alignment as closely as the canyon topography allows and will be designed to current standards as a two-lane road. No allowances are made for expected future traffic. Under Federal law, the non-Federal sponsor of the project is responsible for carrying out this replacement.

Highway 49 between Placerville and Grass Valley has been under study by Caltrans over the last 25 years. Increasing growth and recreational activity in this corridor require upgrading the level of service of the highway. The latest Route Concept Report for Highway 49, prepared by Caltrans in August

1990, calls for upgrading this stretch of highway, including the American River crossing, to at least a four-lane expressway. Currently the American River canyon section is a relatively low priority because of uncertainty about the construction of the USBR's multipurpose dam at the Auburn site. The need to raise the Highway 49 bridge and approaches to avoid periodic inundation by the proposed flood control dam may provide incentive for Caltrans or other State or County agencies to advance the Highway 49 realignment studies to coincide with construction of the flood control dam relocations.

Section 75 of the California Streets and Highways Code empowers the California Transportation Commission (CTC) to "select, adopt, and determine the location for State highways on routes authorized by law." Highway 49 falls within this legislative provision. A freeway route adoption was executed on February 20, 1969, for a new Highway 49 crossing of the American River between existing Highway 49 south of Cool and Auburn Folsom Road, crossing the proposed USBR multipurpose dam. In the ensuing 21 years, development along this route and increased traffic conditions would likely prohibit use of the alignment for an access-controlled State highway. According to Caltrans regulations, a new route adoption study which includes environmental clearance and CTC approval must be undertaken to revise the adopted alignment. This route adoption process must be based on Caltrans regulations which call for:

- Formation of an interdisciplinary project development team and execution of a cooperative agreement between Caltrans and the other State and local agencies involved in the process.

- Development of a work program providing for initial reconnaissance-level studies to identify alternatives and later feasibility and environmental studies to evaluate the identified alternatives and indicate the recommended plan.

- Selection of the preferred alternative by the CTC.

The route adoption studies and detailed environmental analysis required by Caltrans may be performed in the future to meet the existing and future transportation needs of the area. This chapter presents only a general discussion of the existing condition of the highway, potential alternative relocation alignments, and the types of direct impacts associated with these alternatives. The actual alternatives that would be addressed in these studies are not known.

The route adoption study and environmental analysis mandated by the CTC could be undertaken prior to, concurrently with, or subsequent to State legislative authorization of the American River Watershed Investigation. The State legislature may identify an appropriate lead agency for carrying out this analysis. The lead agency could be the Department of Water Resourcés, The Reclamation Board, Caltrans, El Dorado or Placer County, or the Sacramento Area Flood Control Agency (SAFCA). If the legislature does not identify a lead agency, the lead agency would be determined pursuant to Section 15052 of the CEQA Guidelines. In any event, those State and local agencies, in coordination with the U.S. Department of Transportation, would all participate in the further analysis of alternatives for the Highway 49 replacment. The U.S. Department of Transportation may become involved if the State asks it to authorize Federal highway funds to pay for portions of Highway 49 that may be desirable for the adopted route.

Existing Conditions

Highway 49 connects downtown Auburn to the Cool/Pilot Hill area by a bridge that makes a low crossing of the Middle Fork of the American River, slightly upstream from the proposed damsite. The Auburn area is generally developed, with heavy traffic passing through Auburn along I-80 and heading north along Highway 49 to Grass Valley and Nevada City. About 6,000 to 7,000 vehicles daily use the segment of the highway that crosses the North Fork (1987 Traffic Conditions). It is estimated that traffic is now increasing at a rate of about 3 percent per year. This segment of Highway 49 has poor vertical and horizontal alignments, and travel is slow, with an average travel time of 11 minutes for this 5.8-mile segment, or about 30 miles per hour.

In August 1990, Caltrans revised the Route Concept Report for Highway 49 (Concept Report), including the segment that contains the Highway 49 bridge over the Middle Fork. This segment, which is a two-lane conventional facility, is currently rated at Level of Service (LOS) "D." The LOS ranking system is based upon peak-hour traffic on this segment, which is already operating at LOS "E" and is expected to decline to LOS "F" by 2000.

Possible Highway 49 Realignment Alternatives

The Concept Report states that ". . . the unique nature of Route 49 (that is, historical and topographical constraints) in urban areas, precludes the possibility of significantly improving Route 49 on the existing alignment." According to Caltrans, the "concept facility" from El Dorado to Lotus in El Dorado County is a realigned, staged four-lane expressway, while the "concept improvements" to Highway 49 from Auburn to Grass Valley would consist of upgrading to expressway standards and adding lanes, including a bypass east of Auburn. The portion of Highway 49 affected by the project would serve as a link between these two sections of the highway. Thus, it is reasonably foreseeable that a similar staged four-lane expressway would eventually connect these two segments.

The following possible alternative alignments were developed by the Corps in early studies for the American River Watershed Investigation. Alternatives 1 and 2 are very similar to concepts proposed by Placer County Department of Public Works in 1987. These or similar routes may be addressed in future route adoption studies. These alternative routes are shown in Figure 17-1.

Alternative 1 - Middle Fork Crossing - Twin Bridge Concept. This alternative includes the construction of a high bridge across the Middle Fork of the American River, connecting Highway 49 near Cool and Foresthill Road and designating Foresthill Road as Highway 49 from Cool to its intersection with I-80. This alternative could require adding an additional lane to the existing Foresthill bridge. One disadvantage to this alternative is that portions of Foresthill Road have grades in excess of 7 percent, which exceed Caltrans planning criteria. Another impact is that upgrading the I-80 interchange at Foresthill Road would probably eliminate certain commercial development.

Alternatives 2 and 2A - River Mile 19. These alternatives include a new road and high bridge from I-80 near Newcastle, terminating on Highway 49 midway between Pilot Hill and Cool. The existing I-80 interchange at Newcastle could be more easily upgraded than others to accommodate the alignment and increased projected traffic levels. This alternative would require a substantially longer bridge. Alternative 2A would follow essentially the same alignment; however, this alternative would require a new interchange between Auburn and Newcastle and a new road segment between I-80 and Auburn.

Alternative 3 - River Mile 17. This alternative diverges from Highway 49 just north of Pilot Hill, crosses the North Fork at river mile 17, and joins I-80 at the existing Newcastle interchange. This alternative and alternative 2A share the same alignment from the Newcastle interchange for approximately 3 miles. The bridge crossing could be at a lower elevation than the mile 19 alternative, allowing the use of less expensive concrete construction.

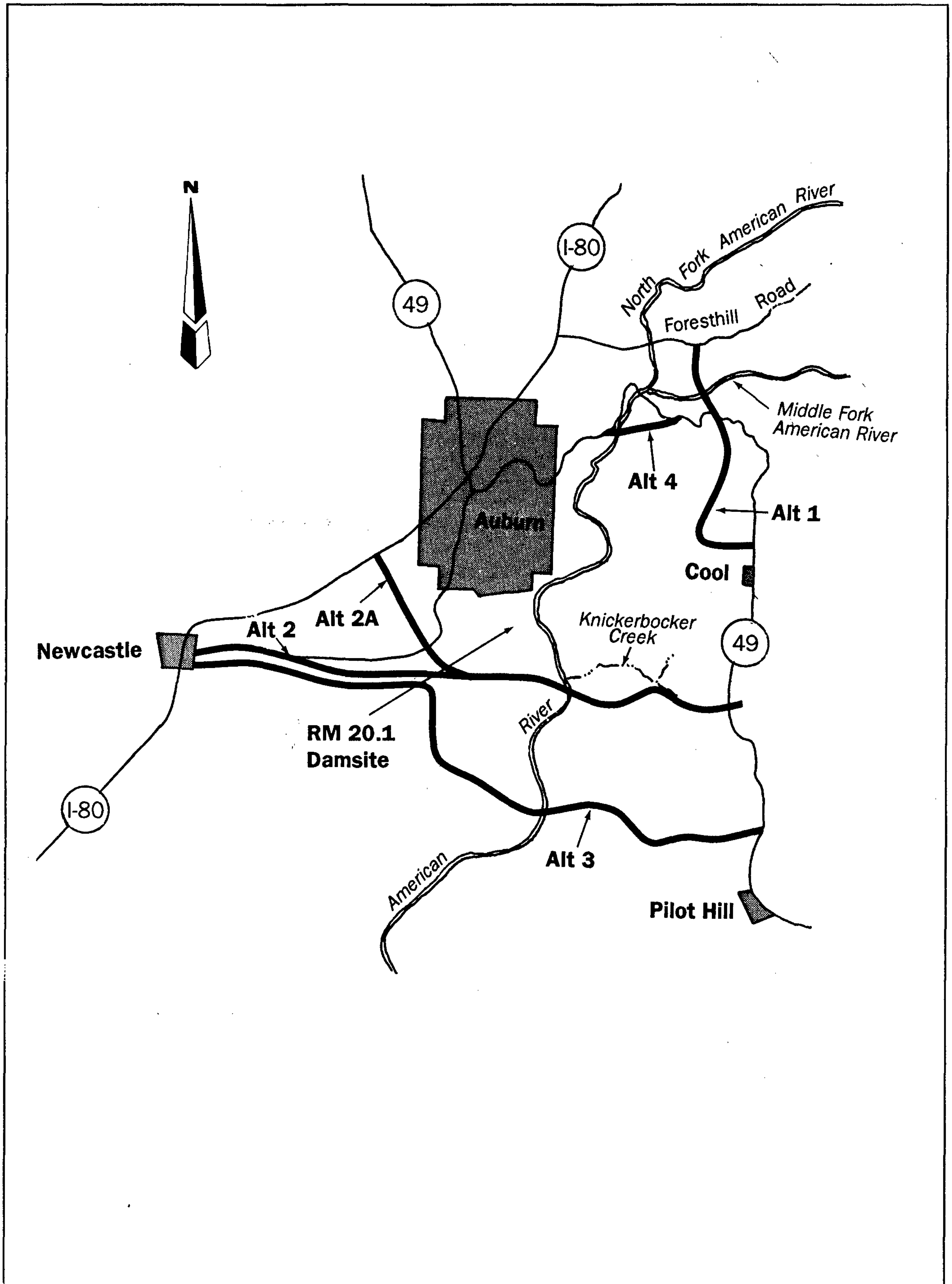


FIGURE 17-1. Highway 49 Relocation - Alternative Alignments

Alternative 4 - High Bridge - Present Location. This alternative involves replacing the present low bridge with a high bridge along a nearly identical alignment across the canyon. This alternative could compound present traffic problems where Highway 49 enters the downtown Auburn area and could also disrupt existing residential areas near Auburn.

Impacts

The following section provides a general discussion of direct impacts by issue area for each of the possible alignments identified. Where appropriate, impacts are identified that would be common for all alignments. A complete analysis of environmental impacts would be accomplished during the route adoption process.

Land Use. The relocated highway could result in the displacement of existing residential units and conversion of rural uses to alternative land uses. Relocation assistance would be made available to eligible displaced persons. Other land use impacts, (e.g., loss of prime agricultural lands) would be insignificant based on a review of the land uses along possible alignments.

Alternative 1. Of the alternatives involving a new route, the proposed alternative 1 alignment of Highway 49 would have the least impact on the surrounding land uses for two reasons. First, relative to alternatives 2, 2a and 3, alternative 1 requires little acquisition of land. Second, this alternative passes through an area with very little existing development; thus, increased noise levels and changes in viewshed would affect very few people. This alignment would not result in any direct access improvement to lands that could be developed with urban uses.

Alternative 2. Impacts resulting from alternative alignment 2 would be significant due to the level of disruption of the surrounding land uses. Alternative 2 would pass through designated recreational areas, agricultural land, existing and proposed housing tracts, and across a historically significant railroad track. Alignment 2 would pass through the Auburn State Recreation Area located along the American River southeast of the City of Auburn. Just below Auburn, the land use is agricultural and residential. There are several existing housing tracts at various levels of buildout and several more proposed developments in the area. With implementation of this alternative, a substantial amount of land as well as homes may be lost. Furthermore, alternative alignment 2 would create substantial impacts on the residents of the area due to increased noise and air quality impacts.

One benefit of this alignment would be a reduction in the amount of traffic passing through Cool and the City of Auburn.

Alternative 2A. Since alternative 2A follows generally the same alignment as alternative 2, the impacts would be essentially the same as listed above.

Alternative 3. Again, due to its similarity to alternative 2, alternative 3 would have similar impacts. The main difference between these two alignments is that alternative 3 would not pass through the Auburn State Recreation Area.

Alternative 4. The proposed alternative 4 follows a path similar to the existing Highway 49. The only deviation is the location of the bridge which would be just south and higher up on the canyon from the existing Highway 49 bridge. Because this alignment requires little change from the existing route, there would be minimal land use impacts. Those lands that would be directly affected all fall within the Auburn State Recreation Area.

Construction-Related Impacts. Construction-related impacts would occur for any of the alternatives. These impacts would include temporary increases in air pollutant emissions, noise levels, disruption of local transportation routes, and potential water-quality concerns. These impacts would occur during the construction phase and could result in short-term significant impacts. The relative level of impact is dependent on the proximity of sensitive uses to the construction sites and the number of transportation facilities disrupted. Based on the information presented under Land Use, alternatives 2, 2A, and 3 would result in substantially higher direct impacts during construction because of the scope of improvements required and their location in relation to existing and proposed residential uses.

Vegetation. All the alignments would require removal of vegetation within the right-of-way. HEP analyses conducted for the entire Auburn State Recreation Area identified six broad vegetation cover types in the project area: evergreen hardwood forest (north slope oak woodland), evergreen hardwood forest (south slope oak woodland), grassland/savannah, riverine riparian, chaparral, and wetland. Mitigation for vegetation loss along all the alternative routes would include revegetation of disturbed areas and possible set-asides at other locations. Development of any of the alignments would incrementally contribute to cumulative impacts associated with conversion of natural habitat to urban uses.

Alternative 1. On the northern side of the Middle Fork, south of Foresthill Road, this alignment would encounter a 30- to 40-degree slope. The orientation of this slope is south; vegetation is chaparral (90 percent) and herbaceous (10 percent). The rest of the alignment would be south of the Middle Fork. In this area, slopes are approximately 30 degrees, orientation is north-northeast, and vegetation is mixed oak woodland. Implementation of this route would result in the removal of a substantial amount of relatively undisturbed vegetation in these areas.

Alternative 2, 2A, and 3. On the Placer County side of the river, these alignments would pass through an area that is 50 percent developed residential/commercial with the balance in open space and agricultural uses. Natural vegetative communities in the area include scattered live oak woodland and nonnative grasslands. These alignments would also result in removal of evergreen hardwood forest (north and south slope oak woodland) and chaparral in the Middle Fork canyon area.

Alternative 4. Vegetation removal would be much less for this alignment. Some vegetation loss would be required to construct the bridge crossing; however, extensive new roadways would not be required. Vegetative cover expected to be affected would include both north and south slope evergreen hardwood forest and chaparral.

Fisheries. Historical records of fish resources in the Middle Fork of the American River are limited. Construction of the Placer County Water Agency's Middle Fork American River project in 1962 resulted in cooler water temperatures in summer and fall, improving and protecting the habitat for resident and stocked cold water species. FWS surveys in September 1989 found the following species: Sacramento hitch, Sacramento sucker, Sacramento squawfish, riffle sculpin, and brown and rainbow trout. All the proposed alignments would require a bridge crossing of the Middle Fork of the American River. Impacts on fisheries could occur if water quality is affected by construction activities. This potential impact would be short term during construction, and implementation of appropriate construction techniques, including diversion of natural streamflows from active bridge construction sites, could mitigate this impact to less than significant.

Wildlife. The possible highway alignments are in a region of high wildlife species diversity. Six broad vegetation cover types were recognized in the upper American River study area for HEP analysis. Four of these cover types occur in the Middle Fork canyon. The cover types and the wildlife associated with each are:

- Riverine riparian: water and shore birds, such as dipper, sandpipers, Great Blue Heron. Amphibians and reptiles flourish here. Important to large mammals such as deer, bobcat, raccoon, and ringtail.

- Grassland/savanna: important foraging sites for deer, bear, raptors such as red-tailed hawk, golden eagles, and many small mammals, reptiles, amphibians, and songbirds.

- Chaparral: quail, turkey vulture, deer, mountain lion, many species of small mammals, reptiles, and songbirds.

- Evergreen hardwood forest (south slope oak woodland): species such as deer, bobcat, coyote, wild turkey, grey squirrel, and songbirds. Upland game, such as cottontail rabbit, quail, and turkey. Many species of snakes and lizards.

Any of these alignments would result in elimination of natural habitat areas and disruption of movement corridors. These losses could significantly affect local wildlife populations. On the other hand, one advantage of a high bridge alignment would be to reduce traffic in the canyon bottom as this area is an important wildlife movement corridor.

Endangered Species. Based on the species lists provided by FWS and the California Department of Fish and Game, several studies were initiated to determine if listed species occurred in the project area. The following species have been identified as potentially inhabiting the Middle Fork project area: valley elderberry longhorn beetle, California red-legged frog, and Yate's snail.

Visual. Replacement of Highway 49 would result in visual impacts by changing the character of existing land uses. A high bridge would be required for all alternatives. Road alignments would require cut and fill and would alter existing viewsheds along each alignment. Although visual impacts along each alignment could be partially mitigated through revegetation, residual direct impacts would be significant and unavoidable.

Cultural Resources. Studies prepared by the University of California, Davis, in connection with the USBR multipurpose project identified a total of 1,589 historic and 125 prehistoric sites in the Auburn area. The Middle Fork has 99 historic sites and 8 prehistoric sites documented.

Review of the possible alignments indicated there are relatively few known cultural resources along them. However, additional surveys would be performed during the route adoption study to determine the existence of any cultural or archeological resources. If any such resources are identified, appropriate mitigation measures would be adopted in consultation with the State Historic Preservation Officer.

Noise. Alternative alignments 2, 2A, and 3 would potentially expose existing residences in southwest Auburn to unacceptable noise levels. Noise impacts along alternative 1 would be minimal because of the low population along the alignment. Alternative 4 would not substantially alter existing noise conditions as it would effectively follow the existing alignment. Appropriate noise mitigation techniques could be employed to reduce these impacts to less than significant.

Recreation. Construction of a high bridge alternative would divert traffic away from the current low bridge alignment of Highway 49. Depending on whether supplemental access points are provided to the canyon bottom and whether the existing Highway 49 route is maintained, recreational access to the American River canyon could be significantly reduced. Appropriate mitigation would include retaining the existing Highway 49 alignment as a recreational access to the canyon bottom and considering other potential access points off each alignment.

Growth Inducement. The potential for each of the high bridge alignments to accelerate growth in the upper American River area and the impacts likely to result from this growth are discussed in Chapter 18.

MULTIPURPOSE AUBURN DAM

BACKGROUND

The Auburn-Folsom South Unit of the Central Valley Project was authorized in 1965 under Public Law 89-161 for construction by the USBR. Included among its features were the Auburn Dam and Reservoir on the North Fork American River above Folsom Reservoir. The dam, as originally proposed, would have impounded a reservoir of 2.3 million acre-feet, inundating over 10,000 acres of lands and providing water supply, hydropower, recreation, fish and wildlife, and flood control benefits. The dam would have operated in conjunction with Folsom Reservoir to provide what was then approximately a 250-year level of flood protection to the Sacramento area. At that time this was considered the standard project flood. To provide similar protection today would require substantially more dedicated flood control space in the multipurpose reservoir.

Construction of the dam was suspended in 1975 following a 5.7 Richter magnitude earthquake at Oroville, California. Although seismic studies indicated that the probability of a major earthquake (6.0 or greater) at the Auburn site was relatively low, the planned double curvature, thin arch design was replaced with a concrete gravity design. Construction was not restarted because Federal policy changed on non-Federal cost-sharing. Currently, the local non-Federal project sponsor must pay, at the time the project is constructed, the cost of all hydropower and municipal and industrial water supply features. To date, a non-Federal project sponsor has not been identified.

There is a fairly consistent and vocal constituency for completion of a multipurpose dam. The current drought and water-quality concerns have been cited as reasons for such a facility. The USBR has been funded to conduct new water needs studies for the CVP's American River Service Area. These factors suggest there is a reasonable foreseeable possibility of the construction of a multipurpose project in the future.

A multipurpose project could occur in one of two possible ways: (1) construction of a multipurpose facility independent of flood control proposals on the American River (authorized and built instead of flood-control-only facilities or at a different location from the proposed flood control dam) or (2) expansion of the proposed flood-control-only dam sometime in the future. This section discusses the facilities required to expand the proposed flood control facilities to a multipurpose dam, and then summarizes the potential impacts of a large multipurpose dam that would occur under either method of authorization. This discussion draws heavily on the previous environmental work completed by the USBR for the full-sized multipurpose Auburn Dam.

ACTIONS REQUIRED TO EXPAND A FLOOD-CONTROL-ONLY DAM TO A MULTIPURPOSE FACILITY

Expansion of the proposed flood control dam into a multipurpose facility providing water supply, electric power generation, and recreation in addition to flood control would require physical modifications, Congressional authorization, and identification of non-Federal cost-sharing partners.

The major physical modifications to the flood control facilities include:

- o Additional foundation work and grouting.
- o Additional RCC to raise the dam to the desired crest elevation.
- o Removal of existing bulkhead emergency gates.
- o Construction of outlet works.
- o Construction of a generating plant and electrical transmission facilities.
- o Reconstruction of the emergency spillway.
- o Installation of regulatory gates on the spillway.
- o Construction of recreational facilities.

In addition to structural modifications, it will be necessary to acquire fee title to additional lands not currently in governmental ownership and to convert flowage easements acquired for the flood detention dam to fee title.

Recent reconnaissance-level cost projections have estimated the cost of a 2.3 million acre-foot multipurpose dam at approximately $1.6 billion. This cost would be reduced by the value of the flood control dam facilities which are incorporated into the expanded multipurpose facility.

The expansion of the flood control dam to a multipurpose facility would trigger a reallocation of costs among the project purposes. The reallocation would most likely be implemented using the principles of the Separable Costs-Remaining Benefits methodology.

Under this methodology, each purpose bears the full cost of including that purpose in the project (its separable cost); the remaining joint costs are shared among project purposes in proportion to "remaining benefits" (the excess of benefits over separable costs for each purpose). If the separable costs of any purpose exceed its benefits, the inclusion of that purpose in the multipurpose project is not economically justified and reformulation is indicated. An additional principle of the methodology is that the cost allocated to any purpose may not exceed the cost of a single-purpose alternative means of obtaining the same benefits. The cost of the single-purpose alternative project is not relevant to the allocation unless it is smaller than the benefits assigned to that purpose. A cost allocation, using a recent USBR cost estimate for a 2.3 million acre-foot reservoir, demonstrates how the reallocation might work for that reservoir. Allocation percentages would be different for a flood control dam expanded to a 2.3 million acre-foot multipurpose reservoir, but would be similar enough to allow a comparison with the flood control facility costs.

Since the Separable Costs-Remaining Benefits allocation procedure constrains the cost allocated to flood control (and any other purpose) to the cost of the single-purpose alternative--in this case the cost of the constructed single-purpose flood control dam--the allocation to flood control would most likely be the same as or perhaps less than the actual expended cost of the flood control dam.

The Federal sponsor of a dam expansion project would, under current Federal regulations, be required to find non-Federal cost-sharing partners to fund the costs allocated to the water supply, recreation, and hydropower purposes. These cost-sharing percentages vary from purpose to purpose and for flood control are subject to minimum and maximum values; however, they can be generally described as:

	Non-Federal Sponsor	Federal Sponsor
Hydropower	100%	0%
Agricultural Water Supply	35%	65%
M&I Water Supply	100%	0%
Recreation	50%	50%
Flood Control	25%-50%	50%-75%

A potential breakdown of non-Federal cost-sharing percentages is shown in Table 17-2. A detailed feasibility study would be required to specify exact Federal and non-Federal costs for any expanded dam project.

TABLE 17-2. Approximate Costs and Allocations for a 2.3 Million Acre-Foot Multipurpose Auburn Dam, Expanded from Flood Control Only

Purpose	Allocated Cost (million)	Allocated Share	Federal Cost	Non-Federal Cost	Non-Federal Sharing Percentage
Hydropower	460	29.0%	0	460	100.0
Water Supply	370	23.0%	0	370	100.0
Recreation	20	1.5%	10	10	50.0
Instream Flow	120	7.5%	60	60	50.0
Flood Control	620	39.0%	460	160	26.0
TOTAL	1,590	100.0%	530	1,060	

Note: USBR October 1989 estimated costs were projected to October 1990 using a 4 percent escalation factor. Cost allocation by USBR.

The American River Watershed Investigation feasibility study does not recommend deauthorizing of Auburn-Folsom South Unit of the CVP (the original authorization for USBR's Auburn Dam Project). By leaving the previous authorization intact, the Federal ownership of lands in the inundation zone would not be affected. All fee land required for the flood control project will be acquired by joint use permits. The non-Federal sponsor will obtain flowage easements from the Federal landowners within the inundation zone. Any future disposition of lands would have no effect on the flood control project. Congress could then determine the disposition of those lands outside of the inundation zone, independent of the flood control project. These lands could be retained for a future multipurpose dam or a Federal recreation area.

Under applicable Federal planning principles and guidelines as well as Congressional policies, the authorized multipurpose project could not proceed at the Auburn site without being redesigned, subjected to environmental review, and reauthorized by Congress. This would be true whether the redesigned project provided for converting or expanding the flood control dam or for constructing a new dam in a different location. Since such review and reauthorization would be required even without the proposed flood control dam, implementation of the selected plan would not impose any new procedural requirements on the multipurpose project or avoid any requirements which would otherwise apply (CEQA Guidelines, Section 1502.9).

IMPACTS

This section discusses the impacts that would result from the expansion of the proposed dam into a multipurpose project (assuming that design plans for such an expansion are completed and authorized by Congress). The discussion will focus primarily on the expected direct project impacts of the 2.3 million acre-foot reservoir analyzed by the USBR. Smaller multipurpose reservoirs have been studied by the USBR and the DWR. However, consideration of the largest feasible structure would maximize impacts and, therefore, represent a worst-case scenario. This approach allows for the fullest range of alternatives.

Fish and Wildlife

A 2.3 million acre-foot reservoir, with a maximum water-surface elevation of 1,135 feet above sea level, would permanently inundate over 10,000 acres of river canyon and 48 miles of mostly free-flowing stream. By comparison, the flood-control-only dam, with a maximum water-surface elevation of 920 feet above sea level, would temporarily inundate 4,000 acres of canyon and 36 miles of stream.

Mapping efforts conducted by the FWS in 1989 showed that the predominant cover types within the respective flood storage pools of both the dry dam and multipurpose dam include north slope oak woodlands, south slope oak woodlands, chaparral, coniferous forest, grasslands, and riverine/riparian habitat. A comparison of the acreages for the various cover types is displayed in Table 17-3.

Based on the total acres of each cover type inundated by the large reservoir and average Habitat Suitability Indices for those cover types, it is estimated that the large reservoir would increase the loss of habitat units within the north slope oak woodlands by 872 percent over the flood control dam, increase

TABLE 17-3. Comparison of Habitat Losses Between Projects

	North Slope Oak Woodland	South Slope Oak Woodland	Chaparral	Coniferous Forest	Grassland	Montane Riverine	Total
A. Total Acres of Cover Type Inundation Zone							
Multipurpose Reservoir[1]	4034	4068	653	729	757	NA*	10241*
Flood Control Dam	1790	1753	241	274	533	NA*	4591*
Difference	2244	2315	412	455	224	NA*	5650*
B. Acreage Losses Attributable to Project Construction and Operation							
Multipurpose Reservoir	4034	4068	653	729	757	NA*	10241*
Flood Control Dam	603	585	180	93	166	301	1927
Difference	3431	3483	473	636	591	301	8615*
C. Habitat Unit Losses Attributable to Project Construction and Operation							
Multipurpose Reservoir Acreage	4034	4068	653	729	757	NA*	10241*
Average HSI/Acre	0.77	0.59	0.85	0.77	0.73		
Total HUs Lost	3106	2400	555	561	553		7175*
Flood Control Dam Acreage	603	585	180	93	166	301	1927
Average HSI/Acre	0.77	0.59	0.85	0.77	0.73	0.80	
Total HU's Lost	356	450	153	71	121	241	1392
D. Net Increase in Habitat Units Lost Resulting From Multipurpose Reservoir							
	2750	1950	402	490	432		5783
E. Percent Increased Habitat Loss of Multipurpose Reservoir over Flood Control Dam							
	872	533	363	790	457		

[1] U.S. Fish and Wildlife Service, 1990

NA - Not available

the loss of south slope oak woodlands by 533 percent, and increase the loss of chaparral by 363 percent (Table 17-3). Grassland habitat acreages would be expected to increase with the flood control reservoir due to conversion from other cover types, while the multipurpose reservoir would be expected to result in the loss of 757 acres of grassland. The acreages associated with these projects are not directly comparable between alternatives, but an absolute loss of 553 habitat units associated with grassland cover would be expected with a large reservoir.

The flood control reservoir would be expected intermittently to inundate approximately 36 miles of the North and Middle Forks of the American River. The large reservoir would permanently impound 48 miles of stream. Notwithstanding Lake Clementine in the North Fork, the large reservoir would result in the conversion of a free-flowing riverine fishery to a flat-water lake fishery. The flood control reservoir would maintain existing stocks of warm and cold water species, such as rainbow trout, brown trout, smallmouth bass, Sacramento squawfish, and Sacramento sucker. The large reservoir would tend to favor sunfishes, largemouth bass, smallmouth bass, and catfish. However, species compositions and populations would be highly dependent on stocking programs implemented by the California Department of Fish and Game.

The multipurpose reservoir project could provide benefits to the regional fishery by dampening the water-level fluctuations in Folsom Reservoir and providing additional cold water storage capacity to enhance natural production of steelhead trout and Chinook salmon in the lower American River. The magnitude of these potential benefits would depend upon operating procedures and the amount of water storage allocated to these purposes.

Recreation

As described in previous sections, the estimated visitation in the upper American River canyons is approximately 500,000 persons annually. Notwithstanding the viewshed impacts described in Chapter 16, the flood control dam is not expected to change the type, location, or quality of recreation in the upper American River basin. In addition, visitation is not expected to be significantly affected during flood operations because such events would be infrequent, of relatively short duration, and would occur during off-peak season when visitation is less than 10 percent of annual use. Inclement weather would be associated with flood operations and would normally inhibit off-season visitation with or without an impounded flood pool.

In contrast, a large multipurpose reservoir would significantly alter recreation in the canyons. River-dependent or river-enhanced recreation would be replaced by reservoir-dependent recreation. Within the 48 miles of permanently inundated river channels, unique activities such as whitewater rafting and recreational gold mining would be eliminated. Because of the scarcity of whitewater rafting reaches in California, this would be considered a significant impact. Of the existing 72 miles of equestrian, hiking, and biking trails, 58 miles would be inundated. The Auburn Project General Plan calls for the development of 120 miles of riding and hiking trails. If constructed, the trails would generally be located a considerable distance from the lakeshore due to the steep canyon topography.

Approximately 100 existing primitive campsites would be lost due to inundation. However, park development plans indicate that these would be replaced with 280 developed campground sites, including 5 trail campgrounds and 6 boat-in campsites.

Stream fishing would be supplanted by reservoir fishing with a higher dependence on motorized boating, which would limit fishing opportunities to those with such boats.

A large permanent reservoir could provide additional opportunities for motorboating, sailboating, waterskiing, jet-skiing, and other reservoir-dependent activities. The California Department of Parks and Recreation (DPR) has projected that approximately 2,400 acres of the large reservoir would be reserved for nonpower boating and 3,400 acres would be reserved for waterskiing and powerboating; restricted speedboating would be allowed on 4,200 acres (BLM, 1990). The reservoir would have a design capacity for 117 boats in the ski zone and 145 boats in the restricted speed zones. However, the large multipurpose reservoir is expected to fluctuate by as much as 300 vertical feet during drawdown, which is expected to decrease the surface area of the lake to 4,000 acres and reduce boat capacity by 60 percent.

USBR anticipated that facilities would be provided at the large reservoir to accommodate 2 million visitor-days annually and sufficient land to accommodate 5 million visitor-days. The character of the recreation experience would change from wilderness/semiwilderness to developed recreation. The change would likely be considered a significant loss due to the scarcity of semiwilderness areas close to major metropolitan areas and easily accessible by major roadways. In contrast, several reservoirs within the basin and within reasonable driving distances provide recreation opportunities similar to those that would be provided by a large multipurpose reservoir.

A large reservoir could potentially enhance recreational experiences in Folsom Reservoir by stabilizing pool levels and in the lower American River by providing higher sustained releases. However, the magnitude of these potential beneficial effects would depend on specific operational procedures.

Water Quality

Construction of a permanent reservoir would result in short- and long-term changes in water quality. After initial filling, new reservoirs undergo several years of biological and chemical change resulting from the decomposition of flooded organic matter (Gunnison et al., 1986). Nutrients, such as phosphorus, nitrogen, and trace metals, enter the reservoir by four primary means: (1) leaching and physical separation from mixed soils and organic debris; (2) leachate and particulate matter from submerged terrestrial vegetation; (3) inflow from the drainage basin; and (4) drowned terrestrial animals (Ploskey 1981). The increase and bioavailability of nutrients and detritus accelerate the rate of biological productivity for periods of 5 to 10 years, which, in turn, increases the biochemical oxygen demand and depletes concentrations of dissolved oxygen. As the reservoir ages, water quality gradually improves.

The multipurpose reservoir would be very deep and would undergo thermal stratification. Stratification results when spring and summer air temperatures warm the upper layers of water (epilimnion) in the reservoir. As the epilimnion warms, it becomes less dense, and a barrier, or thermocline, develops between the cool bottom waters (hypolimnion) and the epilimnion. As a result of this density gradient, dissolved oxygen from the surface cannot diffuse to the hypolimnion. Concurrently, decomposition of organic matter in the hypolimnion exhausts residual supplies of oxygen. These anaerobic (oxygen-deficient) bottom conditions cause the release of unoxidized metals, such as iron, manganese, and phosphorus.

The process reverses in the fall. Surface temperatures cool, become more dense than the hypolimnion, and sink to the bottom, displacing the hypolimnion. This "turnover" results in mixing of epilimnion and hypolimnion, resulting in the sudden availability of nutrients which, in some cases, cause algal blooms. Most of the nutrients released from the bottom materials during summertime anaerobic conditions are taken up by organisms during the fall turnover.

As noted above, a large multipurpose reservoir could potentially enhance water quality in the lower American River by increasing the volume of cooler water released. This would, in turn, increase the concentration of dissolved oxygen. The magnitude of these benefits would depend largely on the volume of water stored for such specific purposes and the operation of the downstream releases.

Water Supply

A principal benefit of a large multipurpose reservoir would be the provision of additional water supplies. Recent estimates by USBR (1987) indicate that a 2.3 million acre-foot reservoir would provide long-term firm yields of between 270,000 acre-feet and 350,000 acre-feet depending on the instream flow schedule maintained. Firm supply is defined as water that would be available even in the most critically dry years as defined by the 7 driest years of historical record.

To put these numbers into perspective, it is estimated that a family of five in California requires approximately 1 acre-foot of water annually for domestic needs. Therefore, the firm yield from such a reservoir would support between 270,000 and 350,000 families per year. In terms of agricultural production, approximately 25 acre-feet of water per year is required for the production of food for a family of five. Therefore, if some combination of supply, demand, taxation, and/or subsidy were to make Auburn Reservoir water available to agriculture, then the firm yield from that reservoir would supply sufficient water to produce enough food to support between 10,800 and 14,000 families.

Provision of between 270,000 and 350,000 acre-feet of new water supply annually could be growth-inducing in two respects. First, additional water supplies would permit increased crop production to feed and cloth new residents, and second, new supplies could be used to meet the domestic water needs of new development.

The amount of new agricultural lands that could be put into production is a function of the specific water demands of the crop. For example, 270,000 acre-feet of water could support production of over 300,000 acres of safflower, but only 42,000 acres of rice. Table 17-4 displays typical water demands of various crops in the Sacramento region and shows the estimates for the crop-specific acreage that could be cultivated with increased water supplies.

TABLE 17-4. Potential Increase in Agricultural and Urban Land Uses Based on Additional Water Supplies From a Large Auburn Reservoir[1]

	Annual Water Use (AF/Ac/Yr)	Potential Increase in Acreage
1. AGRICULTURAL		
Grain	1.4	196,429
Rice	6.5	42,308
Safflower	0.9	305,556
Sugar Beets	3.5	78,571
Field Corn	3.0	91,667
General Field	2.3	119,565
Alfalfa	4.4	62,500
Pasture	5.3	51,887
Tomato	3.1	88,710
Misc. Truck Crops	1.9	144,737
Deciduous	3.6	76,389
Vineyard	2.9	94,828
2. LAND USE		
Light Industry	5.0	55,000
Office/Business	6.2	44,355
Commercial	5.0	55,000
Rural Estate	4.5	61,111
Low Density Residential	8.7	31,609
High Density Residential	9.2	29,891

[1] Assuming yield of 275,000 acre-feet per year and would be used to meet the water needs for each crop or land use.

The amount of urban development potentially accommodated by additional water supplies also varies as a function of specific land use. For example, 270,000 acre-feet of additional supply could increase urban development between 30,000 acres (high density residential) and 55,000 acres (light industry or commercial) depending on the specific land use category (Table 17-4). In a real time situation, supplies would be allocated to most or all potential uses, but the net effect would be that fallow or undeveloped agricultural lands could be put into production, and undeveloped and/or agricultural lands could be converted to urban uses.

Hydropower

USBR estimated that a 2.3 million acre-foot reservoir equipped with a 300-megawatt (MW) powerplant would generate about 600 gigawatthours annually. Based on average electrical demand rates of 7,200 kWh for a typical household and 132,000 kWh for a typical commercial facility of 10,000 square feet, the power generated by the powerplant could supply the power needs for either 84,000 new homes or 4,500 new commercial facilities.

Cultural Resources

The flood-control-only reservoir would periodically inundate 17 prehistoric sites and 163 historic sites in the upper American River. The prehistoric sites are mostly bedrock mortars, and the historic sites are associated with gold mining activities. These impacts are described in the Cultural and Paleontological Resources chapter.

The large multipurpose reservoir would permanently inundate approximately 33 prehistoric and 460 known historic sites of all types and various levels of State and Federal significance. Additional consultation with the State Historic Preservation Officer and Advisory Council on Historic Preservation would be required.

Growth Inducement

A detailed discussion of the growth-related impacts of a multipurpose project is beyond the scope of this analysis for two principal reasons. First, the nature of the growth likely to result from an expansion project is not reasonably foreseeable at this time. Second, such an assessment would be exceedingly speculative. Nevertheless, it is clear that lack of available water supply is a constraint to growth in the upper American River area. Expansion of the flood control dam for multiple purposes could serve to ease this restraint. In that case, more intense development could proceed in the area. A general discussion of the impacts associated with such an accelerated growth pattern is presented in Chapter 18. As discussed above, if a multiple-purpose project is undertaken, a full discussion of impacts, including growth-related impacts, would be required.

OTHER NON-FLOOD CONTROL PROJECTS

YOLO BASIN WETLANDS PROJECT

This project, if authorized, is scheduled to begin in 1992. The work will be a modification of the Sacramento River Flood Control Project. Approximately 3,800 acres of wetlands will be restored within the Yolo Bypass and the Yolo Basin area. The purpose of the work is to convert a portion of the flood control bypass presently used for agriculture as well as flood control to a wetlands useful for fish and wildlife, while the flood control function will continue undiminished. Physical improvements within the existing flood control system could include modifying existing drainage canals or constructing small dikes and weirs to redirect available water to proposed wetland areas. The wetlands would be a mixture of permanent and seasonal wetlands, uplands, and riparian forest. Environmental impact assessment is in progress; however, impacts are expected to be positive since wetlands and wildlife habitat are being created.

USBR American River Water Resources Investigation

This 4-year study was initiated in late 1991 to reaffirm the water needs in the American River Service Area, to identify the need for additional development and improved management, and to evaluate alternative plans to meet identified water needs. This study will be conducted in accordance with current Federal, State, and local procedures, guidelines, and legal requirements. Scheduled to be completed in 1995, the $4.7 million study will be cost shared between the Bureau of Reclamation and the local cost-sharing partners, which include the Sacramento Metropolitan Water Authority, the American River Authority, the Sacramento County Water Agency, the San Juan Flood Control and Water Conservation District, and the Department of Water Resources.

The study will reexamine the area's existing and projected supplemental agricultural and urban water needs as well as overused ground-water supplies. Other water concerns to be addressed are instream flows, the river fishery, hydroelectric power generation, and recreation. Among the alternative actions to be explored are improvement of water delivery systems, increased water conservation and management, and development of additional storage.

As the investigation is just starting, no plans or impact analyses have been developed.

SUMMARY OF CUMULATIVE IMPACTS

DIRECT PROJECT IMPACTS

The flood control projects along the Sacramento River and its tributaries individually provide increased protection or serve to reestablish existing flood protection to portions of the Sacramento metropolitan area, including the City of West Sacramento. By insuring that the Sacramento River Flood Control Project functions in accordance with its original design and by enhancing the capability of this system to provide protection in excess of the original design, these projects acting together provide protection to property and lives within the flood plain. This would be a beneficial impact insofar as the risk of flooding and flood-related damages in the areas protected by the system would be significantly reduced.

Construction of these individual projects has direct impacts which incrementally remove pieces of scarce remaining riparian habitats in the Central Valley. When added together, these small losses significantly reduce the small remaining wetland and riparian ecosystems found along the project area rivers. Since passage of NEPA, adverse impacts are generally mitigated, resulting in no net loss of the values of these resources. However, mitigation may take place in other areas and sometimes depends on substituting types of habitats different from those that are lost. So while mitigation results in compensation for losses, it can result in changes in the specific types, quantities, and locations of these habitats. New legislative authority has been enacted in recent years which allows development of habitat restoration as a separate project purpose. Projects in response to these authorities, such as the Yolo Bypass Wetlands Project, could help reverse the ongoing loss of these critical resources and undo some of the unmitigated damage that occurred prior to the passage of NEPA.

GROWTH-INDUCED IMPACTS

The selected plan would remove flood-related restraints to growth in undeveloped portions of the Natomas, Meadowview, and Pocket areas of the city. It is recognized, however, that the selected plan alone would not be sufficient to produce growth in these areas. In addition, there must be a series of local projects aimed at overcoming infrastructural obstacles other than flooding. The growth-related impacts associated with these infrastructural projects are discussed under each impact category in the main body of this report as well as in Chapter 18.

The SAFCA local project and the temporary reoperation of Folsom Reservoir, if authorized, could enable Sacramento to achieve an increased level of flood protection on an expedited basis pending completion of the American River Watershed Investigation. This would have a beneficial impact on the environment by reducing the risk of flooding and flood-related damage in the areas lying within the American River flood plain. This expedited flood protection would also relieve present homeowners of any mandatory requirement to maintain flood insurance and allow development in the Sacramento area to proceed prior to completion of permanent flood control facilities. This accelerated development would incorporate some of the growth-inducing impacts evaluated by impact category in the main body of this EIS/EIR and in Chapter 18.

CHAPTER 18

GROWTH-INDUCING IMPACTS

The selected plan will likely have a negligible impact on regional population growth. The future population of the Sacramento metropolitan area will be determined more by economic forces than by flood protection. Thus, if inadequate flood protection rendered development in portions of the American River flood plain infeasible, this development would probably be absorbed outside the flood plain, most notably along the I-80 and U.S. Highway 50 corridors east of Sacramento and along I-5. As those areas approach buildout, the foothill areas and the I-80 corridor west of the Yolo Bypass could begin to absorb a larger share of regional growth.

On a local scale, however, the selected plan would permit growth in Natomas and the Pocket and Meadowview sections of the City by removing flood-related constraints. As discussed in Chapter 4 (Land Use), without the increased flood protection provided by the project, high base flood elevations combined with stringent Federal and local flood plain management regulations would make development in these areas infeasible. The extent to which the growth-accommodating potential of the project is fulfilled will depend on objective economic conditions and on the political, social, and environmental considerations which are important to the local agencies controlling land use in the affected areas.

Given the uncertainty of long-term socioeconomic forecasting, it is difficult to predict the direction of land use planning policy over the assumed 100-year life of the project. Therefore, in order to evaluate the growth-related impacts that could result from the project, a distinction has been made between adopted land use plans or policies, which generally cover about a 20-year period, and plans or policies that may be adopted in the future.

In instances where the project would permit growth as anticipated under existing local plans, the impacts of this growth are specifically identified and evaluated by impact category in the preceding chapters of this EIS/EIR. This level of analysis is possible because a considerable amount of information on these impacts has already been gathered and evaluated as part of the local plan-adoption process. However, where there is no local plan to accommodate the growth which could be permitted by the project, information on the impacts that could result from this growth is less definitive. Accordingly, these impacts must be discussed in more qualitative terms, with the recognition that more specific analyses will be undertaken as the local planning process moves forward.

Local agencies with land use jurisdiction over the areas in which growth could occur as a result of the project would be responsible for mitigating these impacts associated with this growth on a project-by-project basis, as required under applicable State and Federal law. Growth-related impacts in five specific resource areas would be addressed in accordance with the provisions of a mitigation plan prior to authorization of the project.

The mitigation plan would be in the form of an agreement between the responsible local agencies and the State Department of Water Resources/Reclamation Board. This agreement would in turn be incorporated by reference into the local cost-sharing agreement for the project.

The elements of the mitigation plan are outlined in the Memorandum of Understanding Regarding Local Assurances, which was prepared by staff represntatives of the Corps and the local sponsors. This Memorandum of Understanding is included in Chapter 22.

What follows, therefore, is a general discussion of the potential for growth and growth-related impacts in three distinct areas: (1) the portion of the Natomas basin which lies within south Sutter County, (2) the unincorporated area of Natomas which lies within Sacramento County but outside the North and South Natomas community plan areas, and (3) the upper American River.

NATOMAS

SOUTH SUTTER COUNTY

Sutter County's current general plan (adopted in 1983) is strongly oriented toward protecting and preserving agricultural resources in the northern Natomas basin. Since 1983, however, declining agricultural production has coincided with increasing development pressure in the southern portion of Sutter County. Responding to these trends, the board of supervisors initiated a study of the ability of the area to support urban development (Bechtel and SRI International, November 1989). Based on the findings of that study, the County issued a Notice of Preparation for an Environmental Impact Report to address the impacts of a proposed general plan amendment (Sutter County Planning Department,. October 26, 1990). The draft EIR for the South Sutter County General Plan Amendment (GPA) was released on July 31, 1991.

The proposed GPA establishes guidelines for future growth in the study area. All development would be subject to further review. Under the GPA, about 25,000 acres in southern Sutter County would be planned for residential, commercial, and industrial uses. Of these acres, 17,042 are located within the Natomas basin. Buildout is anticipated to take place over 40 years or more. The following discussion identifies the impacts likely to result from this buildout and possible mitigation for these impacts.

Table 18-1 displays the buildout scenario for the Natomas portion of the GPA. These data show the difference between the level of development likely to be achieved if the selected plan project is authorized and the GPA is adopted versus the level achieved if no action is taken and the south Sutter County area remains in its current (1992) condition.

TABLE 18-1. South Sutter County - GPA Buildout Scenario (acres)

South Sutter County	With Project	Without Project	Change
Commercial/Industrial	3,528	390	+3,138
Residential	7,094	390	+6,704
Public	1,332	200	+1,132
Agricultural/Open Space	5,088	16,062	-10,974
TOTAL	17,042	17,042	0

Table 18-2 compares the net impact of buildout under the GPA to the net impact of buildout under the existing general plan for south Sutter County during the assumed 100-year life of the selected plan.

TABLE 18-2. South Sutter County - Comparison of Net Indirect Impacts (acres)

Land Use	Existing General Plan			GPA			Net Change
	1992	2100	Net	1992	2100	Net	
All Urban Uses Combined	980	1,700	720	980	11,954	10,974	10,254
Agriculture/Vacant	16,062	15,342	-720	16,062	5,088	-10,974	-10,254

Jobs, housing, and population generated by the GPA under buildout would be as follows:

Housing Units	42,249
Jobs	70,420
Population	104,770

This planned development could not take place until existing flood hazards have been remedied.

The "Draft Environmental Impact Report for the South Sutter County General Plan Amendment," 1991, provides an analysis of significant impacts and lists those goals, policies, and additional measures which would mitigate significant impacts associated with development under the GPA. This analysis is summarized below. For a detailed discussion of these matters, refer to the draft EIR which is hereby incorporated by reference.

Document Locations: Copies of the draft EIR are available for review and purchase at the Sutter County Planning Department, 1160 Civic Center Boulevard, Suite F, Yuba City, California. The EIR may also be reviewed at the following library branches:

Barber Branch
10321 Live Oak Boulevard
Live Oak, CA 95953

Browns Branch
1248 Pacific Avenue
Rio Oso, CA 95674

Pleasant Grove Branch
3089 Howsley Road
Pleasant Grove, CA 95668

Sutter Branch
2147 California Street
Sutter, CA 95982

Main Branch
750 Forbes Avenue
Yuba City, CA 95991

Hazardous and Toxic Waste

The selected plan would significantly reduce the risk of flood-related discharges of hazardous materials from existing industrial sites in Natomas. However, the project would increase the volume of hazardous materials in the area by permitting 2,167 acres of land designated Research and Development under the GPA to be developed with land uses that involve the use of hazardous or toxic substances. Such materials, if used, stored, transported, or disposed of improperly, could expose workers and the general public to health hazards from nonflood-related discharges. This potentially significant impact could be reduced to a less than significant level through adherence to the numerous existing laws and regulations related to hazardous materials.

Urban growth under the GPA would also increase the number of people exposed to hazardous materials from agricultural operations in south Sutter County. This potentially significant impact could be reduced to a less than significant level by incorporating an agricultural-urban buffer area in the GPA; locating development on croplands, such as rice, which are least compatible with urban uses; fostering integrated pest management methods; and adhering to existing laws and regulations governing the use of pesticides.

Drainage and Water Quality

Storm drainage is presently provided in the Natomas portion of south Sutter County by Reclamation District 1000.

Development according to the GPA would substantially alter drainage patterns, increase stormwater runoff, and require master planning of drainage facilities to serve the area. An estimated 32 miles of drainage canals, 610 acres of cell detention ponds, and 1,350 acres of regional detention basins would be required.

Urbanization and the construction of drainage and flood control improvements would have direct and/or secondary impacts to the environment, including disturbance of soils, vegetation, and wildlife. Mitigation for these impacts is discussed below under Fish, Vegetation, and Wildlife.

There would be a potential impact to the integrity of the levees along the Sacramento River, the Natomas Cross Canal, and the Pleasant Grove Canal from pumping increased stormwater runoff into these waterways during peak-flow periods. The draft EIR for the GPA indicates that the drainage infrastructure recommended for the study area would provide a new drainage pattern sized to accommodate a 100-year rainstorm event for the new urbanized area. However, the recommended drainage facilities would not require an immediate discharge of the resulting flows. Instead, the facilities would be designed to retain interior drainage within the basin when flows in the surrounding channels are at peak stage. Thus, the impact of this drainage system on the levees adjoining these channels would be less than significant.

There would be a potential for significant degradation of surface-water quality due to discharges of urban storm runoff. Two municipal drinking water treatment plants are located downstream of the south Sutter County GPA plan area. The West Sacramento plant is located slightly upstream of the I-80 bridge on the south bank of the Sacramento River, and the City of Sacramento plant is located downstream from Natomas at the confluence with the American River on the east bank. Project-related impacts on water quality could be mitigated, but not necessarily to a less than significant level, through the application of "best management practices," as discussed in Chapter 6 (Drainage and Water Quality), including sale of reclaimed wastewater.

As proposed in the GPA, containment of urban stormwater runoff in cell detention ponds and regional detention basins during severe storm events could affect ground-water quality if urban stormwaters of poor water quality percolate into the underlying ground-water table. The detention pond and basin concept is designed to temporarily retain stormwater runoff during storm events and provide a controlled release of the detained water. Seepage of stormwater into the ground water is possible during these temporary time periods, as ground-water levels are likely to also be high during storms. As the detention time for the urban drainage water is short, contamination of ground water would most likely be limited to temporary impacts on shallow ground water. Nevertheless, these impacts should be monitored and best management practices implemented in the event the impacts are deemed significant.

Fish, Vegetation, and Wildlife

Development of the south Sutter County area as proposed under the GPA would result in a significant loss of wetland habitat due to the realignment or modification of existing drainage canals and the conversion of rice fields to urban uses. Over 20 miles of canals and irrigation ditches would be removed, realigned, or modified, and approximately 9,000 acres of land currently under rice production would be lost. These changes would diminish the habitat available to at least one State-listed threatened species, the giant garter snake (see discussion below), and to a number of nonthreatened species including migratory waterfowl and other aquatic birds and mammals found in the southern Sacramento River basin. The value of the affected habitat is enhanced by virtue of its geographic connection to the adjacent Yolo Bypass, the Colusa/Butte County wetland habitats to the north, and the Beach and Stone Lakes wetland habitats to the south.

Impacts to wetlands protected under the Federal Clean Water Act ("jurisdictional wetlands") could be mitigated to a less than significant level through cooperation with the Corps in the enforcement of a "no net loss of jurisdictional wetlands" policy. Unavoidable losses of wetland habitat could be compensated through the creation of new wetlands in appropriate locations. Replacement drainage canals and planned detention areas, in particular, could be used for a comprehensive wetland reconstruction and revegetation program.

Endangered Species

At least three species protected under either the Federal Endangered Species Act or the California Endangered Species Act are thought to occupy the south Sutter County portion of the Natomas basin. The valley elderberry longhorn beetle (Desmocerus californicus dimorphous) is a Federally listed "threatened species" which inhabits remnant enclaves of riparian forest and has been identified along the lower American River. The Swainson's hawk (Buteo swainsoni) is a State-listed "threatened species" which nests during the spring and summer along the Sacramento River near the south Sutter County area. It forages for rodents and other prey inhabiting the following crop types in the area: alfalfa, sugar beets, tomatoes, wheat, and corn/grain. Collectively, these crops are estimated to occupy about 3,000 acres in south Sutter County (USFWS, 1991). The giant garter snake (Thamnophis couchi gigas) is a State-listed "threatened species" which inhabits the 26 miles of drainage canals and other wetland areas in the south Sutter County area.

Growth permitted under the GPA would not significantly affect the valley elderberry beetle due to the limited amount of suitable habitat for the beetle in south Sutter County. However, loss of any substantial portion of the agricultural lands providing foraging habitat for the Swainson's hawk and alteration and/or destruction of the agricultural drainage system presently serving the south Sutter County area could significantly affect the Swainson's hawk and giant garter snake. These impacts could be mitigated to a less than significant level by implementing the measures discussed in Chapter 8 (Endangered Species), including the development of a habitat conservation plan capable of addressing the biological needs of the hawk and the snake on a regional level.

Agriculture

Under the GPA, 10,974 acres of land in agriculture or other open space (fallow fields, drainage canals, jurisdictional wetlands, etc.,) would be converted to urban uses. This would be 10,254 acres more than the 720 acres which would be converted under Sutter County's existing general plan. To gauge the impact of this increased urbanization on prime and unique farmlands, it was assumed that of the 16,062 agricultural/open space acres which will remain in the Natomas portion of south Sutter County by 1992, more than half (roughly 8,850 acres) would qualify under California Department of Conservation criteria as prime farmland (land with the best combination of physical and chemical features for the production of agricultural crops). The balance (7,200 acres) would qualify as farmland of statewide importance (land with a good combination of physical and chemical features) for the production of agricultural crops. Thus, all of the 10,974 agricultural/open space acres which would be converted to urban use under the GPA would be either prime farmland or farmland of statewide interest. This would be a significant impact.

Cultural/Historical

The south Sutter County subarea has a low-to-moderate sensitivity for the presence of prehistoric sites and moderate sensitivity for historic sites. Thus, there would be a potential for damage to unidentified prehistoric or historic resources as a result of urbanization. This would be a significant impact. It is anticipated that a basinwide survey of significant sites will be completed as part of the American River Watershed Investigation prior to any new construction associated with the GPA. Identified sites could be avoided through careful design of projects. Where avoidance is infeasible, data recovery could be completed prior to initiation of construction. In most cases, adoption of these measures would reduce impacts to recognized sites to a less than significant level.

Transportation and Circulation

Development in south Sutter County would generate increased traffic volumes on the existing rural road network. Significant localized impacts could be avoided if the policies contained in the Circulation and Infrastructure Element of the GPA are implemented. To provide level of service D (minimum acceptable under the GPA), Route 99/70 would need to be widened to six lanes for about 3-1/2 miles north of Riego Road; an east-west connector would be needed as a six-lane expressway for about 1 mile west and 2 miles east of Route 99/70; and Riego Road would be six lanes around its interchange with Route 99/70. The remaining east-west and north-south arterials are recommended to be two or four lanes. Buildout of the area would contribute to cumulative regional traffic volumes and peak-hour congestion on the regional roadways connecting south Sutter County to downtown Sacramento. This would be a significant impact. Cooperative planning with the City and County of Sacramento, implementation of appropriate jobs/housing and transportation management policies, and construction of feasible infrastructural improvements could reduce this impact, but not to a less than significant level.

Air Quality

Development under the GPA would substantially alter the direct sources of air pollutant emissions in south Sutter County from agricultural to urban sources and would significantly increase the volume of emissions attributable to vehicular and other indirect sources in the area. Table 18-3 compares projected emissions of reactive organic gas (ROG), nitrogen oxides (NO_x), and carbon monoxide (CO) under existing conditions and under an assumed general plan update (GPU) buildout condition.

TABLE 18-3. South Sutter County Estimated Air Pollutant Emissions - Existing Conditions and GPA Buildout (tons/year)

	ROG (ton/yr)	NO_x (ton/yr)	CO (ton/yr)
Existing Conditions	50.5	16.9	267.8
GPA Buildout	629.8	524.9	3212.2
Difference	579.3	508.0	2944.4

Source: TRC Environmental Consultants, Inc.

As discussed in Chapter 12, the increases shown in Table 18-3 could occur even if the selected plan is not implemented and urban development is severely constrained in south Sutter County. However, for this analysis, increases in air pollutant emissions over existing conditions in a defined local area are considered significant.

Whether these impacts could be reduced to a less than significant level is unknown. The growth projected under the GPA is outside the geographic and temporal scope of the Sacramento Metropolitan Air Quality Management District (SMAQMD) attainment plan. As discussed in Chapter 12, adherence to the plan could achieve sufficient reductions in emissions from existing sources to accommodate projected new source emissions and still achieve compliance with State and Federal standards by 1997. If the geographic and temporal scope of the plan could be extended to include development under the GPA, without compromising the objectives of the plan, then the impacts on regional air quality attributable to the GPA could be reduced to a less than significant level. Otherwise, they would remain significant and unavoidable.

<u>Noise</u>

Noise levels due to construction activities would increase temporarily. Localized construction noise would continue in the area until buildout is complete. Any significant impacts resulting from such noise could be mitigated to a less than significant level by limiting construction hours to 7 a.m. to 7 p.m.

Long-term noise impacts from mobile sources would occur due to cumulative development in the region. Adherence to applicable local noise standards would reduce these impacts to a less than significant level.

There would be a potential impact to future development from aircraft, railroads, and other transportation-related noise. According to State Office of Planning and Research Guidelines, a noise environment of 50 to 60 dB CNEL (decibels, Community Noise Equivalency Level) is considered to be "normally acceptable" for residential uses. This standard would be exceeded in the western portion of south Sutter County due to noise from air traffic at Sacramento Metropolitan Airport which generates noise levels in the range of 65 dB CNEL. This would be a significant impact. Over time, however, it is anticipated that noise from air traffic will decline due to a gradual phaseout of noisier planes. Future aircraft noise levels affecting the western portion of the GPA planning area are expected to gradually lessen until the 65 dB CNEL noise contour recedes completely out of south Sutter County.

Railway noise constrains development in a narrow corridor extending 200 feet on either side of the tracks. This existing development constraint is unlikely to expand. Therefore, development of the area could be designed to accommodate this constraint.

Esthetics

The visual character of south Sutter County would change significantly from predominantly rural to urban as a result of development. Large areas of open space would unavoidably be replaced by buildings interspersed with open space corridors. Existing viewsheds from the study area would also be obstructed. Presently, travelers through the area are afforded an uninterrupted view of the North Coast Range and the Sutter Buttes to the west. Buildings and landscaping would interrupt these views.

Recreation

Development of the south Sutter County area would result in a demand for recreation activities and facilities by the future residents of the area. Existing recreational facilities would not be adequate to meet this demand. The GPA proposes to establish minimum park standards which if implemented would provide adequate recreational facilities and avoid any significant recreational impacts.

The GPA Community Facilities and Services Element proposes 1,426 acres of park and open space lands be dispersed throughout the south Sutter County planning area, including 1,040 acres in the Natomas basin portion of the plan area. The standard set for the planning area is 10 acres of park development per 1,000 population. The plan suggests a variety of park facilities ranging from intense recreational activity to more passive activities.

The GPA Land Use, Growth Management, and Community Design Element proposes a 1,200-acre Regional Park, to be located in the Town of Pleasant Grove, which is designed to provide open space for major active recreational facilities such as golf courses, softball, soccer, and multipurpose turf areas. The majority of the park would also serve dual duty as a regional stormwater and treated effluent detention facility during major storms. A series of tiered detention basins designed for different flood elevations would be developed.

Socioeconomics

Population. The existing population in the Natomas basin portion of south Sutter County is estimated at 1,000. An estimated population of 104,770 would reside in this portion of south Sutter County upon buildout of the area, according to the GPA.

Housing. A potential imbalance between available jobs, projected population, and available housing in south Sutter County could occur. Residential development not supported by local employment opportunities would force residents to commute to regional employment centers located primarily in Sacramento, about 12 miles away. Excessive employment development in the area would result in increased regional commuting, resulting in traffic congestion and significant effects on air quality. These impacts could be avoided by adherence to the jobs-housing goals contained in the GPA.

Water Supply. The Natomas Central Mutual Water Company (NCMWC) presently supplies water from the Sacramento River for agriculture. The NCMWC owns and operates a canal system and pumps water from the Sacramento River to serve agricultural users in the Natomas basin. The company is licensed to serve water anywhere in Reclamation District 1000 and has obtained a permit from the State Division of Water Rights to change use of water from agricultural to municipal and industrial uses. Domestic water is currently provided by individual landowners via wells, with the exception of the Rio Ramaza subdivision.

The proposed development would result in a 17.98 million gallons per day (Mgal/d) (20,137 acre-feet per year) residential water demand and a 4.25 Mgal/d (4,760 acre-feet per year) nonresidential water demand at buildout for this portion of south Sutter County. Development of the area would require construction of pumping stations, conveyance facilities, and storage and delivery facilities for domestic water as well as establishment of a source for domestic water.

The NCMWC indicates that it has an adjudicated right to 100,000 acre-feet of water from the Sacramento River for agricultural use and a contract with the USBR for 22,000 acre-feet of water from Shasta Reservoir for agricultural use during the summer and 10,000 acre-feet from Shasta Reservoir during the winter. Typical agricultural usage is 80,000 acre-feet per year.

A number of entities in or near the plan area would be potential sources for domestic water for future development in the area. Developing an independent water supply could be accomplished in several ways.

- o By obtaining a water right to divert from a watercourse that has unallocated water.
- o By purchasing water rights or lands with water rights connected thereto.
- o By leasing water rights.
- o By obtaining access to ground water.
- o By obtaining county-of-origin water in Sutter County.

Converting surface water from agricultural use to municipal/ industrial uses would result in a reduction in water use for the area (80,000 to 90,000 acre-feet per year versus 36,000 acre-feet per year). It is estimated that 10 percent of the water supply would be provided from ground water. Though the area is underlain by one of the largest underground aquifers in the country, the impact on ground water is unknown at this time. It appears that there is adequate water to serve the proposed GPA; however, cumulative water demands, including agriculture, could have an adverse impact on water supply. This impact could be minimized through the adoption of water conservation policies (that is, use of drought-tolerant landscaping), and reuse of tertiary wastewater treatment effluent for irrigation and other nonpotable purposes.

Sewage System. There are presently no sewage treatment plants or collection systems in the Natomas basin portion of south Sutter County.

It is estimated that buildout of the area under the proposed GPA would generate 18.62 million gallons per day (average dry weather) of wastewater. Development of the area would require construction of wastewater treatment and collection facilities. This represents a significant undertaking by local government to plan, finance, and construct wastewater infrastructure for the area.

Solid Waste. The existing solid waste disposal system serving south Sutter County is landfill dependent. This disposal system will be modified as required by the California Waste Management Act (AB 939).

Under the GPA, buildout would generate an estimated 172,085 tons per year of solid waste assuming 9 pounds per person per day multiplied by 104,770 population. High water tables would restrict landfill within the Natomas basin portion of south Sutter County. The countywide solid waste management plan required under AB 939 must address disposal of solid waste generated by development in the area. The County's ability to dispose of solid waste generated within this area has not been determined.

Emergency Services. Development of the Natomas basin portion of south Sutter County would generate additional population of up to 104,770. This contribution to the total countywide need for additional health/medical services represents a significant impact to the County's health care system. Presently no health care facilities exist in the project area. Fremont Medical Center, a general care hospital located in Yuba City, is operating at 100 percent capacity. A shortage of beds is predicted over the next 10 years. This impact could be avoided by ensuring the adequacy of the health care services available to residents of south Sutter County.

The Sutter County Sheriff, with headquarters in Yuba City, provides protective services to the study area. These services are minimal at the present time since the majority of the area is agricultural. The buildout of the area would generate a population of 104,770. Using a ratio of 2 officers per 1,000 population, 210 additional officers and 70 new vehicles would be needed. This represents a significant impact to countywide protection services.

The Sutter County Fire Department provides fire protection, rescue, and emergency medical services to the area. The Pleasant Grove Fire Station and a garage at Sankey/Pleasant Grove Road, east of the Natomas area, are staffed with 25 volunteer firefighters. Development of the area will significantly increase the demand for fire protection services.

Schools. Development of the project area will generate a significant need for additional school facilities to serve the new population. It is projected that a total of 33 elementary schools and 10 high schools would be needed to serve the population of the entire GPA area (includes a 7,673-acre area outside Natomas basin). Enactment of development fees and other school financing mechanisms (such as a Mello-Roos Community Facilities District) will be needed to provide schools for the area.

Economy. In south Sutter County, agriculture and agriculture-related industries are dominant employment generators. The unemployment rate for Sutter County is about 20 percent; 6,200 persons are unemployed. Development of the Natomas area, according to the GPA, would increase employment opportunities in the south Sutter County area by increasing the potential for research and development and industrial uses to locate in the area. The total number of jobs generated by the GPA is estimated to be 70,420 for the portion of south Sutter County within the Natomas basin. The jobs-to-housing ratio at buildout would be 1:1.66, or 1.66 jobs per household. An imbalance between jobs and housing would affect commute patterns in the region. (See the discussion in "Housing.")

UNINCORPORATED NORTH NATOMAS (SACRAMENTO COUNTY)

Background

Unincorporated North Natomas (Sacramento County) is that area of the Natomas basin lying north of the incorporated (City of Sacramento) North Natomas Community Plan area and south of Sutter County. Covering 26,598 acres, unincorporated North Natomas is designated almost exclusively for agricultural uses under Sacramento County's existing general plan. The principal nonagricultural use is the Sacramento Metropolitan Airport, which occupies 2,860 acres north off I-5 near the Sacramento River.

The County is in the process of updating its general plan. Circulation of the draft EIR is projected for spring 1992, and adoption of the GPU is anticipated for November 1992.

The GPU proposes two boundaries: the Urban Policy Boundary (UPB) and the Urban Service Boundary (USB).

Those areas within the UPB are identified as new growth areas within the 20-year timeframe of the plan. Included in this boundary are existing urban areas and new areas designated for growth. The UPB is intended to be flexible, dependent on actual growth trends and needs, site specific constraints, and compliance with performance standards.

The USB is intended to define the ultimate boundary of urban growth. It is not intended that this area be fully urbanized during the 20-year timeframe of the plan. The USB is intended to provide a basis for long-term planning beyond the 20-year life of the GPU.

Unincorporated North Natomas is not identified in the GPU as a growth area. However, to present a worst-case scenario, it was assumed that new development would take place within the USB (south of Elverta Road and east of Lone Tree Road) and outside the UPB as a result of the implementation of flood protection measures. This development was estimated based on a conceptual land use plan developed by the Sacramento County Planning and Community Development Department. This concept plan is only one of several alternatives being considered in connection with the GPU. However, it represents the most ambitious growth scenario for Natomas and thus constitutes a worst-case condition.

Table 18-4 displays the land use estimates used to develop a buildout scenario for unincorporated North Natomas under the GPU (concept plan). These data show the difference between the level of development which would be achieved if the selected plan is authorized and the GPU is adopted versus the level achieved if no action is taken and unincorporated North Natomas remains in its 1992 condition.

TABLE 18-4. Unincorporated North Natomas - Preliminary Land Use Estimates, GPU (Concept Plan) (acres)

Unincorporated North Natomas	With Project	Without Project	Change
Commercial	2,892	90	+2,802
Residential	3,346	180	+3,166
Industrial	607	90	+517
Public	3,253	2,860	+393
Agriculture/Open Space	16,500	23,378	-6,878
TOTAL	26,598	26,598	0

Table 18-5 compares the net impact of buildout under the GPU to the net impact of buildout under the existing general plan for unincorporated North Natomas during the assumed 100-year life of the selected plan.

TABLE 18-5. Unincorporated North Natomas - Comparison of Net Indirect Impacts (acres)

Land Use	Existing General Plan			GPU (Concept Plan)			Net Change
	1992	2100	Net	1992	2100	Net	
All Urban Uses Combined	3,220	4,436	1,216	3,220	10,098	6,878	5,662
Agriculture/Vacant	23,378	22,162	-1,216	23,378	16,500	-6,878	-5,662

Specific information regarding environmental impacts resulting from potential development in unincorporated North Natomas is limited. Therefore, these impacts were assessed based on available data developed for the GPU, the North and South Natomas Community Plans, and the south Sutter County GPA.

Data were gathered from the following documents:

- "Revised Draft Supplemental Environmental Impact Report for the North Natomas Community Drainage System," City of Sacramento, Department of Public Works, Flood Control and Sewer Division, November 1989.

- "Final Environmental Impact Report for Natomas West Assessment District Improvements," City of Sacramento, Department of Public Works, Engineering Division, April 1991.

- "Draft Environmental Impact Report for the South Sutter County General Plan Amendment," Sutter County Planning Department, July 1991.

- "Final Environmental Impact Report for East Terminal Development Project, Sacramento Metropolitan Airport," Sacramento County, Department of Environmental Review and Assessment, May 1991.

- "County of Sacramento Inter-Departmental Correspondence, Alternatives - Draft General Plan," February 25, 1991.

- "Holding Capacity Sacramento County General Plan," County of Sacramento, Planning and Community Development Department, August 30, 1991.

- "Draft Environmental Impact Report for the City of Sacramento General Plan Update," City of Sacramento, Department of Planning and Development, March 1987.

Hazardous and Toxic Waste

The selected plan would significantly reduce the risk of flood-related discharges of hazardous materials from existing commercial and industrial sites in Natomas. However, increased flood protection combined with the GPU would allow for development of 517 acres for commercial and industrial uses involving hazardous materials. As previously discussed, if such materials are used, stored, transported, or disposed of improperly, workers and the general public may be exposed to health hazards. This potentially significant impact could be reduced to a less than significant level by adhering to existing laws and regulations governing the handling and disposal of hazardous materials.

Urban growth under the GPU would also increase the number of people exposed to hazardous materials from agricultural operations in unincorporated North Natomas. This potentially significant impact could be avoided by including appropriate buffer areas in the performance standards governing development in the area, promoting integrated pest management practices, and adhering to existing laws and regulations governing the use of pesticides.

Drainage

The unincorporated North Natomas area is predominantly agricultural, but also includes the Sacramento Metropolitan Airport and some scattered residential, industrial, and commercial development. Drainage facilities for this area are provided through the facilities of Reclamation District 1000.

No studies have been prepared addressing drainage needs for potential urban development in unincorporated North Natomas; however, land use estimates for the GPU indicate that commercial, industrial, and residential acreage would be roughly the same as for the North Natomas community plan. Assuming that urban stormwater runoff volumes would be similar for the two areas, discharge of these volumes from the basin when surrounding channels are at flood stage could cause water elevations in the Sacramento River, NEMDC, and the Sacramento/Yolo Bypass to encroach into levee freeboard. Onsite retention of runoff in excess of current volumes for the 100-year flood event would effectively mitigate this potentially significant impact.

Water Quality

While new development in unincorporated North Natomas would reduce the volume of agricultural pollutants currently discharged into the Sacramento River, this development would result in increased discharges of pollutants normally associated with urban uses, including elevated levels of metals, hydrocarbons, oil, grease, and sediment. The uncontrolled discharge of urban stormwater runoff from developed areas would degrade the quality of the receiving waters. For this analysis, any degradation in water quality below standards established by the SWRCB, CVRWQCB, or EPA would constitute a significant impact. The potential for such significant impacts would depend on the volume and concentration of the pollutants in the discharge and the volume and background pollutant concentrations of the river. A 2-year storm event, coupled with a low fall riverflow, is expected to represent the worst case because of the flushing of accumulated pollutants into the river. Aquatic resources such as fish and invertebrates could be adversely affected as a result of toxicity or alterations in food sources (City of Sacramento, "Draft EIR for Natomas West Assessment District," 1990).

The NPDES permit issued to the City of Sacramento, County of Sacramento, and other parties does not contain specific water-quality objectives but refers to RWQCB Basin Plan standards and nondegradation policies for water-quality criteria reference points. The permit relies on a monitoring and evaluation period to note any degradation of water quality and aquatic resources from urban runoff (CVRWQCB, 1990). The City and County are obligated under the permit to use best management practices (BMP's) to improve stormwater quality. Under applicable provisions of the Clean Water Act, plan development in unincorporated North Natomas would be subject to these permit requirements. Nevertheless, it appears that periodic exceedences of established standards would be unavoidable. As discussed above, this impact is considered significant and unavoidable (City of Sacramento, "Draft EIR for Natomas West Assessment District," 1990).

Fish, Vegetation, and Wildlife

As in south Sutter County and the City community plan areas, buildout of unincorporated North Natomas under the GPU would result in a significant loss of jurisdictional and other wetland habitat due to the realignment or modification of existing drainage canals and the conversion of rice fields to urban uses. The impacts to jurisdictional wetland habitat could be mitigated to a less than significant level through adoption of a local "no net loss of wetland" policy to augment the efforts of the Corps to protect jurisdictional wetlands. Unavoidable losses of nonjurisdictional wetlands, including drainage canals and rice fields, could be mitigated by enhancing existing wetlands and/or creating new wetland compensation areas.

Endangered Species

Growth permitted under the GPU could significantly affect two State-listed species occupying or foraging in the unincorporated North Natomas area. The Swainson's hawk, which nests along the Sacramento River during the spring and summer, would be adversely affected by any substantial loss of the crop types such as alfalfa, sugar beets, tomatoes, wheat, and grain, which harbor rodents and other prey hunted by the hawk. Similarly, the giant garter snakes which inhabit unincorporated North Natomas would be adversely affected by any substantial alteration and/or destruction of the drainage system currently serving agricultural operations in the area as well as the loss of rice fields. Rice fields have been shown to play an important part in the life cycle of the giant garter snake in Natomas. These impacts could be mitigated to a less than significant level by implementing the measures discussed in Chapter 8 (Endangered Species), including the development of a habitat conservation plan capable of addressing the biological issues related to the hawk and snake on a regional level.

Agriculture

Under the GPU, 6,878 acres of land in agriculture or other open space would be converted to urban uses. This would be 5,662 acres more than the 1,216 acres converted under Sacramento County's existing general plan. It is unclear how much of the affected acreage would qualify as either prime farmland, farmland of statewide importance, or unique farmland. However, since virtually all of the nonurban land in unincorporated North Natomas falls into one of these categories, it may be assumed that the loss of productive agricultural land converted under the GPU would be a significant impact.

Cultural/Historical

Archeological field surveys conducted in the Natomas basin resulted in recording prehistoric archeological sites and isolated artifacts. These findings suggest that other sites were present at one time, but have been destroyed or obscured as a result of development, long-term land reclamation, and agricultural activities. These findings do not preclude the possibility that subsurface sites and artifacts exist. Therefore, development in unincorporated North Natomas may result in significant impacts to cultural resources. Implementation of standard mitigation strategies could reduce this impact to less than significant.

Transportation and Circulation

Because land use planning is at a preliminary stage in unincorporated North Natomas, no future traffic volumes were available for this area. It is assumed that development would contribute to cumulative regional traffic volumes and peak-hour congestion on regional roadways. This significant impact could be reduced, but not to a less than significant level, through implementation of appropriate jobs/housing and transportation management policies and construction of feasible infrastructural improvements.

Air Quality

Buildout under the GPU in unincorporated North Natomas would alter the direct sources of air pollutant emissions in this area and would significantly increase the volume of emissions attributable to vehicular and other indirect sources. Table 18-6 compares projected emissions of ROGs, No_x, and CO under existing conditions and under an assumed GPU buildout condition.

The increases shown in Table 18-6 could occur even if the selected plan is not implemented and urban development is severely constrained in unincorporated North Natomas. However, for this analysis, increases in air pollutant emissions over existing conditions in a defined local area are considered significant. Whether or not these impacts could be reduced to a less than significant level is unknown. The growth projected under the GPU would occur after 2010 and thus is outside the temporal scope of the SMAQMD attainment plan. As discussed in Chapter 12 (Air Quality), adherence to the plan could achieve sufficient reductions in emissions from existing sources to accommodate projected new source emissions while still permitting attainment of Federal and State air quality standards by 1997. If this objective is realized, it might be possible to maintain compliance with these standards after 1997 by adhering to subsequent extensions of the plan. In that case, the impacts on regional air quality attributable to development under the GPU could be reduced to a less than significant level. Otherwise, they would remain significant and unavoidable.

TABLE 18-6. Unincorporated North Natomas Estimated Air Pollutant Emissions - Existing Conditions and GPU (Concept Plan) Buildout (tons/year)

	ROG	NO_x	CO
Existing Conditions	23.3	16.9	123.6
GPU (Concept Plan)	369.9	308.2	1,886.4
Difference	346.6	291.3	1,762.8

Source: TRC Environmental Consultants, Inc.

Noise

Noise levels would increase temporarily in the area due to construction activities. Such noise level increases will be localized and will affect those areas adjacent to construction sites. Localized construction noise will continue in the area until buildout is complete.

Long-term noise impacts from mobile sources would occur in the area due to cumulative development in the region. Adherence to applicable local noise standards would reduce these impacts to a less than significant level.

Unincorporated North Natomas is directly east of the Sacramento Metropolitan Airport. The "Final Public Review Draft of the Sacramento County General Plan Noise Element," Sacramento County Planning and Community Development Department, November 1990, contains noise contours based on the 1988 operations at the airport. These contours show the 60 dBA noise level contour extending to Highway 99/70 in the unincorporated North Natomas area. The 65 dBA covers much of the area between Highway 99/70 and Power Line Road, immediately east of the airport.

These contours may change with airport operations and as use of noisier aircraft is phased out, as noted in the "Draft Environmental Impact Report for the South Sutter General Plan Amendment." According to State Office of Planning and Research Guidelines, a noise environment of 50 to 60 dB CNEL is considered to be "normally acceptable" for residential uses. Therefore, using current noise level contours as a guide, development of residential uses west of Highway 99/70 would result in significant impacts.

Other transportation corridors, including major highways and major arterials, are sources of noise levels which can adversely affect residential and sensitive land uses. Planning for the area must accommodate necessary noise reduction measures to avoid significant impacts.

Esthetics

The visual character of the unincorporated North Natomas area would change significantly from predominantly rural to urban as a result of development under the GPU. Large areas of open space would be replaced by buildings interspersed with landscaping and open space areas.

Recreation

Development of unincorporated North Natomas under the GPU would result in a significant demand for recreational activities and facilities by future residents of the area. Existing recreational facilities would not be adequate to meet this demand. Nearby regional facilities such as the American River Parkway would experience increased demand as well.

Minimum park standards set by the County's general plan would have to be met by financing, construction, and maintenance of new park facilities. New or expanded regional facilities would be needed to serve the new population.

Current standards contained in the County's existing general plan require 2.5 acres per 1,000 population for neighborhood and community parks and 20 acres per 1,000 population for regional parks. This would require 106 acres of neighborhood parks, 106 acres of community parks, and 847 acres of regional parks to serve the new population.

Socioeconomics

Population. The Sacramento County Planning and Community Development Department developed the GPU as an alternative to growth in the Laguna/Franklin area south of Sacramento. This scenario provides for a population of 42,371 people to be accommodated in unincorporated North Natomas.

Housing. Under the GPU, a total of 16,949 dwelling units on 3,270 acres could be accommodated in unincorporated North

Natomas. Due to the proximity of the area to employment centers in the City of Sacramento, it would be possible for a considerable number of residents to commute to jobs out of the immediate area.

Water Supply. Unincorporated North Natomas has limited municipal supply service. The Sacramento Metropolitan Airport Water District serves the airport with ground water. According to the "Final Environmental Impact Report for the East Terminal Development Project," Sacramento Metropolitan Airport, Sacramento County Department of Environmental Review and Assessment, May 1991, the proposed expansion of airport facilities would not adversely affect water supply. However, construction of a water treatment plant in the area that would treat surface water and would serve the airport and the North Natomas area is being considered by Sacramento County. The combined demand from these consumers may make a water treatment plant more viable.

The Natomas Central Mutual Water Company owns and operates a canal system and pumps water from the Sacramento River to serve agricultural users in the Natomas basin. The company is licensed to serve water anywhere in Reclamation District 1000 and has obtained a permit from the State Division of Water Rights to change use of water from agricultural to municipal and industrial ("Draft Environmental Impact Report for South Sutter County General Plan Amendment," July 1991).

The NCMWC indicates that it has adjudicated right to 100,000 acre-feet of water from the Sacramento River for agricultural use and a contract with the USBR for 22,000 acre-feet of water from Shasta Reservoir for agricultural use during the summer and 10,000 acre-feet from Shasta Reservoir during the winter. Typical agricultural usage is 80,000 acre-feet per year.

Using water demand rates provided in Chapter 15, estimated annual water demand for unincorporated North Natomas is shown in Table 18-7.

It appears that adequate surface water would be available to serve development in unincorporated North Natomas. However, cumulative water demands for the entire Natomas basin (including agricultural) may result in significant impacts to the water supply. Increased water demand would be partially offset by elimination of agricultural demands as a result of conversion to urban uses.

TABLE 18-7. Unincorporated North Natomas Water Demand

Land Use	Rate	Amount	Water Demand (acre-feet/ year)
Residential	0.19 acre-ft/cap/yr	42,371 pop.	8,050
Commercial	4.4 acre-ft/yr/acre	2,892 acres	12,725
Industrial	1.9 acre-ft/yr/acre	607 acres	1,153
Airport*			31
TOTAL			21,959

*FEIR East Terminal Development Project, Sacramento Metropolitan Airport, May 1991.

Sewage System. With the exception of the wastewater treatment facilities which serve the Sacramento Metropolitan Airport, there are no sewage treatment plants or collection systems in unincorporated North Natomas. Using wastewater generation factors cited in Chapter 15, it is estimated that buildout of the area under the GPU would generate a total of 9.18 Mgal/d of wastewater. Development of the area would require construction of wastewater treatment and collection facilities to serve growth in the area.

Solid Waste. Solid waste generated under the GPU would be taken to the Sacramento County landfill site, which is expected to be at capacity by 2005. This estimate does not take into consideration solid waste generated by future development in the unincorporated North Natomas area.

Using solid waste generation factors cited in Chapter 15, it is estimated that the area's residential development would require disposal of 32,941 tons of solid waste per year, and industrial/commercial development would generate 6,385 tons of solid waste per year.

Future disposal of solid waste must be provided for in accordance with the California Waste Management Act (AB 939), which requires reduction of the waste stream by recycling and other measures. The additional solid waste, however, would accelerate the rate at which the existing landfill will reach capacity.

Emergency Services. Currently, medical facilities are not available within unincorporated North Natomas. Development of the area would result in additional health care demands being placed on existing facilities and the need for the development of new facilities to serve the new population.

Unincorporated North Natomas is serviced by the Sacramento County Sheriff's Department. Assuming a ratio of 1 officer to 1,000 population, development of the area would require 42 additional officers to serve a population of 42,371. Buildout under the GPU would require a significant expansion of law enforcement protection services.

Unincorporated North Natomas is located within the Sacramento City Fire Department contract area. There is an existing fire station on West Elkhorn Boulevard. Development of the area will require a significant expansion of fire protection services.

Schools. The unincorporated North Natomas area is serviced by the Rio Linda School District (elementary) and Grant Joint Union High School District. A population of 42,371 would generate about 4,215 grade K-6 students and 1,966 grade 7-12 students. Development of the area under the GPU would, therefore, require a significant expansion of educational facilities and programs. Developer fees and other financing mechanisms would be needed to finance these facilities.

Economy. Existing land use in unincorporated North Natomas is predominantly agricultural. GPU land uses for the area indicate that a total of 607 acres would be devoted to industrial uses in areas constrained by the 65 dB CNEL and 60 dB CNEL noise contours of the Sacramento Metropolitan Airport. There may be a small area which could accommodate office/business uses. Assuming 75 percent of the area would be developed with industrial uses generating 15 jobs/acre and 25 percent of the area would be developed with uses generating 70 jobs/acre, consistent with mid-rise office generation rates, then a total of 17,452 job opportunities would be generated.

The ratio of jobs to housing is 1.03, indicating that approximately one job opportunity for each household could be provided in the area. However, due to the proximity of the unincorporated North Natomas area to the City of Sacramento, the area will function as a part of the larger regional economy. It is likely that employment opportunities in the unincorporated North Natomas area would attract workers from surrounding areas and that residents of this area would travel to jobs in other parts of the region.

UPPER AMERICAN RIVER

BACKGROUND

This section addresses the growth-inducing impacts that could occur in the upper American River area in the event Highway 49 is replaced along one of the high bridge alignments discussed in Chapter 17 (Cumulative Impacts). As noted in that discussion, the selected plan includes an in-kind replacement of the existing Highway 49 bridge at river mile 23.0. Because this replacement would essentially retain the existing width and alignment of the highway, no growth-inducing impacts are expected. Travel times between western El Dorado County and the I-80 corridor would not be significantly reduced, and the capacity and location of Highway 49 would continue to constrain growth in the area.

However, replacement of Highway 49 is a State responsibility. In discharging this responsibility, the State must undertake appropriate route adoption studies, and the California Transportation Commission must make a final determination as to the preferred route. This process may culminate in selection of a width and alignment other than the one indicated by the Corps for purposes of the selected plan.

The existing Highway 49 passes through the communities of Coloma, Lotus, Pilot Hill, and Cool in El Dorado County. Communities that connect with Highway 49 via Highway 193 in El Dorado County are Greenwood, Georgetown, and Garden Park. Highway 49 crosses the American River just downstream from the confluence of the North Fork American River and the Middle Fork American River via a two-lane bridge. In general, Highway 49 is used as a commuting road between Nevada City and Grass Valley in Nevada County, Auburn in Placer County, and Placerville in El Dorado County and for access to the Auburn State Recreation Area. The segment of Highway 49 crossing the Middle Fork conveys approximately 6,000 to 7,000 vehicles daily. Due to the poor horizontal and vertical alignment of Highway 49, travel along this segment is relatively slow; travel speed averages 30 miles per hour.

The study area is rural, with an approximate population of 41,290. The area is characterized by open space, recreational areas, agricultural lands, and rural residential uses. Development is primarily low-density to rural residential with very little high-density development or industry. Employment for many residents is within the vicinity of the I-80 corridor.

Because of their rural environment and proximity to employment centers along I-80, Placer and El Dorado Counties are desirable places to live. However, these Counties are characterized by several constraints to development, with El Dorado County having more severe development constraints than Placer County. In particular, inadequate water supply, sewage facilities, and traffic capacity constrain development in both Counties. El Dorado County has a severe water shortage, requiring developers to provide a viable source of water prior to development. In addition, there are no sewage treatment facilities within the northwest portion of the County, as all sewage disposal is handled by septic tanks. Large portions of northwest El Dorado County have severe septic field limitations (that is, slopes, shallow bedrock, slow percolation rates, and low available water holding capacity). Development could be constrained further when increases in population affect local road capacities. The rural roads serving northwest El Dorado County are typically narrow and not well maintained, thereby limiting the level of service.

Currently, Highway 49 is at an unacceptable level of service. Because of this and other constraints, development in the area dependent on Highway 49 has been slowed. The widening and realigning of Highway 49 would relieve existing congestion and would improve access to areas south of the Middle Fork of the American River. It is reasonably foreseeable that these improvements would occur even without the impetus of the flood control project. With the project, however, the timing of the improvements would be accelerated. The resulting highway capacity and alignment could result in an incremental increase in regional growth rates, thus requiring the affected local agencies to amend or update their general plans sooner than expected.

IMPACTS

The following analysis is qualitative. It focuses on conflicts between the growth that would result in part from the realignment of Highway 49 and the existing plans and policies in the local areas which would be affected by this growth. It is anticipated that a more extensive analysis of growth-related impacts and potential mitigation measures will be presented in the environmental documents prepared in connection with the State route adoption process that will precede final selection of a new alignment. (See discussion in Chapter 17.)

Alternative Highway 49 Alignments

In prior studies, Caltrans identified five potential routes (alternative alignments 1, 2, 2A, 3, and 4) to replace the existing Highway 49 alignment.

Alternative alignment 1 would make commuting to and from El Dorado County and work places along I-80 only slightly easier. Commuters using this route would encounter congestion on I-80 in the City of Auburn. As a result, this alternative would not be as growth inducing as alternative 2, 2A, or 3.

Alternative alignment 2 would allow for speedier commutes from El Dorado County to I-80. The easier commute could make El Dorado County a more desirable place to live for those who work along I-80. The resulting growth-inducing impacts such as increased noise, pollution, traffic, and use of the Auburn State Recreation Area would be significant.

Alternative alignment 2A basically follows the same alignment as alternative 2, with similar impacts. The main difference is that alternative 2 would use an existing interchange, while alternative 2A would require a new interchange between Newcastle and Auburn. This interchange would improve freeway access from vacant parcels in southwest Auburn, resulting in growth-inducing impacts.

Alternative alignment 3 also follows a course close to that of alternative alignment 2. The main difference between these two alignments is that alternative alignment 3 would not pass through the Auburn State Recreation Area. Thus, the impacts to the recreation area would not be as significant as for alternatives 2 and 2A.

Alternative alignment 4 follows a path similar to the existing Highway 49. The only deviation is that the bridge would be located just south of the existing Highway 49 bridge. Because this alignment would require little change from the existing route and would not significantly raise the level of service on Highway 49, there would be little or no growth-inducing impact.

The indirect impacts associated with alternative alignments 1, 2, 2A, and 3 could lead to noncompliance with the locally adopted plans and policies described below.

Auburn Area General Plan

Placer County approved the current Auburn Area General Plan in late 1978. The Auburn City Council followed suit in early 1979. The plan is intended to guide decisionmaking in the Auburn area until 1995. As part of its general plan update process, however, the County is revising the Auburn Area General Plan. Whether or not the revised plan will account for the possibility that Highway 49 will be replaced is not known. According to the County's planning staff, however, a new Highway 49 alignment would probably have minimal impact on the Auburn plan area in terms of growth. The new roadway would most likely redirect some of the growth that would otherwise have occurred in the Auburn area to locations along Highway 49 in El Dorado County (Yeager, January 1991).

Existing Highway 49 traffic uses some Auburn area streets, but possible growth resulting from the realignment of Highway 49, particularly with alignments 1 and 4, could significantly increase the traffic volumes on these streets. Since a draft Auburn Area Plan update has not yet been released, it is not known if this change in traffic volumes is likely to result in noncompliance with the plan that will eventually be approved. These traffic increases would result in noncompliance with several policies contained in the existing plan, however.

El Dorado County Plans and Policies

El Dorado County adopted its land use plan in 1981. Although it was intended to guide decisionmaking in the County to the year 2000 "and beyond" (see the plan's title page), a draft plan update is in progress. That update will be based on the assumption that no dam will be constructed at the Auburn site within the lifetime of the new plan, which is 20 years, and that Highway 49 will not be realigned. The realignment called for under the selected plan would, according to a study prepared in connection with the general plan update process, increase development pressure in the northern portions of the County (Sedway Cooke Associates, 1990). This increase ". . . would considerably influence land use designations in the area, and would likely initiate a significant general plan amendment process." Unless the final general plan update is revised to accommodate a realigned Highway 49, therefore, the Highway 49 alignment would fail to comply with a number of goals, objectives, and policies in El Dorado County's new general plan. Since a preliminary draft of the new plan's goals and objectives has been released, it is possible to point out those areas where noncompliance due to increased development and traffic levels may occur (Sedway Cooke Associates, October 1990).

In addition, a number of plan areas within El Dorado County would be affected by the replacement of Highway 49. The plans covering most of those areas are, however, outdated and in the process of being revised. At this writing, no draft revised area plans are available for examination. The Highway 49 replacement component of the selected plan does not, however, comply with several policies, goals, and objectives contained in the existing area plans. These potential inconsistencies are discussed below by issue.

Land Use

The replacement of Highway 49 could accelerate growth in Placer and El Dorado Counties by removing existing access restraints to growth. Increased development would mean a change in the rural lifestyle, the loss of agricultural lands, and the promotion of strip development along the new Highway 49 alignment. Access restraints, however, are not the only impediments to growth in northwest El Dorado County. It would be necessary for future developments to provide viable water sources and sewage facilities while mitigating for increased traffic and air emissions within the area. Thus, the realignment of Highway 49 would not, in and of itself, result in a faster pace of growth. However, the removal of at least one important development constraint would contribute cumulatively to conflicts with the land use, open space, and agricultural goals and policies of existing local plans which emphasize preservation of the rural character of El Dorado County and its constituent communities.

Esthetics

Increases in traffic, congestion, and development, along with the possible loss of single-family residences induced in part by the Highway 49 replacement, would result in the loss of important scenic corridors and views of open space in El Dorado and Placer Counties and would generally alter the smalltown character of the area. These changes would not comply with goals and policies of existing local plans which emphasize preservation of the rural character and natural scenic beauty of the Counties.

Transportation and Circulation

Realignment of Highway 49 could increase traffic on the roads connecting with Highway 49. Peak traffic volumes would increase faster than the County's ability to upgrade the affected roadways, thereby imposing constraints on future development. Periods of temporary congestion could result. Accordingly, Highway 49 replacement would result in noncompliance with existing local transportation-oriented policies and goals which emphasize maintenance of safe, efficient, and scenic all-weather roads.

Noise and Air Quality

Depending on the alignment selected for Highway 49, the new highway could pass through existing and planned residential subdivisions, causing a substantial increase in noise levels and a decrease in air quality in those areas. Noise levels and air quality would be affected further by the increased rate of growth that the replacement of Highway 49 could cause. Noise impacts could be mitigated to a less than significant level. However, air quality impacts would be more difficult to mitigate, particularly if El Dorado County remains a designated nonattainment area. Since any exceedence in air quality standards which cannot be offset elsewhere in the designated air basin is considered a significant impact, future development could be delayed until attainment status is achieved.

Natural Resource Conservation and Open Space

Growth resulting from the Highway 49 replacement would replace natural resources and open space with housing and commercial development. Increased urban development would be inconsistent with goals and policies which emphasize conserving and improving the County's existing high-quality natural resources and open space, including prime agricultural and timber soils, mineral deposits, water and native plants, fish and wildlife species, and habitat. These goals and policies are intended to preserve resources of significant biological, ecological, historical, or cultural importance.

Public Services and Utilities

The growth resulting from the replacement of Highway 49 would have several impacts on public services and utilities. First, increased traffic has the potential to slow emergency response times, possibly increasing the fire hazard to residential and commercial developments. Second, educational services could be decreased due to overcrowding. Third, water, sewage facilities, electricity, gas, and phone service would be required to provide for the increased demand. The impacts on public services and utilities could result in serious constraints on future development as well as noncompliance with applicable local goals and policies.

CHAPTER 19

SIGNIFICANT ADVERSE IMPACTS WHICH CANNOT BE AVOIDED IF THE PROJECT IS IMPLEMENTED

This chapter summarizes significant or potentially significant impacts that could not be eliminated or reduced to a less than significant level by mitigation measures included as part of the project or other mitigation measures that could be implemented. Additional information is presented in the appropriate chapter for each resource and in the summary tables at the end of this report.

NO-ACTION ALTERNATIVE

The no-action alternative would leave the Natomas and lower American River areas (approximately 60,000 acres of developed land) exposed to a long-term risk of flooding. Present estimates are that Folsom Dam and the lower American River and Natomas levee systems can withstand no more than a 70-year flood event. Accordingly, under the no-action alternative, a rainstorm which results in flows larger than a 70-year event could produce the following short- and long-term environmental impacts:

- o Loss of life
- o Considerable damage to and/or destruction of existing residential/commercial and public property in the flood plain
- o Contamination of flood plain lands resulting from flood-induced releases of hazardous and toxic wastes
- o Substantial deposits of flood-borne debris on lands throughout the flood plain and associated temporary visual impacts
- o Short-term emissions of nonattainment pollutants associated with the cleanup and rebuilding of flood-damaged structures
- o Significant and potentially prolonged damage to transportation facilities, including the Sacramento Metropolitan Airport

- o Economic and social impacts stemming from the flood itself, the resulting cleanup costs, and general post-flood recovery and reconstruction

SELECTED PLAN

Implementation of the selected plan would result in unavoidable significant adverse impacts to various resources in the Natomas and upper American River areas.

NATOMAS

Short-term unavoidable impacts in Natomas are related to air quality, traffic, and noise.

Project construction would produce a substantial increase in PM_{10} and ozone precursor emissions. Although the impact would be short term, it is considered significant and unavoidable because emissions would not be offset and, therefore, would contribute to the continued nonattainment status of the Sacramento region with respect to PM_{10} and ozone.

During reconstruction of Main Avenue bridge, detour traffic would incrementally degrade the existing deficient peak-hour level of service along Northgate Boulevard between I-80 and North Market Boulevard.

Construction activities would also produce short-term noise levels which would exceed exterior noise standards for adjacent residential areas at these locations: NEMDC east and west levees, NEMDC pumping station, Sankey Road, Dry and Arcade Creeks, and the borrow site.

Long-term unavoidable impacts include conversion of the flood plain and its agricultural and natural areas to urban land uses. Unavoidable impacts associated with this conversion would affect air quality, water quality, traffic, fish and wildlife habitats, and visual and other environmental resources.

The proposed location and height of the north and south Dry Creek and north Arcade Creek levees would block open space views from existing residences, creating unmitigable visual impacts to adjacent residential and recreational areas.

LOWER AMERICAN RIVER

No significant unavoidable impacts would occur as a result of the selected plan.

UPPER AMERICAN RIVER

Significant and unavoidable impacts in the upper American River area would stem from dam construction and operation, Highway 49 and Ponderosa Way replacements, and aggregate extraction and transport. Unavoidable impacts associated with these project components include short-term water quality, air quality, noise, and visual impacts and long-term land use and visual resources impacts.

Concentrations of dissolved calcium, sulfate, chloride, total iron, manganese and asbestos in the American River would increase significantly during dam construction, causing unavoidable short-term water-quality impacts. In addition, based on worst case estimates, up to 8,000 tons of sediment could be introduced into the American River during dam construction.

The flood control dam, Highway 49 and Ponderosa Way construction activities, aggregate extraction, and transportation activities would produce a substantial increase in PM_{10} and ozone precursor emissions and add to the project's unavoidable air quality impacts.

The increased operational demands placed on production at the Old Cool Quarry would require quarry operation up to 20 hours a day. The noise resulting from quarrying activities and transporting the aggregate to the damsite would result in a significant unavoidable impact to residents of the Auburn Lake Trails subdivision for the 2- to 3-year construction phase of the project.

The dam would only minimally disrupt view corridors due to the limited public vantage points. However, the size, manmade form, and reflective surface of the dam would contrast with adjacent areas of bare rock and vegetation, producing long-term visual dominance impacts and obstructing movement along the North Fork American River above and below the damsite. Furthermore, flood debris clutter in the pool area and river, soil slippage along canyon walls within the inundation zone, vegetation mortality, and other damage caused by periodic filling and emptying of the canyon area would also create significant and unavoidable visual impacts. The Highway 49 replacement would require grading cuts along the canyon wall, resulting in unavoidable visual impacts.

400-YEAR ALTERNATIVE

The significant unavoidable impacts of the 400-year alternative would be substantially the same as those described above for the selected plan. However, upper American River air quality, visual, and noise impacts associated with the dam would proportionally increase due to the increased height of the dam with the 400-year alternative and the slightly longer construction period.

150-YEAR ALTERNATIVE

The 150-year alternative provides the maximum level of flood protection achievable without adding new upstream storage to the existing American River flood control system. This alternative involves increasing the storage space allocated to flood control in Folsom Reservoir, lowering the Folsom Dam spillway, and constructing levee improvements in the Natomas and lower American River areas.

NATOMAS

In Natomas, the levee work required for the 150-year alternative would be essentially the same as that outlined in the selected plan. Portions of the NEMDC would be raised higher and levees along the north and south banks of Dry and Arcade Creeks would be higher and longer. However, the significant unavoidable air quality, traffic, and noise impacts would be about the same as for the selected plan.

The same long-term agricultural and visual impacts described for the selected plan would also occur with implementation of the 150-year alternative.

LOWER AMERICAN RIVER

The significant unavoidable air quality and noise impacts identified in the Natomas area for the selected plan would also occur as a result of levee improvements proposed in the lower American River area under the 150-year alternative. Construction activities associated with lowering the Folsom Dam spillway also would result in an unavoidable short-term noise impact.

Changes in temperature and seasonal flows of the lower American River due to reoperation of Folsom Reservoir could result in a significant decrease in fish resources. This impact is considered potentially unavoidable due to the unknown effectiveness of the proposed mitigation plan.

Unavoidable visual impacts would occur as a result of modifications to levees along the lower American River. These modifications would change the seminatural appearance of the levees and would result in the loss of existing riparian habitat and fish spawning grounds in the American River Parkway.

Unavoidable recreation impacts would result from reoperation of Folsom Dam and associated low surface-water levels that would expose a larger area of reservoir bottom during the winter and dry years. This alternative would also result in unavoidable impacts to recreation in the lower American River due to the permanent loss of vegetation and associated impacts affecting water-dependent recreation such as boating.

UPPER AMERICAN RIVER

This alternative does not require any flood control facilities in the upper American River area; therefore, no impacts would occur.

100-YEAR (FEMA) LEVEE ALTERNATIVE

Unavoidable impacts in the Natomas and lower American River areas would be substantially the same for this alternative as the non-reservoir-related impacts described for the 150-year alternative. No flood control facilities or related impacts would occur in the upper American River.

100-YEAR (FEMA) STORAGE ALTERNATIVE

Unavoidable impacts associated with this alternative would be about the same in Natomas as the selected plan and substantially the same in the lower American River area as the reservoir-related impacts described for the 150-year alternative. No flood control facilities or related impacts would occur in the upper American River area.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

Unavoidable impacts associated with this alternative would be substantially the same in the Natomas and lower American River areas as those described for the 150-year alternative. No flood control facilities or related impacts would occur in the upper American River area.

CHAPTER 20

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF THE ENVIRONMENT AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

Implementation of the proposed project would involve direct and indirect impacts which would constitute short-term uses of the environment. Levee improvements, dam construction, and the conversion of undeveloped land to urban uses (after flood control measures are in place) would result in foreclosed opportunities for future environmental productivity. In the case of urbanization, one type of productivity (agriculture, mineral extraction, recreation, or other types of open-space activities) would be traded for the types of productivity associated with commercial, industrial, and residential land uses. In all cases, the commitment of land would be long term.

Chapters 4 through 16 of this report discuss in greater detail the direct and indirect impacts of the proposed project and project alternatives. The following discussion briefly summarizes the long-term and cumulative impacts for each region, any modifications to the range of beneficial uses of the local environment, and the implications of the selected plan for the health and safety of the general public.

NATOMAS

The following discussion of the Natomas area is applicable to implementation of the selected plan and all other alternatives except the no-action alternative. With the no-action alternative, the Natomas area would remain vulnerable to flood events with an occurrence greater than 70 years, while existing short-term uses and the potential long-term productivity of the area would remain unchanged.

The likely cumulative and indirect long-term effects of the project would be the conversion of agricultural and other categories of "open-space" lands to alternative uses, specifically urban and suburban development. While foreclosing the option to benefit from the open-space-related productivity of these lands, the urban uses to which they would be converted would result in more diverse and intense economic development. The associated environmental tradeoffs, however, include impacts on air quality, water quality, agricultural production, fish and wildlife habitat, and other resource categories.

These impacts are not linked solely to the implementation of the selected plan or any other alternative: even with flood protection, these impacts could not occur without appropriate additional actions by the City of Sacramento and Sacramento and Sutter Counties. These actions, in turn, are linked to prevailing economic forces. Thus, flood control is necessary, but not the only action required for these impacts to occur.

The potential short-term gains of the project would be the immediate protection of the area from flooding and a reduction in flood insurance requirements. Without the project, significant numbers of people would be vulnerable to potentially catastrophic flood risk, and billions of dollars of property would be vulnerable to damage or loss.

The long-term productivity of certain economic and resource categories could be reduced by the potential indirect effects of the project. These include agricultural lands, fish and wildlife habitat, and recreation areas. The productivity of other economic sectors, such as retail trade, housing, light industry, and transportation, could increase as a result of project implementation.

LOWER AMERICAN RIVER

Selection of the no-action alternative would result in no change to existing uses of the environment or future potential long-term productivity in the lower American River area. However, existing development would remain vulnerable to flood events with an occurrence greater than 70 years.

Implementation of the 150-year alternative or 100-year (FEMA) levee or levee/storage and spillway alternative would result in short-term direct air quality and noise impacts during construction.

Most areas in the urbanized portion of the American River flood plain are currently at or near buildout. Flood protection is not expected to affect either the timing or type of development that would occur on the remaining vacant lands within the flood plain (but outside the Natomas basin). The project would, however, be necessary to permit development of vacant lands in the Meadowview and Pocket areas, where high base-flood elevations might otherwise constrain growth. Thus, long-term productivity (that is, agriculture/open space) would be exchanged for short-term urban uses along the lower American River.

UPPER AMERICAN RIVER

Implementation of the selected plan or 400-year alternative would require construction of a flood control dam near Auburn. Operation of the dam would result in permanent changes to the physical character of areas in the inundation zone behind the dam. Some plant communities in the inundation zone likely would be destroyed by the physiological effects of inundation and by soil slippage associated with the impoundment of floodwaters. (See Chapter 7, Fish, Vegetation, and Wildlife, for a more thorough discussion of potential inundation impacts.) The inundation zone involves approximately 5,000 acres of the American River canyon and 40 miles of river along the North and Middle Forks. Inundation--especially at higher elevations--would be infrequent and of short duration. Replacement of Highway 49 could result in increased air pollutant emissions and noise levels and temporary disruptions of local traffic during construction.

The project would involve replacing Highway 49 with a new bridge and highway alignment across the north fork of the river at river mile 23.0. This in-kind replacement of the existing bridge and road would not substantially alter existing local traffic or commute patterns and would thus have no significant impact on growth in northwestern El Dorado County.

Natural resources upstream from the damsite would remain productive over the long term as land uses would be limited to agricultural practices, open space, and/or natural habitat because of the possibility of inundation.

PROJECT JUSTIFICATION

The need for the project is based primarily on (1) the current low level of protection (about 70 years in most areas) and (2) the consequences of a major flood in the area. Without the project, a 100-year flood would cause many deaths and billions of dollars in property damage; a 200-year event would result in greater property damage and a larger number of deaths.

If these lives and property are to be effectively and efficiently protected, developed as well as undeveloped areas must be removed from the flood plain. At least some of the undeveloped land protected with the selected plan would probably be urbanized once the threat of frequent flooding is removed. It is this conversion of agricultural and open-space land to urban and suburban uses that constitutes most of the "local, short-term uses of the environment" which would preclude certain categories of future productivity (agricultural production, mineral extraction, and recreation would be traded for the types of productivity associated with urban and suburban land uses).

With respect to the benefits achieved by the selected plan, the project would:

- Produce economic benefits substantially in excess of project costs.
- Avoid damage to aquatic resources that would result with the non-dam alternatives evaluated in this report.
- Provide a significantly higher margin of public safety for the people and property occupying the American River flood plain than all alternatives other than the 400-year alternative.

On this basis, it may be concluded that the short- and long-term benefits obtained by the selected plan outweigh the losses of agricultural and open-space land that would result from implementing the project. Furthermore, with respect to the timing of project implementation, it is clear that the sooner the project is completed, the greater the benefits achieved will be in terms of diminishing the risk of major flooding.

CHAPTER 21

SIGNIFICANT IRREVERSIBLE ENVIRONMENTAL CHANGES ASSOCIATED WITH THE PROJECT

The following direct irreversible environmental changes are associated with the selected plan:

- o The use of nonrenewable resources in the construction of a flood control dam, Highway 49 and Ponderosa Way replacements, and levee improvements.
- o The long-term commitment of land to flood control facilities.
- o The possibility of realizing full buildout in flood plain areas protected from flooding by the project.

The indirect irreversible effects associated with the selected plan include loss of agricultural and other open-space lands and increases in local public service demands (police, fire, sewer, library) resulting from urbanization in newly protected areas.

The following sections describe both the direct and indirect irreversible changes that would result from project implementation, as well as the justification for the approval of such changes at this time.

NO-ACTION ALTERNATIVE

Under the no-action alternative, current levels of nonrenewable natural resources committed to flood protection in the Sacramento region would not change, nor would nonrenewable resources be consumed for road and bridge relocations. In the absence of a significant flood, commitments of such resources to new development in the region as a whole would be the same as under any of the other alternatives (flood control is not expected to affect growth on a regional scale). Those resources would simply be consumed in the process of developing other subareas within the region.

With the no-action alternative, however, nonrenewable resources would be consumed following major floods in the Sacramento region. These resources would be used in rescue, salvage, and reconstruction operations. Whether or not the amount of nonrenewable resources consumed in this way would surpass the amount consumed in the implementation of a flood control alternative depends on the extent of the damage and the amount of reconstruction undertaken.

Following a destructive flood, however, one of two things would happen: a flood control project would be constructed or another destructive flood would eventually occur. Thus, the amount of nonrenewable resources consumed under the no-action alternative would, over the long term, probably surpass the amount consumed in constructing any of the alternative flood control projects discussed in this report. The economic analysis for the selected plan supports this in showing that the selected plan will provide more benefits than the costs needed to achieve the benefits.

SELECTED PLAN

USE OF NATURAL RESOURCES FOR PROJECT CONSTRUCTION AND OPERATION

Implementation of the selected plan would consume nonrenewable resources for three main purposes: (1) the mobilization of equipment, supplies, and manpower to construction sites; (2) the use of natural resources as construction materials in flood control structures; and (3) the consumption of resources in the course of maintenance operations. Construction would occur at the dam, Highway 49 and Ponderosa Way replacements, and at levees in the Natomas vicinity.

Resources consumed in the process of completing these tasks would be committed to the project rather than to other uses. These resources would include the building materials used, the energy necessary for construction of each project component, and the energy used for the long-term maintenance of the levees and the flood control dam.

The use of fuels and materials necessary to complete the project would not be recoverable. However, the incremental short-term increased use of fuels necessary to complete the project is minor compared to the national or local daily use and reserve supply. Moreover, the consumption of resources associated with implementing the selected plan is not expected to exceed consumption levels under the no-action alternative.

IRREVERSIBLE COMMITMENT OF LAND

The selected plan also involves the irreversible commitment of land for use in conjunction with flood control facilities; the land beneath the dam and beneath project levees falls within this category, as does the land in the temporary inundation pool behind the dam. The land in the inundation pool comprises by far the largest commitment of this type. Although inundation would be infrequent, about 4,000 acres could potentially be covered with water. The dam itself would be about 400 feet wide at its base and 2,600 feet long at its crest. As such, it would cover about 24 acres of land.

The land covered in the process of constructing new levees and raising existing levees would also be irretrievably committed to those uses. About 54 acres would be needed in the Natomas area, including the Natomas detention basin and Dry and Arcade Creek areas. The effects of this irretrievable commitment, however, are decreased by three factors:

- Much of the land upstream from the proposed damsite was purchased by the Federal Government as part of the Auburn multipurpose dam project. Under that project, most of the lands would have been permanently inundated. They are currently designated as a State Recreation Area. If no dam is built at the Auburn site, some or all of the lands would likely remain in recreational area or park status because of the area's steepness and natural beauty. Thus, the commitment of the area to the flood control project does not mean that future land uses would be significantly different.

- With the exception of the land beneath the dam, the commitment of the land to the flood control project is not a commitment to a single use. Recreational uses would be possible on the levees and behind the flood control dam.

- In the context of the current extensive Natomas levee system, the proposed commitment of additional land to levees in the area is minor.

OPTION FOR FULL BUILDOUT OF PROTECTED AREAS AS AN IRREVERSIBLE CHANGE

The three local governments whose jurisdictions include portions of the Natomas basin (Sacramento City and County and Sutter County) have indicated, via general plans and proposed general plan amendments, their intention to permit varying amounts of development in the basin. These documents were written assuming that adequate flood protection either existed in or would be provided to the affected areas. The selected plan would provide the necessary level of flood protection. Full buildout of the entire basin is not foreseen in existing planning documents, but could become a reality under future general plans if the selected plan were implemented.

This irreversible effect of the project is unavoidable, however, because it is impossible to provide increased flood protection to the currently developed portions of the flood plain without facilitating growth in the undevelped portions, including most of the Natomas basin. It must also be recognized that the extent to which the selected plan would facilitate growth would depend largely on the land use policies adopted by the appropriate local jurisdictions. These policies would in turn be shaped by objective economic conditions and by the political, social, and environmental considerations important to the affected communities.

REPLACEMENT OF HIGHWAY 49

Implementation of the selected plan would require replacement of the sections of Highway 49 that would be temporarily inundated during major storms. The selected plan calls for replacing Highway 49 via a new bridge that would be above the maximum flood control pool. The design of the new roadway would be as close as possible to the existing configuration in terms of capacity and alignment. A total of 9,300 feet of roadway would be replaced; of this, 8,900 feet would be bridge construction and 400 feet would be roadway construction. The bridge would span the North Fork at river mile 23. As discussed elsewhere, the Highway 49 replacement ultimately constructed could change because of local decisions. In this case, specific impacts would be identified later in route adoption studies conducted by the State.

Nonrenewable resources, including fuel, asphalt, and concrete, would be consumed in the construction of the roadway.

OTHER CHANGES

Other unavoidable and irreversible environmental changes associated with the selected plan include modification in the streambed at the damsite and alterations in the hydrologic regime and the topography in areas of levee modifications and at the damsite.

If the selected plan is authorized by October 1992, FEMA requirements would have been met and development in the flood plain would not be subject to Federal lending prohibitions or flood-proofing restrictions. Sacramento City and County and Sutter County have all indicated that they intend to permit varying levels of development in the basin. The indirect irreversible impacts associated with this development include loss of agricultural areas, wildlife habitat, and other forms of open space and increased demand for public services (police, fire protection, schools, water, and sewer connections). This development would also lead to decreased air and water quality, but these impacts could potentially be lessened with changes in transportation and water treatment technology.

Although the selected plan would allow growth in the Natomas basin, it is not expected to affect growth levels on a regional scale. Thus, the indirect irreversible impacts in Natomas following implementation of the selected plan would occur elsewhere in the region outside the flood plain if the project is not implemented.

UPPER AMERICAN RIVER

The dam constructed as part of the selected plan would impound floodwaters only temporarily in the canyons of the upper American River. Occasional short-term inundation would cause some irreversible impacts to vegetative communities in the inundation zone.

400-YEAR ALTERNATIVE

The irreversible environmental changes associated with the 400-year alternative are almost identical to those associated with the selected plan. The two primary differences would be a larger dam footprint and a larger maximum inundation pool.

150-YEAR ALTERNATIVE

USE OF NATURAL RESOURCES FOR PROJECT CONSTRUCTION AND OPERATION

Construction with the 150-year alternative would occur at levees along the lower American River, at levees in the Natomas vicinity, and at Folsom Dam. The natural resources consumed in construction and operating these features would be the same as described for the selected plan.

IRREVERSIBLE COMMITMENT OF LAND AND WATER

The 150-year alternative also involves the irreversible commitment of land for use in conjunction with flood control facilities; the lands beneath project levees and beneath the expanded Sacramento Weir fall into this category. Because the flood storage space behind Folsom Dam would be increased, less space would be available for agricultural and municipal water (this includes water for use in the generation of electricity). The commitment of these resources would be irretrievable in that attempts to reclaim them for other uses could expose some or all of the densely populated Sacramento area to a potentially serious flood danger. As with the selected plan, project levees would continue to be used for recreation.

OPTION FOR FULL BUILDOUT OF PROTECTED AREAS AS AN IRREVERSIBLE CHANGE

The irreversible changes associated with indirect impacts of the 150-year alternative in the Natomas area are similar to those associated with the selected plan. The 150-year alternative would have no impacts in the upper American River area or along Highway 49.

100-YEAR (FEMA) LEVEE ALTERNATIVE

USE OF NATURAL RESOURCES FOR PROJECT CONSTRUCTION AND OPERATION

Implementation of the 100-year (FEMA) levee alternative would result in construction at levees in the Natomas vicinity and along the lower American River. Resources consumed and the fuels and materials necessary to implement this alternative would be essentially the same as described for the 150-year alternative.

IRREVERSIBLE COMMITMENT OF LAND AND WATER

The alternative also involves the irreversible commitment of land for use in conjunction with flood control facilities; the lands beneath project levees fall into this category. As with the selected plan, project levees could continue to be used for recreation.

OPTION FOR FULL BUILDOUT OF PROTECTED AREAS AS AN IRREVERSIBLE CHANGE

The potential for the 100-year levee alternative to lead to full buildout of protected areas and thereby irreversibly change the local environment is the same as the selected plan's potential to bring about these effects.

100-YEAR (FEMA) STORAGE ALTERNATIVE

USE OF NATURAL RESOURCES FOR PROJECT CONSTRUCTION AND OPERATION

Implementation of the 100-year storage alternative would involve levee improvements in the Natomas vicinity and the reoperation of Folsom Dam. Resources consumed and the fuels and materials necessary to implement the Natomas levee improvements would be essentially the same as described for the selected plan.

IRREVERSIBLE COMMITMENT OF LAND AND WATER

The 100-year storage alternative also involves the irreversible commitment of land for use in conjunction with flood control facilities; the lands beneath project levees fall into this category. Because the flood storage space behind Folsom Dam would be increased, less space would be available for agricultural and municipal water (this includes water for use in the generation of electricity). The commitment of these resources would be irretrievable in that attempts to reclaim them for other uses could expose some or all of the densely populated Sacramento area to a potentially serious flood danger. As with the selected plan, project levees could continue to be used for recreation.

OPTION FOR FULL BUILDOUT OF PROTECTED AREAS AS AN IRREVERSIBLE CHANGE

The potential for the 100-year storage alternative to lead to full buildout of protected areas and thereby irreversibly change the local environment is the same as the selected plan's potential to bring about these effects.

100-YEAR (FEMA) LEVEE/STORAGE AND SPILLWAY ALTERNATIVE

USE OF NATURAL RESOURCES FOR PROJECT CONSTRUCTION AND OPERATION

The use of natural resources for project construction and operation of the 100-year levee/storage and spillway alternative would be similar to the resource uses of the 150-year alternative.

IRREVERSIBLE COMMITMENT OF LAND AND WATER

The irreversible commitment of land and water which would result from implementation of the 100-year levee/storage and spillway alternative would be similar to the commitments for the 150-year alternative.

OPTION FOR FULL BUILDOUT OF PROTECTED AREAS AS AN IRREVERSIBLE CHANGE

The potential for the alternative to lead to full buildout in protected areas and thereby irreversibly change the local environment is the same as the selected plan's potential to bring about these effects.

CHAPTER 22

MITIGATION AND ENVIRONMENTAL MONITORING

This chapter discusses the mechanisms needed to ensure that the mitigation measures identified in Chapters 4 through 18 and summarized in Chapter 1 (Summary) will be accomplished. These measures consist of habitat preservation, restoration, or improvement and other actions required to minimize or compensate for unavoidable impacts of the selected plan. In accordance with Section 906 of the Water Resources Development Act of 1986, mitigation for direct project impacts, including land acquisition and vegetative plantings, will be accomplished prior to or concurrent with construction. This mitigation will be an authorized project feature and will be cost shared by the Federal Government and the project's non-Federal sponsor. Mitigation for indirect impacts will be the responsibility of the local governmental agencies controlling land use in the areas where future development will be facilitated by the project. These agencies will be responsible for ensuring that mitigation for growth-related impacts is provided as these impacts occur. Tables 1-2 through 1-14 (located at the back of the EIS/EIR) summarize the mitigation requirements for construction and operation impacts. These mitigation requirements are presented in detail in the mitigation section of the chapters which discuss the various resources. Table 1-15 lists the mitigation specified for indirect impacts.

MONITORING OF MITIGATION FOR DIRECT IMPACTS

FEDERAL COMMITMENT

To ensure that mitigation for direct project impacts is accomplished, a mitigation monitoring program will be prepared by the District Engineer in consultation with the non-Federal sponsor and appropriate resources agencies. The program will define appropriate mitigation monitoring criteria and outline the methods needed to ensure that these criteria are fulfilled.

To ensure that mitigation for impacts to cultural resources in the project area is complied with, the Corps and non-Federal sponsor will adhere to the stipulations contained in the Programmatic Agreement (see Appendix F) between the Corps, the non-Federal sponsor, the U.S. Bureau of Reclamation, the Advisory

Council on Historic Preservation, and the State Historic Preservation Officer. The Corps and non-Federal sponsor will also implement Federal guidelines which will ensure compliance with Section 110 of the National Historic Preservation Act.

Mitigation for impacts to local drainage and water quality, air quality, traffic patterns, and noise resulting from construction activities will be accomplished by requiring contractors to adhere to appropriate standards for operating heavy equipment, to submit spill containment plans for handling petroleum products and hazardous materials, to conform to applicable local standards for operating equipment on public roadways, to properly dispose of trash and refuse generated by construction activities and workers, and to construct such facilities required to prevent sediment from being introduced into the aquatic environment as a result of construction activities. These requirements will be included in the plans and specifications of the construction contracts issued in connection with the project.

The mitigation monitoring program will contain specific measures to ensure that impacts to wildlife habitat are mitigated as planned and that adequate habitat values result. The program will validate the initial mitigation plan assumptions discussed in Chapter 7, and provide for any necessary adjustments in the plan. The Corps will lead a monitoring team consisting of members from the appropriate resources agencies and the non-Federal sponsor. The monitoring team will annually review the effectiveness of the mitigation program and report the results to the District Engineer. Should mitigation fail, the monitoring team would recommend that the local sponsor take appropriate remedial action. If the local sponsor does not initiate appropriate action within 6 months or complete remediation within 1 year of receiving notice of mitigation failure, the Corps may design and construct the remedial mitigation and bill the local sponsor for substandard project operation and maintenance, or the Corps may implement other remedies as provided by Section 912 of the Water Resources Development Act of 1986.

STATE COMMITMENTS

Pursuant to CEQA, Section 21081.6, whenever the Department of Water Resources adopts a Negative Declaration or an EIR for a flood control project, The Reclamation Board is required to adopt a reporting and monitoring plan for each mitigation measure included in the project. In addition, California Water Code 8611 requires that the Board prepare a mitigation plan in consultation with the Department of Fish and Game prior to construction of a flood control, channel clearance, or bank stabilization project. This plan must contain:

- o A description of actions to be taken to ensure that the project meets all mitigation requirements required by law and causes no net loss of riparian, fishery, or wildlife habitat.
- o A designation of the agency or agencies responsible for implementing and maintaining each element of the mitigation plan.
- o A schedule of mitigation implementation, ensuring that the mitigation measures would be accomplished prior to or concurrent with construction of the project, unless the Board determines that to do so would be impracticable.
- o A financing plan, identifying the sources of funds, the share of mitigation costs attributable to each source, and a schedule of when the funds are to be provided.

MITIGATION FOR INDIRECT IMPACTS

Local agencies with land use jurisdiction over the areas in which growth-related impacts could occur as a result of the project would be responsible for ensuring that mitigation for these impacts is accomplished on a project-by-project basis, as required under applicable State and Federal law. It is anticipated that growth-related impacts in five specific resource areas will be addressed in accordance with the provisions of the Memorandum of Understanding Regarding Local Assurances (MOU), prepared by staff representatives of the Corps and the non-Federal sponsors. The MOU is set forth at the conclusion of this chapter. It covers indirect impacts to resources in the following areas:

- o Significant cultural resources identified under the National Historic Preservation Act
- o Wetlands protected under Section 404(b)(1) of the Clean Water Act
- o Fish and wildlife resources protected under the Fish and Wildlife Coordination Act and other applicable laws
- o Species protected under the State and Federal Endangered Species Acts

- o Air quality protected under the State and Federal Clean Air Acts

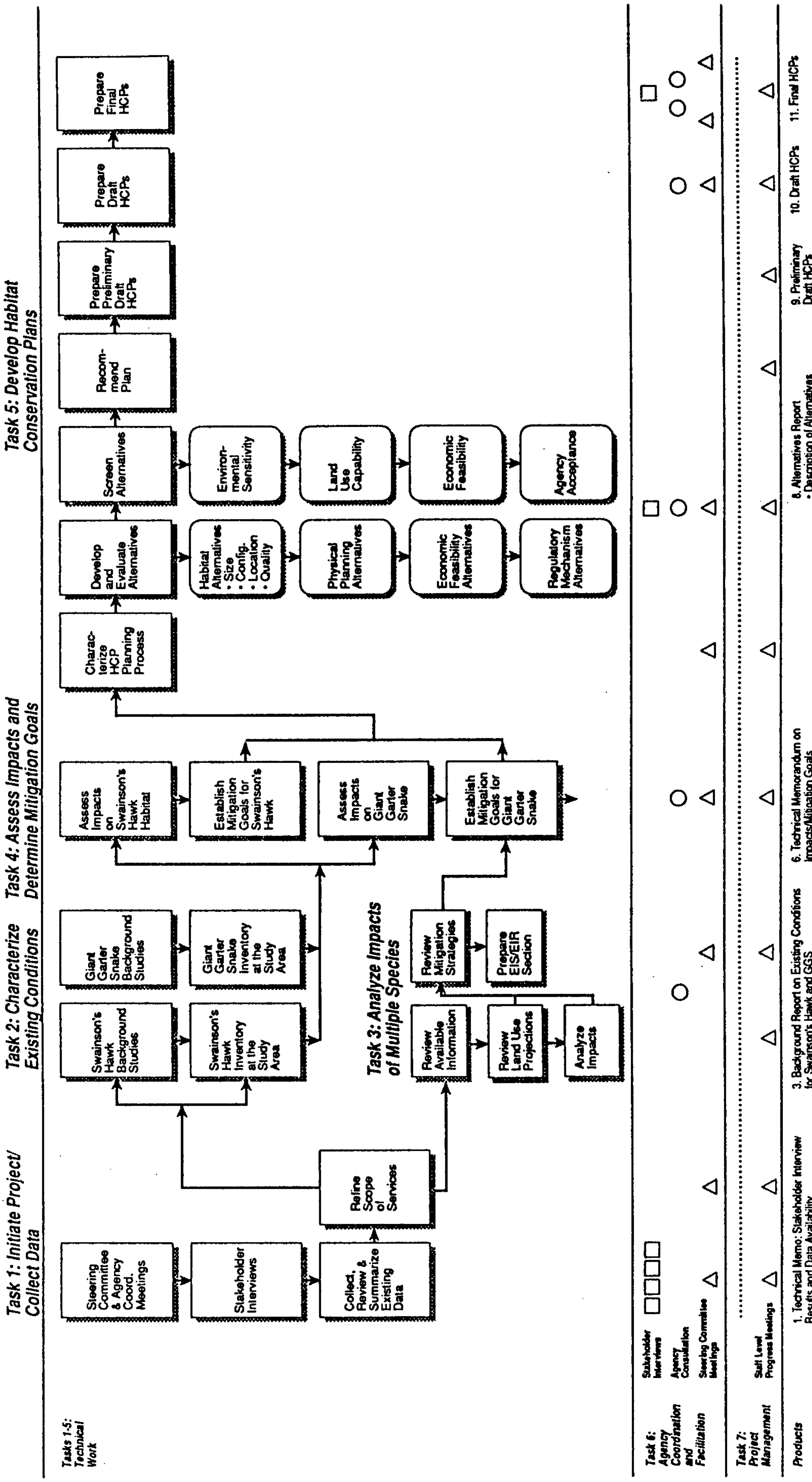
Upon approval by the governing bodies of the responsible local agencies and The Reclamation Board, the MOU would be incorporated by reference into the local cost-sharing agreement for the project. The manner in which the local agencies will discharge their obligations under the MOU will be spelled out in more detail during the course of the public review and comment period following the publication of this EIS/EIR. Some noteworthy actions have been initiated since the publication on the Draft EIS/EIR in April 1991. These actions include:

- o Execution of a Federal programmatic agreement regarding the identification, preservation, and treatment of sites, buildings, and objects of historical and archeological significance in all portions of the project area, including Natomas. This agreement is contained in Appendix F (Cultural and Paleontological Resources).

- o Initiation of a habitat conservation planning process by SAFCA, the City of Sacramento, Sacramento County, Sutter County, and The Reclamation Board to satisfy applicable provisions of the State Endangered Species Act. This planning process focuses on potential indirect impacts to the Swainson's hawk and the California giant garter snake, two State-listed species which occupy or forage in the Natomas and Meadowview portions of the project area. A detailed description of the scope of this planning process is included in Appendix P (Endangered Species). Figure 22-1 indicates the tasks which are being undertaken and the timeframe in which they will be completed.

- o Adoption by the Sacramento Metropolitan Air Quality Management District of a regional air quality attainment plan designed to achieve compliance with State and Federal standards by 1997. This plan is discussed in Chapter 12 (Air Quality).

FIGURE 22-1
Sacramento Area Flood Control Agency
Threatened Species Habitat Conservation Plan – Work Flow Diagram



MEMORANDUM OF UNDERSTANDING REGARDING LOCAL ASSURANCES

THIS MEMORANDUM OF UNDERSTANDING (MOU) is the product of a series of discussions held between staff representatives of the U.S. Army Corps of Engineers (hereinafter referred to as the "Corps"), the California State Department of Water Resources and Reclamation Board (hereinafter referred to as the "State"), the City of Sacramento, the County of Sacramento, the County of Sutter, (hereinafter collectively referred to as the "Local Agencies"), and the Sacramento Area Flood Control Agency (SAFCA)

RECITALS

1. The Corps and the State are preparing a feasibility study and joint environmental impact report/environmental impact statement (EIR/EIS) for flood control measures in the Sacramento metropolitan area. The purpose of these measures is to reduce potential flood damages during major storm events. The study recommends construction of appropriate works to reduce flood damages along the American River and in the Natomas area.

2. Prior to commencing the feasibility study, the Corps completed a reconnaissance study titled "American River Watershed Investigation, California." This study was undertaken primarily in response to the near disastrous flooding in the Sacramento area in February 1986. The study concluded that the area had significantly less flood protection than was previously believed and that large parts of the City and County of Sacramento and the entire Natomas basin lay within the 100-year flood plain.

3. SAFCA and the State are sharing in the cost of the feasibility study and joint EIR/EIS and will act as the local sponsors of the flood control project authorized by Congress.

4. Because of the severity of the threat of major flooding to large areas of metropolitan Sacramento, the feasibility study concentrates on alternatives designed to provide high levels of flood protection (i.e., greater than about 200 years). Along the main stem of the American River, the study focuses on a flood-control-only dam at or near the existing Auburn Dam site, constructed so as not to preclude future expansion into a larger multipurpose reservoir. For the Natomas area, the study primarily examines measures for enlarging and improving existing levees.

5. The parties agree that without construction of the project, development in areas of the 100-year flood plain, including Natomas, could be severely constrained. In effect, the project is needed to permit Local Agencies to continue the orderly development of these areas in accordance with their respective development plans. Construction of the project may thus be deemed to induce growth and to indirectly cause the environmental impacts associated with such growth.

6. The parties are particularly concerned about the growth anticipated to occur in the Natomas area and the potential adverse impacts of this growth in five natural resource areas currently protected under Federal and State law. These resource areas are cultural resources, wetlands, fish and wildlife resources, endangered species, and air quality.

7. Prior environmental documents prepared by the Local Agencies in connection with their development plans have evaluated the impacts of anticipated growth in Natomas on these resources, and a series of mitigation measures have been adopted. However, the parties recognize that some of the analysis contained in these documents must be updated to incorporate new information on growth-related impacts. As a result, the responsible Federal and State resource agencies may recommend that mitigation measures in addition to those already adopted be undertaken by the Local Agencies.

8. Furthermore, the parties recognize that the project has the potential to induce growth in the Natomas area beyond the levels currently anticipated. Existing Local Agency plans project development to the year 2010 and anticipate that approximately one-third (1/3) of Natomas will be urbanized as of that date. However, current population projections suggest that growth beyond these parameters may occur, particularly if the project provides flood protection to the entire Natomas basin. The timing, extent, and character of this growth, while dependent on flood control, will also be affected by future demographic, social, attitudinal, environmental and technological trends which cannot be fully anticipated at this time. Accordingly, it is presently impossible to specify the adverse environmental impacts which may result from this growth. Therefore, the parties agree that the potential for such adverse impacts may be best addressed by obtaining reasonable assurances from the Local Agencies as to how these impacts will be managed if and when they occur.

9. The purpose of this MOU is to provide a statement of these reasonable assurances.

ASSURANCES

1. **Cultural and Historical Preservation**. The parties are mutually committed to the preservation of historic sites, buildings, and objects of cultural, historical and archeological significance in the Natomas area. In order to carry out this commitment, the parties agree that prior to any Congressional authorization of the project, a programmatic agreement will be executed by and among the Local Agencies, the Corps, the State, the State Historic Preservation Officer, the Advisory Council on Historic Preservation (ACHP) and all other interested parties in accordance with applicable regulations established by the ACHP under Section 106 of the National Historic Preservation Act. This agreement will set forth the procedures which the Local Agencies will follow in identifying and evaluating the historic properties and archeological sites requiring preservation, and will lead toward the adoption, prior to the start of project construction, of a management plan for these properties and sites.

2. **Wetlands**. The parties recognize the importance of the social, economic, environmental, and ecological values provided by wetlands. Accordingly, the Local Agencies agree to implement or insure implementation of all requirements imposed by the Corps in regulating the use of Natomas area wetlands which are protected under Section 404 of the Clean Water Act. Furthermore, each Local Agency will use its best efforts to adopt, prior to any Congressional authorization of the project, a "no net loss of wetland acreage or values" policy for the Natomas area. This policy will apply to all naturally occurring wetlands in Natomas, but not to artificially created seasonal wetlands such as rice fields. Under this policy, each Local Agency, to the extent permitted by law, will avoid approval of any new development located in a locally protected wetland, unless there is no practical alternative to such development, in which case the Local Agency will require mitigation and/or compensation as a condition of project approval.

3. **Fish and Wildlife Resources**. The parties are mutually committed to the conservation of fish and wildlife resources in the Natomas area. It is recognized that urban growth in Natomas, as anticipated under existing Local Agency plans, and as may occur beyond the lands currently designated for urbanization, could adversely affect fish and wildlife resources in the area. Accordingly, in connection with all future development in Natomas, the Local Agencies will evaluate impacts to fish and wildlife resources on a project-by-project basis and consider appropriate mitigation measures consistent with CEQA and NEPA requirements.

4. **Endangered Species**. The parties are committed to protecting all habitat which may be deemed essential to the

existence of any Federal or State listed species in the Natomas area. Accordingly, each Local Agency, to the extent required by law, will insure that no new project in the Natomas area will jeopardize the continued existence of any Federal or State listed species by destroying or adversely modifying habitat which is determined to be essential to such species. If it is determined that a project could destroy or adversely modify essential habitat, the Local Agency will develop an appropriate mitigation plan for adoption as part of the project approval.

5. **Air Quality**. The parties are mutually committed to the attainment and maintenance of adopted Federal and State ambient air quality standards in the Sacramento region, and recognize that the region does not presently meet these standards. In Sacramento County, the Sacramento Metropolitan Air Quality Management District ("AQMD") has been formed to develop, adopt and maintain regional control programs for mobile sources and indirect sources of air pollution, in addition to strengthening traditional stationary source controls. The Sutter County Air Pollution Control District (APCD) serves a similar function in Sutter County. The AQMD and the APCD are developing plans, in cooperation with other public agencies, and with full participation of the public at large, to satisfy adopted Federal and State air quality standards.

With full recognition of the adverse effects of polluted, unhealthy air on the citizenry, agriculture, tourism, business, economic growth, and the general quality of life in the Sacramento area, the Local Agencies will:

a. Support the efforts of the AQMD and the APCD to reduce regional emissions at a rate of 5% per year from the base year of 1987, as required under Section 40914 of the California Health and Safety Code, until state ambient air quality standards are achieved; and to maintain these standards thereafter.

b. Complement AQMD and APCD efforts to achieve healthful air with their own policies, programs and decisions.

c. Recognize and support the authority of the AQMD and APCD in controlling sources of emissions.

d. Coordinate land use and transportation planning with the pollution control efforts of AQMD and the APCD in order to minimize conflicting plans, policies and programs.

e. Participate, to the extent possible, in non-regulatory AQMD and APCD programs such as public education, surveys, studies and elements of the clean burning fuels program, among others.

f. Coordinate with other public agencies, business, and others in seeking regional consistency and equity in attaining and maintaining adopted Federal and State air quality standards.

g. Recognize the direct and indirect, potential and real, adverse impacts on air quality of Local Agency land use and transportation planning decisions and cooperate with the AQMD and APCD in mitigating and offsetting such adverse impacts.

h. Provide and encourage alternative technology and programs that result in less dependence on public actions which contribute to high levels of air pollution.

CHAPTER 23

COMPLIANCE WITH APPLICABLE LAWS, POLICIES, AND PLANS

The relationship of the selected plan to applicable Federal and State environmental requirements is outlined below. The project is in compliance with all laws, regulations, and Executive orders.

FEDERAL REQUIREMENTS

NATIONAL HISTORIC PRESERVATION ACT OF 1966, AS AMENDED (16 USC SEC. 470 ET SEQ.), HISTORIC AND ARCHEOLOGICAL DATA PRESERVATION, AS AMENDED (16 USC 469 ET SEQ.), ARCHAEOLOGICAL RESOURCES PROTECTION ACT (16 USC SEC. 470AA ET SEQ.), PROTECTION OF HISTORIC PROPERTIES (36 CFR 800), ABANDONED SHIPWRECK ACT (43 USC SEC. 2102 ET SEQ.).

These acts and regulations require Federal agencies to take into account the effects of Federal undertakings on historical and archeological resources. Under these requirements, the area of potential effect of the selected project shall be inventoried and evaluated to identify historical or archeological properties that have been placed on the National Register of Historic Properties and those that the agency and the State Historic Preservation Officer (SHPO) agree are eligible for listing in the National Register. If the project is determined to have an effect on such properties, the agency must consult with the SHPO and the Advisory Council on Historic Preservation (Council) to develop alternatives or mitigation measures.

Consultation with the SHPO and Council has been initiated. The SHPO and Council have concurred with the Corps that sufficient evidence exists to show that the project would adversely affect at least some significant historic properties.

Based on this appraisal and previous investigations, the Corps, Bureau of Reclamation, non-Federal sponsor, SHPO, and Council have developed a Programmatic Agreement under which cultural resources would be further treated during the project planning, engineering and design phase, or once Congress authorizes the project. A management plan would be developed to evaluate and avoid impacts to cultural resources as project-induced land use changes occurred. Chapter 9, Cultural

Resources, describes potential effects of the selected project and alternatives and identifies mitigation measures.

CLEAN AIR ACT (42 USC SEC. 1857 ET SEQ. (1970), AS AMENDED AND RECODIFIED, 42 USC SEC 7401 ET SEQ. (SUPP II 1978)).

Coordination has been conducted with EPA, California Air Resources Board, Sacramento Area Council of Governments, Sacramento Air Quality Management District, and local City and County air quality authorities. The EIS/EIR summarizes the project's impacts on local and regional air quality in Chapter 12, Air Quality. The chapter discusses the issues relative to the project's compliance with the State Implementation Plan for air quality. The requirements shall be more fully identified and developed during the engineering and design phase of the project. The Corps will be responsible for mitigation of direct impacts; the local sponsor will be responsible for compliance and mitigation of indirect impacts. The local sponsor's responsibilities shall not be covered by project cost-sharing principles.

CLEAN WATER ACT (33 USC SEC. 1251 ET SEQ. (1976 & SUPP II 1978)

The project must comply with the Federal Clean Water Act including Section 404 because construction of the flood control project will require the placement of fill material into the waters of the North Fork American River and in selected areas in the Natomas area. A Section 404(b)(1) evaluation has been prepared and is included as Appendix G of this EIS/EIR. In accordance with Section 404(r) of the Clean Water Act, this information is being presented to Congress with a request for exemption from Federal and State Clean Water Act regulation.

ENDANGERED SPECIES ACT (16 USC SEC 1531 ET SEQ.)

Section 7 of the Endangered Species Act requires Federal agencies, in consultation with the Secretary of the Interior, to ensure that their actions do not jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of these species.

A list of threatened and endangered species relating to this project was obtained from FWS. A biological assessment was prepared indicating that only the threatened valley elderberry longhorn beetle is likely to be adversely affected. Mitigation features have been included in the project plan. The features include elderberry shrub plantings in the Natomas area and the South Fork of the American River. The FWS provided its biological opinion in a letter dated 27 November 1991 concurring in the Corps mitigation plans and found that the project will not jeopardize the continued existence of the threatened species. The FWS specified four mitigation features, nine incidental take provisions, and two conservation recommendations; all of these have been included in the project plan to be implemented.

Due to a recent action by FWS officially proposing the delta smelt as threatened, the Corps has asked FWS to advise if this species is in the project area; further compliance action may be required.

FEDERAL WATER PROJECT RECREATION ACT (16 USC SEC. 460L-5, 460L-12 ET SEQ., 662.

This act requires Federal projects to consider features which would lead to enhancement of recreational opportunities. Recreation benefits of the project are included in the economic analysis of the project alternatives. As local sponsors, the City and County of Sacramento would cost share the development of recreation opportunities associated with the project. If the existing or "historic" portion of Highway 49 is left intact to provide recreation access to the river, a local agency would be responsible entirely for this non-project recreational feature.

FISH AND WILDLIFE COORDINATION ACT (16 USC SEC 661 ET SEQ.)

This act requires Federal agencies to consult with the FWS and State fish and game agencies (DFG) before undertaking projects that control or modify surface water (water projects). This consultation is intended to promote the conservation of wildlife resources by preventing loss of or damage to fish and wildlife resources and to provide for the development and improvement of fish and wildlife resources in connection with water projects. The FWS and DFG are authorized to conduct necessary surveys and investigation to determine the possible damage to resources and to determine measures of preventing such losses. Representatives of the Corps and non-Federal sponsor participated in these studies. The reports and recommendations of FWS and DFG must be integrated into any report that seeks permission or authority to construct a project or modify or supplement plans for previously authorized projects. This act requires the Corps to incorporate into the project plan "such justifiable means and measures for wildlife purposes as the Corps finds should be adopted to obtain maximum overall project benefits." These reports are included in Appendix S. The incremental analysis relating to the justifiable mitigation measures is located in Appendix R.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) (42 USC SEC. 4321 ET SEQ.)

This act requires the full disclosure of the environmental impacts, alternatives, potential mitigation, and environmental compliance procedures of the selected project. This EIS/EIR provides partial NEPA compliance. This document provides responses to the comments to the Draft EIS/EIR. A Record of Decision (ROD) will complete the environmental documentation required by the act.

WILD AND SCENIC RIVERS ACT (16 USC SEC. 1271 ET SEQ.), PRESIDENT'S ENVIRONMENTAL MESSAGE OF AUGUST 1979, AND CEQ MEMORANDUM OF AUGUST 10, 1980, FOR HEADS OF AGENCIES

Portions of both the upper and lower American River areas are designated as Wild and Scenic Rivers. The EIS/EIR considers the impacts to these portions in Chapter 14, Recreation. The selected plan does not propose work along reaches of the river designated as wild and scenic and should not adversely affect values related to such designation.

EXECUTIVE ORDER 11988, FLOOD PLAIN MANAGEMENT

This Executive order requires the Corps to provide leadership and take action to (1) avoid development in the base (100-year) flood plain (unless such development is the only practicable alternative); (2) reduce the hazards and risk associated with floods; (3) minimize the impact of floods on human safety, health, and welfare; and (4) restore and preserve the natural and beneficial values of the base flood plain.

In this regard, the policy of the Corps is to formulate projects which, to the extent possible, avoid or minimize adverse impacts associated with use of the base flood plain and avoid inducing development in the base flood plain unless there is no practicable alternative. The flood control plans identified are in compliance with this Executive order.

The protection measures in the Natomas area comply with the Executive order in that the area being protected was reclaimed from the flood plain during the early part of the century. The protection that will be provided by the selected plan is the only practicable manner to protect the homes and structures that existed prior to the recently revised flood plain determination.

The local sponsors will complete a Memorandum of Understanding prescribing reasonable preservation of values associated with the five principal Federally mandated resources of concern: clean air, clean water, endangered species, fish and wildlife, and cultural resources. The local sponsors will comply with State-mandated resource protection including the State's Endangered Species Act. Accordingly, the natural and beneficial values of the Natomas flood plain will be appropriately protected as further urban development continues.

EXECUTIVE ORDER 11990, PROTECTION OF WETLANDS

This order directs the Corps to provide leadership and take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands in implementing civil works. Before Federal agencies undertake any new construction in wetlands, the Executive order requires that they must:

- Determine whether a practicable alternative exists (if so, action should not be undertaken in wetlands).
- Include practical measures to minimize harm to wetlands if action must be taken.
- Preserve and enhance the natural and beneficial values of the wetlands.
- Involve the public early in the decisionmaking process for any action involving new construction in wetlands.

The Corps is coordinating with FWS and EPA in their efforts to identify the areas of least impact for the selected project and to mitigate for any unavoidable losses. Appendix G provides the Section 404(b)(1) evaluation. Chapter 22, Mitigation and Environmental Monitoring, discusses the local agencies' representations regarding their goals toward providing assurances for protection of wetlands.

FARMLAND PROTECTION POLICY ACT (7 USC SECTION 4201 ET SEQ.)

This act requires a Federal agency to consider the effects of its actions and programs on the Nation's farmlands. The Corps provided the U.S. Soil Conservation Service with project maps and descriptions to assess impacts on prime and unique farmlands. The SCS completed its analysis and responded with a Farmland Conversion Impact Rating letter, which is included in the Technical Appendixes. A detailed discussion of the impacts is found in Chapter 10 of the EIS.

STATE LAWS, REGULATIONS, AND POLICIES

This section discusses the relationship of the selected plan to applicable California environmental requirements. Many of the requirements listed below were identified by the Office of Planning and Research as potential project clearance points (Nunenkamp, November 1990). Others were obtained via personal communication with agency personnel.

CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

This document will be adopted as a joint EIS/EIR and will fully comply with NEPA and CEQA requirements. However, the State anticipates the need for supplemental environmental analysis to determine specific environmental effects relative to relocating Highway 49.

The relocation analyses will meet CEQA requirements, which specifically authorize the use of staged or tiered environmental analyses. The lead agency for preparation of the subsequent environmental documentation will be determined either by the California Legislature or CEQA Guidelines.

RECLAMATION BOARD

As a cooperating lead agency and local sponsor of the American River Watershed Investigation, the Department of Water Resources/Reclamation Board has primary responsibility for the CEQA review process and project review.

The Reclamation Board maintains jurisdiction over all flood control levees constructed with funds from Federal-State cost-sharing agreements. Generally, jurisdiction extends from a point 10 feet landward of the levee across to a point 10 feet landward on the other side and includes all portions of the levee and riverbed. Also under the Board's jurisdiction are "designated floodways," including all bypasses and weirs.

<u>Permits or Approvals Required</u>

The Reclamation Board requires an encroachment permit for any activity along or near Federal flood control project levees or in designated floodways to ensure that proposed local actions or projects do not impair the integrity of existing flood control systems to withstand flood conditions.

Encroachment permit applications are evaluated according to criteria in designated floodway plans and the Board's "Standards for Encroachment." Applications are not reviewed until all necessary environmental review is completed, at which time the Board has the discretion to approve or deny an application. Permit decisions are usually made administratively unless the proposed project is very large or is contested.

The Reclamation Board has determined that, as currently defined, the selected plan will require no encroachment permits.

DEPARTMENT OF WATER RESOURCES, DIVISION OF SAFETY OF DAMS

As the responsible agency for ensuring the safety of non-Federal dams and reservoirs, the Department's dam safety division approves plans and specifications to construct dams and reservoirs after completion of the appropriate environmental documentation and review process.

The Department's jurisdiction extends to artificial barriers impounding or diverting water that are or would be (1) capable of impounding at least 50 acre-feet of water and (2) at least

25 feet high (measured from the bed of the watercourse at the downstream toe of the barrier to the maximum water storage elevation for natural stream channels and from the lowest outside elevation to the maximum water storage elevation for barriers not constructed across stream channels).

Permits or Approvals Required

The Division of Safety of Dams issues a Certificate of Approval for any dam construction or enlargement plans after a determination that the selected project could safely impound water. Because the flood control dam will be constructed by a Federal agency, it is not within the State's jurisdiction and would not require a Certificate of Approval from the Division prior to construction. Nonetheless, Division engineers and geologists would review plans and specifications for proposed dam construction to determine whether the design met acceptable modern engineering practices and Division dam safety standards.

The Division would work with project engineers to resolve any safety concerns before final design and construction and would visit the site during construction to monitor progress and check for compliance with the approved plans and specifications. After the dam was completed and operational and turned over to the State, it would become jurisdictional and the Division would conduct periodic inspections to ensure proper maintenance and require the owner/operator to correct any deficiencies. (Fitzpatrick, 1990; DWR Bulletin 17-88, 1988).

STATE WATER RESOURCES CONTROL BOARD, DIVISION OF WATER QUALITY, AND THE CALIFORNIA REGIONAL QUALITY CONTROL BOARD, CENTRAL VALLEY REGION

The State Water Resources Control Board and the California Regional Water Quality Control Board for the Central Valley Region review activities that affect water quality in the Central Valley. The Boards administer the requirements mandated by State and Federal law (Clean Water Act). The Regional Water Quality Control Board establishes water-quality standards and reviews individual projects for compliance with the standards.

Permits or Approvals Required

The type of permit or approval issued depends upon the nature of the waste discharge. Normally, construction activities associated with the selected plan would require a certificate or waiver denoting compliance with the adopted water-quality standards. However, it is proposed that the Congressional authorization of the project include an exemption from such regulation pursuant to Section 404(r) of the Clean Water Act.

STATE WATER RESOURCES CONTROL BOARD, DIVISION OF WATER RIGHTS

This agency issues permits for the appropriation of water resulting from storage or diversion. The appropriation must be related to a beneficial use.

Permits or Approvals Required

The selected plan is solely a flood control project. All of the floodflows will be passed through the dam and not result in an appropriation. No water rights approvals will be required.

CALIFORNIA DEPARTMENT OF FISH AND GAME, REGION 2

Generally, the Department of Fish and Game administers the State laws providing protection of fish and wildlife resources. The Department administers the California Endangered Species Act of 1984. This requires State lead agencies to prepare biological assessments if a project may adversely affect one or more State-listed endangered species.

Permits or Approvals Required

The Department requires a Stream Alteration Agreement for any activity that will change the natural state of any lake, river, or stream in California. The agreements are issued by the Department's regional offices and are intended to minimize impacts, protect fish and wildlife habitat, and ensure the best operation practices (for example, erosion control and revegetation). Since the selected plan will be a Federal project authorized by Congress, there is no need to obtain a Stream Alteration Agreement. However, protection of fish and wildlife resources will continue to be coordinated with the Department.

The Department of Water Resources, as the non-Federal project sponsor, has initiated coordination with the Department of Fish and Game as required under the State Endangered Species Act. Completion of the biological resources analysis to the satisfaction of the Department of Fish and Game will satisfy this requirement. The analysis is included in the EIS/EIR. If necessary, the Department grants an Endangered Species Take Permit in conjunction with a project mitigation or habitat conservation plan. The permit allows for the loss of some identified endangered species in a project area if the mitigation plan is determined to be beneficial for the endangered species population as a whole. The text of the proposed Memorandum of Understanding for the selected plan is included in Chapter 22.

STATE MINING AND GEOLOGY BOARD

The State Mining and Geology Board oversees the implementation of pertinent State laws and regulations. One of the laws within its jurisdiction is the Surface Mining and Reclamation Act of 1975 (Public Resources Code, Div. 2, Chapter 9, Sec. 2710, et seq.).

Permits or Approvals Required

The Surface Mining and Reclamation Act requires that an entity seeking to conduct a surface-mining operation obtain a permit from, and submit a reclamation plan to, the lead agency overseeing that operation. To be adequate, the reclamation plan must contain all categories of information specified in the Surface Mining and Reclamation Act. A lead agency's finding can be appealed to the State Mining and Geology Board. The selected plan involves two types of activities which might potentially be classified as surface mining: the extraction of (1) aggregate for use in a flood control dam and (2) borrow material for use in levee modification and construction. The Department of Water Resources/Reclamation Board will coordinate any need for a permit with the State Mining and Geology Board.

STATE HISTORIC PRESERVATION OFFICE

Permits or Approvals Required

To ensure compliance with Section 106 of the National Historic Preservation Act of 1966, the Corps and non-Federal sponsors have entered into a Programmatic Agreement with the State Historic Preservation Officer. The agreement describes the work which will be accomplished to document significant resources and avoid or mitigate damages. Details on the Programmatic Agreement for the selected plan are discussed in Chapter 9, Cultural Resources.

STATE LANDS COMMISSION

In addition to such State-owned lands as parks and State highways, the State Lands Commission has exclusive jurisdiction over all ungranted tidelands and submerged lands owned by the State and the beds of navigable rivers, sloughs, and lakes (Public Resources Code, Section 6301). State ownership extends to lands lying below the ordinary high-water mark of tidal waterways and below the low-water mark of nontidal waterways (Civil Code, Section 830). The area between the ordinary high and low water on nontidal waterways is subject to a "public trust easement."

Permits or Approvals Required

A project cannot use these State lands unless a lease is first obtained from the State Lands Commission. Such projects as bridges, transmission lines, and pipelines fall into this category. The Commission also issues separate permits for dredging. The selected plan involves the construction or modification of several bridges.

CALIFORNIA DEPARTMENT OF PARKS AND RECREATION, ACQUISITIONS DIVISION

The California Department of Parks and Recreation currently has an interim agreement with the USBR for management and operation of recreation activities associated with the completion of a multipurpose dam project at Auburn. The proposed project has no impact on continuing this activity.

Permits or Approvals Required

None.

CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS), DISTRICT 3

Caltrans is responsible for ensuring the safety and integrity of the State of California's highway system.

Permits or Approvals Required

The non-Federal sponsors of the proposed project intend to coordinate the relocation of Highway 49 with Caltrans. Under California law, any relocation or realignment of a State highway must be approved by the California Transportation Commission. In accord with State law and procedures, the State agencies will likely pursue a Route Adoption Study, usually conducted by or under the supervision of Caltrans. The Transportation Commission reviews the Route Adoption Study and an environmental assessment of all alternatives. The EIS/EIR acknowledges this likely study and further environmental analysis.

In addition, any project involving the placement of encroachments within, under, or over a State highway right-of-way must be covered by an Encroachment Permit. Levee work under or near State Route 99 may fall into this category.

REVIEWING AGENCIES

Reviewing agencies evaluate proposed development plans for consistency with adopted standards and plans and may make recommendations on site improvements, required infrastructure, or mitigation which would be required of the project developer. These agencies also review and comment on the EIR prepared by the lead agency. The agencies which have reviewed this EIS/EIR are listed in Chapter 26.

NATIVE AMERICAN HERITAGE COMMISSION

The Commission reviews projects and comments on potential impacts to Native American archeological resources. The Commission is directly involved with a procedure if Native American artifacts or remains are discovered during construction activities.

CALIFORNIA HIGHWAY PATROL, LONG-RANGE PLANNING AND PLANNING AND ANALYSIS SECTIONS

The California Highway Patrol, which reviews the safety of ingress/egress from a project in relation to State highways, may comment on the realignment of Highway 49 and suggest mitigation to improve safety concerns. If levee work in the vicinity of State Route 99-70 involves changes in egress and ingress relative to that highway, the Highway Patrol should be consulted. The non-Federal sponsors will consult with the Highway Patrol as necessary during the implementation of the proposed project after authorization.

LOCAL PLANS AND POLICIES

This section discusses the degree to which individual project components comply with locally adopted plans and policies and the factors which can complicate the process of evaluating the level of compliance. Among these factors are:

- **The intentionally broad and unspecific goals articulated in local General Plans.** California's General Plan Guidelines (California Office of Planning and Research, 1990, p. 16) state that "a goal is a general expression of community values and, therefore, is abstract in nature." Although general policies, according to the Guidelines, are supposed to be more specific, they often are not specific enough to determine compliance.

- **The potential of the selected plan to influence the location, density, and rate of development in ways that differ from existing local plans and policies.** The selected plan, for example, could stimulate an increase in the number of development applications submitted to the local planning department, which in turn could result in a higher approval rate, ultimately forcing a reevaluation or change in the General Plan. Clear cases of noncompliance with the General Plan, however, occur only when a local jurisdiction continues to approve projects that violate general plan policies but does not appropriately revise the plan, as required by California Government Code, Section 65000. It is assumed that local jurisdictions would either conform to previously approved plans and policies or amend them as necessary. Thus, the selected plan's potential to facilitate growth would not compromise locally adopted plans or policies.

- **The currency of local plans.** Not all local plans are up to date. Sacramento and El Dorado Counties, for example, are in the process of revising their plans, and Sutter County is considering a general plan amendment which would affect land uses in the Natomas basin. Often, the presence of one or more of these complications makes difficult a determination of whether or not compliance will be achieved. In such cases, a finding of potential noncompliance would be reached.

The non-Federal sponsors will coordinate with local governments as necessary during the implementation of the proposed project after authorization.

FLOOD CONTROL DAM AND HIGHWAY 49 REPLACEMENT

The damsite, which was also the site of the USBR's proposed multipurpose dam, straddles the border between Placer and El Dorado Counties. The selected plan calls for raising the existing Highway 49 bridge above the maximum flood control pool of the selected plan.

In the existing Auburn Area General Plan, Placer County and the City of Auburn recognize and accommodate the construction of an Auburn dam (Placer County, 1978, pages 5 and 46). Placer County is now revising both its General Plan and the Auburn Area General Plan, however, and the assumptions the County will make about a dam at the Auburn site are not known at this writing (Yeager, January 1991). The compliance of the selected plan with the goals and policies of the updated plan is also unknown.

The El Dorado County Long Range Land Use Plan, which is now being updated, does not mention a possible dam at Auburn. The update will assume that no dam will be constructed at Auburn and that Highway 49 will not be realigned. According to a recently released draft update, "there are numerous environmental and political obstacles to overcome before the project could be realized" [this refers to the USBR multiple-purpose reservoir project] (Sedway Cooke Associates, December 1990, p. 10). The proposed plan update also states that realignment of Highway 49 would probably necessitate a further plan update.

The Cool-Pilot Hill Area Plan, which is also being updated, refers to the Auburn Dam Project and states that approval of an Auburn Dam Project or Highway 49 bridge alignment would initiate a reassessment of the area plan to determine "probable impacts and appropriate solutions" (El Dorado County Planning Department, 1982, p. 5).

__Direct Impacts__

Raising the Highway 49 bridge to pass above the maximum flood pool would entail no direct impacts that did not comply with local plans and policies.

Indirect Impacts

As designed, the new bridge and roadway would have the same capacity as the existing facilities and would not significantly improve access to northwestern El Dorado County and stimulate growth in that area. The selected plan would therefore have no indirect impacts that did not comply with existing and proposed local plans and policies.

If subsequent State route adoption studies resulted in approval of an alternate alignment that decreased travel times between Auburn and northwestern El Dorado County, mitigation plans for the impacts associated with that alignment would be formulated at that time.

NATOMAS LEVEE IMPROVEMENTS

Direct Impacts

Levee improvements and construction in the Natomas area would entail no impacts that did not comply with local plans and policies.

Indirect Impacts

The indirect impacts of protecting the Natomas area from flooding are described in Chapter 18, Growth-Inducing Impacts. Protecting the basin from flooding would enable that area to urbanize to a much greater extent than would otherwise have been possible. Flood protection, however, is not expected to affect regionwide growth. If the selected plan is not implemented, the development that would have occurred in the Natomas basin would likely be diverted to other areas.

County General Plans covering the Natomas basin were written assuming that the basin is (or would be) adequately protected from flooding. Thus, the selected plan would make possible the levels of development already called for under existing general plans. If increased flood protection stimulates growth beyond these levels, noncompliance with the plans could result. However, since local jurisdictions can revise their plans to accommodate higher than expected growth rates, the analysis in this section assumes that accelerated growth would either not violate local policies or would result in appropriate revisions. No cases of General Plan noncompliance are therefore anticipated.

The extent to which the selected plan complies with each individual general plan covering the Natomas basin is discussed below.

- **The Sutter County General Plan.** Although the County's 1983 General Plan was strongly oriented toward protecting and preserving the area's agricultural resources, the board of supervisors, in response to changing land use trends, initiated the South Sutter County Land Use Development Study in 1989 (Bechtel and SRI International, 1989). The study evaluated the area's ability to support urbanization and discussed changes necessary to the County's General Plan before land use conversion could occur.

In November 1990, the County issued a Notice of Preparation for an environmental impact report for a General Plan amendment proposal to rezone about 25,000 acres in the southern part of the County for residential, commercial, and industrial uses (Sutter County Planning Department, October 26, 1990; Sutter County Planning Department, n.d.). At buildout, the proposed community would support a population of up to 175,000.

If Sutter County eventually adopts some version of this General Plan amendment, the selected plan would fully comply with County plans and policies. If the County continues its agricultural protection policies, however, the selected plan could foster development pressures that might lead to non-compliance. Given the significant investment already made by Sutter County in studying potential urbanization in the southernmost portion of its jurisdiction, amendment of its General Plan to permit some level of urban development is possible. The County is currently in the early stages of implementing changes in the General Plan called for in the development study.

- **City of Sacramento General Plan and Community Plans.** The selected plan would assist the City in its efforts to meet flood protection goals contained in the General Plan and the North and South Natomas Community Plans by removing most of the City's plan areas from the 100-year flood plain. The City's General Plan acknowledges the role of the American River Watershed Investigation in meeting local flood control goals (p. 8-15). Corps-initiated studies as a result of the 1986 flooding led to the remapping of most of the plan area into the 100-year flood plain and called into doubt the development levels described in the various plans, specifically the North and South Natomas Community Plans.

The selected plan would permit the level of development originally called for in both the North and South Natomas Community Plans and complies with all the specific goals and policies called for in those plans. The North Natomas Community Plan was adopted in 1986, with near full development expected by 2005. The South Natomas Community Plan was updated in 1988, with full development expected to occur within 20 years. The South Natomas plan discusses at some length the pressing need for greater flood protection and acknowledges the role of the American River Watershed Investigation.

No areas of potential noncompliance were found in the Airport-Meadowview, South Sacramento, Central City, or Pocket Community Plans. The selected plan may fail to comply with portions of the North Sacramento Community Plan, which states that areas along Dry, Arcade, and Magpie Creeks are within the 100-year flood plain and are therefore not available for development. The selected plan would raise levees along portions of Dry and Arcade Creeks. With one exception, these levee improvements would ensure only that postproject flooding frequencies and depths would not change from preproject levels.

The exception is the levee along the north bank of Dry Creek, which would act in concert with the NEMDC pumping station to provide more than 100-year protection to an area which roughly forms a triangle with its apex at Rio Linda and its base along Dry Creek, just east of the NEMDC. Thus, areas assumed to be undevelopable under the North Sacramento Community Plan will be subject to development. If this increased development significantly taxed the area's infrastructure, noncompliance with goals and policies in the Plan's Transportation, Public Facilities and Services, and, possibly, Neighborhood ("Emergency Services") Elements could result.

- **Sacramento County General Plan.** The selected plan complies with all specific goals, objectives, and policies contained in the County's draft plan update released in September 1990. The draft plan supported a flood control dam at Auburn, acknowledged the possibility that such a dam would make growth possible on the flood plain, and left open the possibility of incorporating habitat mitigation measures associated with the project into its open space maps (Sacramento County, September 1990, Conservation Element Water Resources Background Report).

- **Sacramento Metropolitan Airport and County Airport Special Planning Area.** The selected plan complies with provisions of the Sacramento Metropolitan Airport's master plan, completed in 1976. A plan update was temporarily suspended following the release of a 1986 interim report (Peat Marwick, 1986; Kozub, 1991). Provisions contained in the plans of some neighboring jurisdictions, however, may not comply with the airport's plan (Kozub, 1991).

The North Natomas Community Plan and the proposed Sutter County General Plan amendment covering the northern end of the Natomas basin call for residential development west of I-5, an area where airport planners believe noise levels are unacceptably high for neighborhood development. The planners believe that commercial and industrial land uses are acceptable in these locations. Although most of this development would not be possible without increased flood protection, the decision to locate residential neighborhoods in an airport noise corridor is not a function of flood control.

Sacramento County has designated lands to the east of the airport proper as a Special Planning Area. County Ordinance 83-SPA-3 describes acceptable land uses in this area as those "which either [require] airport services or directly [support] the development and/or function of the airport" (Sacramento County, 1983).

OTHER LOCAL PLANS AND POLICIES

AIR POLLUTION CONTROL DISTRICTS

The proposed project construction-related facilities potentially fall under the jurisdiction of El Dorado, Placer, and Yolo County Air Pollution Control Districts and the Sacramento Metropolitan Air Quality Maintenance District, which would determine whether project emission sources and levels significantly affected air quality, based on Federal standards promulgated by EPA and the California Air Resources Board. The districts would first issue a permit to construct, followed by a permit to operate, which would be evaluated to determine whether all facilities had been constructed in accordance with the authority to construct permit. The districts would also determine whether applicants complied with district rules and regulations while operating the facility.

PUBLIC WORKS AND TRANSPORTATION DEPARTMENTS

All proposed activity involving the placement of encroachments within, under, or over County or City road rights-of-way must be covered by an Encroachment Permit. The following local agencies will be consulted by the non-Federal sponsor of the proposed project where appropriate: El Dorado County Department of Transportation; Placer County Public Works Department; Sacramento County Public Works Department, Encroachment and Transportation Permits; Sacramento City Public Works Department; and Yolo County Public Works Department.

LOCAL PARK DISTRICTS

A project which encroaches on a City or County park may require an encroachment permit from the local park district. The non-Federal project sponsors will obtain this if necessary.

OTHER

Other agreements from local jurisdictions may also be required to provide public services, such as law enforcement, during the construction and operational stages of the facilities. The non-Federal project sponsors will obtain such agreements if necessary.

CHAPTER 24

CONSEQUENCES OF DAM FAILURE

Concerns about the safety of new and existing dams led to the establishment in 1984 of a Committee on Safety Criteria for Dams under the National Research Council of the National Academy of Science. Concerns had developed as a result of several dam failures, or near failures, that had occurred in recent years in various parts of the world. Also, Section 1202 of the Water Resources Development Act of 1986 requires an analysis of consequences of failure and geologic or design factors which could contribute to failure when a dam is proposed for authorization by Congress. As a result, an evaluation has been made of the potential for catastrophic dam failure and its consequences at the proposed damsite near Auburn.

Most documented dam failures over the past 20 years have been the result of inadequate design or construction techniques or of storms or earthquakes that exceeded the design criteria. Outside of deliberate destruction, the most likely cause of a sudden dam failure at the Auburn site would be an extremely large earthquake. The most severe set of circumstances which could cause a catastrophic, sudden failure would be the occurrence of a very large earthquake at the same time the flood control detention basin was filled to capacity as a result of the design flood. The potential for simultaneous occurrence of these events is significantly rare as to not consider this possibility as reasonable.

The selected plan is designed to minimize the potential for catastrophic failure. Seismicity of the project site was fully considered in the design of the flood control dam for this project. The dam was designed to withstand the maximum credible earthquake, the largest earthquake that appears to be capable of affecting the site. The dam is designed with a trapezoidal shape and a slightly curved alignment to provide additional seismic stability. Some leakage might occur as a result of the maximum credible earthquake, but total failure and its consequences would not.

The potential for catastrophic failure is also related to the volume of floodwater controlled by the flood control dam and the inundation duration. Inundation of the detention area would occur under various-frequency events. The duration of inundation could extend from a few hour during frequent storm events to over 21 days for the 200-year flood. The amount of storage would also vary from only a few thousand acre-feet for a relatively frequent flood to the gross pool storage of 545,000 acre-feet for a 200-year flood.

Since the proposed flood control dam would be "dry," the detention are would be empty a significant portion of the time, thus decreasing the probability of any catastrophic failure when the area was inundated to its maximum capacity. Even if a 200-year flood filled the capacity of the detention area, the water elevations would remain at maximum height less than 12 hours. The probability of a maximum credible earthquake during that short period is extremely low.

Should a complete failure occur during flood operations, assuming both Folsom Reservoir and the detention area at the Auburn site were full, significant flooding would occur downstream. Such a sudden failure at Auburn would have a major effect on Folsom Dam. Assuming that Folsom Dam remained intact after an earthquake that caused catastrophic failure at the Auburn site and that Auburn was filled to capacity at the time, the wave created by the failure of the dam at Auburn would overtop Folsom Dam and its dikes. This overtopping likely would cause failure of the Folsom dikes. Levees downstream would be overwhelmed, and the City of Sacramento would be inundated to a depth of several feet. The wave from a Folsom dike failure would take about 6 hours to reach Sacramento.

CHAPTER 25

LIST OF PREPARERS

CORPS OF ENGINEERS - PRIMARY PREPARERS

NAME/EXPERTISE	EXPERIENCE	ROLE IN PREPARING EIS
Dorothy Cornell Technical Editor	21 years Corps of Engineers	Report editing
Larry Dacus Civil Engineer	19 years Corps of Engineers	Project engineer for designs and cost estimates
Matt Davis Environmental Resource Planner	8 years Corps of Engineers	Incremental analysis
Elizabeth Davis Sociologist	5 years Corps of Engineers	Socioeconomic impact identification and description
Dick Eng Civil Engineer/ Assistant Planning Chief	31 years Corps of Engineers	Report review
Jerry Fuentes Historian/Social Scientist	2 years Corps of Engineers	Agricultural and hazardous and toxic waste impact identification and comment/response appendix coordination
Donna Garcia Economist	4 years Corps of Engineers	Assistance on inundation reduction and land use analyses
Bob Childs Civil Engineer	17 years Corps of Engineers	Life Cycle Project Management
Dave Gore Civil Engineer	2 years Corps of Engineers; 12 years Bureau of Reclamation	Study Manager, overall formulation of alternatives and primary responsibility for preparation of Main Report and appendixes
Jeff Harris Hydrologist	17 years Corps of Engineers	Hydrologic analysis
Dail Hatch Civil Engineer	20 years Corps of Engineers	Plan formulation for Natomas elements and report coordination
Fred Kindel Wildlife Biologist/Supervisory Environmental Resource Planner	26 years Corps of Engineers; 8 years State and private wildlife management	Report review
Lee Laurence Public Affairs Specialist Writer/Editor	5 years Corps of Engineers; 1 year Army Audit Agency; 9 years Bureau of Reclamation; 10 years Geological Survey	Report review, editing, and coordination
David Lewis Economist	13 years Corps of Engineers	Location benefit estimate and project optimization

List of Preparers

F. Chris Mangan Assistant District Counsel	5 years Corps of Engineers	Report review
Sannie Osborn Archeologist	8 years Corps of Engineers	Cultural and paleontological resources/ impact identification, coordination, and description
Teresa Pacheco Economist	4 years Corps of Engineers	Inundation reduction benefit analysis
Susan Ramos Environmental Resource Planner	3 years Corps of Engineers; 5 years Bureau of Reclamation; 5 years Environmental Protection Agency	Report review
Merritt Rice Civil Engineer	16 years Corps of Engineers	Report review
Jane Rinck Geography/Environmental Resource Planner	5 years Corps of Engineers	Effects on fish, vegetation, and wildlife; mitigation analysis and description
Jane Scott Real Estate Specialist	4 years Corps of Engineers	Real estate evaluations and descriptions
Donna Stanek Outdoor Recreation Planner	2 years Corps of Engineers; 10 years Fish and Wildlife Service	Endangered species impact identification, and recreation resources evaluation and descriptions
Meredith Stephens Environmental/Land Use Planner	5 years Corps of Engineers; 10 years consultant	Land use analysis
Mike Welsh General Biologist/ Environmental Resource Planner	15 years Corps of Engineers	Environmental, endangered species, and related coordination
Walter Yep Chief, Planning Division	24 years Corps of Engineers	Report review

CORPS OF ENGINEERS - SUPPORT PREPARERS

NAME/EXPERTISE	EXPERIENCE	ROLE IN PREPARING EIS
Cynthia Adornetto Biologist/Environmental Resource Planner	5 years Corps of Engineers, Forest Service, Soil Conservation Service	Comment review, cumulative effects, and classification
Louis Aspey Civil Engineer	1 year Corps of Engineers	Report preparation assistance
Charles Baad Student Intern/Biology	2 years Corps of Engineers	Graphics preparation
Lisa Bettencourt Student Intern Wildlife Genetics	1 year Corps of Engineers	Bibliography
Nicole Bugarin Office Automation Clerk	1 year Corps of Engineers	Clerical support
Charles Christoff Engineering Technician	23 years Corps of Engineers	Graphics support

Trina Farris Editorial Assistant	10 years Corps of Engineers	Editorial review
Alicia Kirchner Engineering Technician	2 years Corps of Engineers	Clerical and graphics support
Lea Lentz Program Support Clerk	6 years Corps of Engineers	Clerical support
Maria Moore Division Secretary	4 years Corps of Engineers	Clerical support
Julie Najera Clerk/Typist	2 years Corps of Engineers	Clerical support
Jim Slover Clerk/Typist	Corps of Engineers	Clerical support

NON-FEDERAL SPONSOR/AGENCIES

NAME/EXPERTISE	AGENCY	ROLE IN PREPARING EIR
Analena Bronson Environmental Specialist CEQA Coordination	Department of Water Resources	Report review
Earle Cummings Environmental Specialist Vegetation Specialist	Department of Water Resources	Vegetation analysis for inundation area
Toccoy Dudley Geology Engineering Geology	Department of Water Resources	Soil stability analysis for inundation zone
Dan Fua Water Quality Chemistry and Engineering	Department of Water Resources	Response to comments
Sandi Gonzalez Environmental Specialist	Department of Water Resources	Response to comments
Gary Hester Hydrology and Water Resources Engineering	Department of Water Resources	Response to comments
Hal Higgins Water Resources Planning and Engineering	Department of Water Resources	Report review
Ron Landingham Economist	Department of Water Resources	Response to comments
Michael Norris Water Resources Engineering and Planning	Department of Water Resources	Response to comments
Victor Pacheco Water Resources Engineering and Planning	Department of Water Resources	Response to comments
Ricardo Pineda Water Resources Engineering and Planning	Department of Water Resources	Response to comments
Ward Tabor Attorney, Environmental Law	Department of Water Resources	Response to comments

List of Preparers

Steve Yeager Water Resources Engineering and Planning	Department of Water Resources	State Project Coordinator, Supervising Engineer
Chris Christman Landscape Architect	6 years Department of Parks and Recreation; 2 years McMurray and McCormaick Environmental Group; 18 years EARTH ART, INC.	Visual analysis
Wes Ingram Fiscal Analysis, CEQA and NEPA Compliance	4 years Corps of Engineers, 2 years Fugro-McClelland (West), Inc.	Plan compliance, cumulative impacts, growth-inducing impacts, visual resources, short-term uses versus long-term impacts, significant irreversible changes, State endangered species
Richard Meredith Biological Resources	10 years Corps of Engineers, 2 years National Marine Fisheries Service, 3 years Fugro-McClelland (West), Inc.	Overall responsibility for consulting services on EIS/EIR
Tamara J. Mihm CEQA Compliance Water Quality	3 years Fugro-McClelland (West), Inc.	Short-term uses versus long-term productivity, cumulative impacts, plan compliance, impact summary tables
Susan Miller Environmental Planner	2 years Fugro-McClelland (West), Inc.	Natomas and Highway 49 growth issues
Melinda Rivasplata Land Use Planning CEQA Compliance	7 years Kern County, 5 years Fugro-McClelland (West), Inc.	Cumulative impacts, growth-inducing impacts
Jim Robinson Environmental Geologist	3 years consultant, 2 years U.S. Geological Survey, 2 years Fugro-McClelland (West), Inc.	Aggregate source analysis, spoils disposal analysis
Garth Ruffner Landscape Architect	7 years EARTH ART, INC	Visual analysis, photo simulation, report preparation and review
Jean M. Shepard Landscape Design	3 months City of Paso Robles, 10 years Landscape Design, (private consultant) 1 year Fugro-McClelland (West), Inc.	Visual resources, endangered species, plan compliance, impact summary tables
Chris Stabenfeldt CEQA compliance Quality Control	8 years Fugro-McClelland (West), Inc.	CEQA sections and editorial review
Eric Tattersall Wildlife Biologist	3 years Fugro-McClelland (West), Inc.	Biological field work
Duane Vander Pluym Environmental Scientist/ Biologist	12 years Fugro-McClelland (West), Inc.	Mitigation planning
Tim Washburn Attorney	Sacramento Area Flood Control Agency	Report preparation and review

CHAPTER 26

PUBLIC INVOLVEMENT

An Executive Committee, established in 1988, has been actively involved in guiding and overseeing the American River Watershed Investigation to ensure that sufficient resources were devoted to the project and that it was kept on schedule. The Committee consists of:

- Colonel Laurence R. Sadoff, District Engineer, Sacramento Corps of Engineers
- Mr. Walter Yep, Chief, Planning Division, Sacramento District, Corps of Engineers
- Mr. David Kennedy, Director, California Department of Water Resources
- Mr. Wallace McCormack, President, The Reclamation Board
- Mayor Anne Rudin, City of Sacramento
- Mr. Grantland Johnson, Chairman, Sacramento County Board of Supervisors
- Ms. Barbara LeVake, Chairwoman, Sutter County Board of Supervisors
- Mr. Alex Ferreira, Chairman, Placer County Board of Supervisors
- Mr. George Campini, American River Flood Control District
- Mr. Richard D. Willey, President, Board of Trustees, Reclamation District 1000

Former members of the Executive Committee include Colonel Wayne J. Scholl and Colonel Jack A. Le Cuyer, former District Engineers, Sacramento Corps of Engineers; and Mr. Jim Streng, Sacramento County Board of Supervisors. Invited elected officials have included Ms. Betsy Marchand, Supervisor, Yolo County, and Ms. Helen Thomson, Supervisor, Yolo County. Invited participants to the Executive Committee meetings have also included representatives from the U.S. Bureau of Reclamation, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, U.S. Bureau of Land Management, and California Department of Fish and Game, and the District Directors for Congressmen Vic Fazio, Robert Matsui, Norm Shumway (retired), and John Doolittle.

The Study Management Committee, chaired by Mr. Merritt Rice, Chief, American River Basin Branch, Corps of Engineers, included staff representatives from the above organizations. The Study

Management Committee meetings often included the participation of representatives from public interest groups such as the Planning Conservation League, American River Coalition, Sierra Club, Friends of the River, and others.

The following section describes the scoping and public involvement process used to obtain comments from agencies and the public for use and consideration in the draft EIS/EIR and the resulting issues and concerns raised by the public on the proposed project.

SCOPING

Publication of a Notice of Intent (NOI) by the Corps of Engineers and a Notice of Preparation (NOP) by The Reclamation Board and California State Clearinghouse initiated the public comment periods. (See Appendix A, Pertinent Correspondence, for copies of these notices.) The NOI review period extended from November 28, 1988, the date of publication of the NOI in the "Federal Register," to April 5, 1991. The review period for the NOP published by The Reclamation Board extended from August 2, 1989, to September 2, 1989; the review period for the NOP published by the State Clearinghouse extended from August 7, 1989, to September 7, 1989.

Three public information meetings were held in Sacramento, South Natomas, and Rocklin on February 7, 8, and 9, 1989, respectively. Scoping workshops were held in Sacramento on February 14, 1989, and in Rocklin on February 15, 1989. The main objective of these meetings was to describe the EIS/EIR process, answer questions, and obtain public comment on the issues and alternatives to be analyzed. Two task groups, the American River Executive Committee and the Study Management Team, formed in conjunction with the American River Watershed Investigation, identified additional issues.

Throughout 1989, Federal and State sponsors conducted an intensive public awareness campaign, making more than 100 presentations to the news media, government officials, environmental groups, trade and fraternal organizations, and other agencies throughout the study area. Primary meeting objectives were to explain the area flood control problem and seek comment from diverse audiences on solutions and concerns.

MAJOR PUBLIC ISSUES AND CONCERNS

This EIS/EIR describes that any of the solutions examined for the flood control problems of the greater Sacramento area would cause significant impacts to the environment. Listed below are issues identified through the public scoping process. These issues and questions, presented in written or verbal comments to the Federal and State project sponsors, reflect the concerns of both the public and responsible or regulatory agencies. They are summarized here and referenced to appropriate sections of this EIS/EIR as well as to the Main Report.

- Identify and quantify both temporary and permanent impacts to wetlands in Natomas, along the lower American River, and at or above the Auburn damsite; and develop a mitigation plan that assures no net loss of wetland functions, values, and acreage. (Chapters 7, Fish, Vegetation, and Wildlife; and 22, Mitigation and Environmental Monitoring)

- Identify impacts to wild and scenic river values (including esthetics). (Chapters 14, Recreation, and 16, Visual Resources)

- Identify and quantify impacts to endangered and candidate species. (Chapter 8, Endangered Species)

- Identify and quantify temporary and permanent impacts on wildlife habitat and develop a mitigation plan. (Chapters 7, Fish, Vegetation, and Wildlife; and 22, Mitigation and Environmental Monitoring)

- Identify and quantify impacts on recreation in Natomas, along American River Parkway, Folsom Lake, and American River canyon at and above the Auburn damsite. (Chapter 14, Recreation)

- Identify and quantify permanent and temporary impacts on American River fishery and develop a mitigation plan. (Chapters 7, Fish, Vegetation, and Wildlife; and 22, Mitigation and Environmental Monitoring)

- Discuss direct and indirect impacts on riparian habitats and waters of the United States in Natomas, along the American River, and at and above the Auburn damsite, and develop a mitigation plan. (Chapters 7, Fish, Vegetation, and Wildlife; and 22, Mitigation and Environmental Monitoring)

- Discuss impacts of each alternative on salinity of waters in the Delta and San Francisco Bay, with reference to historical levels, not current levels. (This specific issue was not addressed but would be analyzed if the selected plan involved reoperation of Folsom Dam.)

- Discuss induced-growth impact of each alternative and, in turn, the pressure each places on water/power demands in future years. (Chapters 15, Socioeconomics, and 18, Growth-Inducing Impacts)

- Explain why 200-year protection is needed, rather than the 100-year protection required for the FEMA flood insurance program. (Chapter 2, Project Description; also Main Report)

- Identify less damaging practicable alternatives for providing flood protection. (Chapter 3, Alternatives; also, Main Report and Appendix B)

- Discuss the feasibility of drawing the affected counties, including Placer, Sacramento, and Sutter, into binding local/Federal agreements to prevent future development within proposed mitigation areas or within existing (pre-project) 100-year flood plain. (Chapter 22, Mitigation and Environmental Monitoring; Main Report)

- Identify and quantify impacts to historical and archeological sites within project boundaries. (Chapter 9, Cultural Resources)

- Discuss seismic safety issues connected with fault at Auburn damsite. (Main Report)

- Assess impacts of flood control on population growth, development, and potential for increased air pollution. (Chapters 12, Air Quality; 15, Socioeconomics; 18, Growth-Inducing Impacts)

- Discuss water quality, including the following: impacts of construction activities on water quality; necessity of obtaining waste discharge requirements and a water-quality permit for construction; and any change in urban water discharges to the rivers and potential impacts on water quality. (Chapter 6, Drainage and Water Quality)

- o Discuss why such a large portion of Natomas is being considered when only a small portion has been developed. (Chapter 2, Project Description; also Main Report)

- o Identify flood-proofing alternatives (for example, elevating homes) in Natomas. (Main Report)

- o Discuss impact of increased development in Natomas on overland flooding. (Main Report)

- o Discuss whether modifications to the Natomas Cross Canal would increase flows into the Sacramento River. (Main Report)

- o Identify impacts of runoff from increased development in foothills on level of flood protection downstream. (Because the project is not expected to influence growth in the foothills, this specific issue is not addressed; however, the Main Report does discuss the flood hydrology of the study area and lists several other studies conducted by the Corps and other agencies to address these issues.)

- o Discuss impacts of development along Laguna and Morrison Creeks and whether or not they pose a flood risk upstream and downstream from Sacramento. (Other studies have evaluated various areas of Sacramento; see the Main Report.)

- o Discuss impact of American River on Sacramento River upstream from confluence. (Main Report)

- o Explain how "revised hydrology" was developed. (Main Report)

- o Discuss use of existing upstream reservoirs as flood control alternatives. (Main Report)

- o Identify downstream impacts that could result from modifying Fremont Weir. Identify mitigation for these impacts. (Modification of Fremont Weir was dropped as a feature of the various flood control alternatives evaluated.)

- o Discuss impacts of flows from other watersheds as a source of flooding in the Sacramento area. (Main Report)

- o Discuss impacts of project on West Sacramento. (The Sacramento Metropolitan Area study covers areas not included in the ARWI, primarily the West Sacramento area; see the Main Report.)

- o Why not bill developers in Natomas for costs of flood protection there? (Chapters 2, Project Description, and 3, Alternatives, discuss the issues involved with protecting Natomas; Chapter 22, Mitigation and Environmental Monitoring, discusses the general measures that will be taken to protect resources in Natomas. The Main Report discusses cost apportionment.)

OPPORTUNITIES FOR PUBLIC INVOLVEMENT

The Notice of Availability for the draft EIS/EIR was published in the "Federal Register" on April 12, 1991, and the following information was provided:

> Public meetings on the DEIS/EIR will be held within 45 days of the release of the Draft EIS/EIR. Verbal and written comments on the DEIS/EIR will be accepted at these meetings.
>
> Comments also can be mailed to the Corps at: U.S. Army Corps of Engineers, Sacramento District, 650 Capitol Mall, Sacramento, CA 95814-4794. All comments received before June 14, 1991 will be incorporated into the FEIS/EIR.

ORGANIZATIONS AND PERSONS CONTACTED

The following agencies and individuals were consulted during preparation of the draft EIS/EIR.

- o American River Flood Control District; Ron Smith
- o Army Corps of Engineers
- o California Department of Fish and Game; Dave Showers, John Brode, Sherry Teresa, and Phyliss Rahn
- o California Department of Parks and Recreation; Doug Healey, Bruce Kranz, Dave Martinez, Dawn Wilson
- o California Department of Transportation; Eric Hansen and Steve Kirkpatrick
- o California Department of Water Resources, Division of Planning; Hal Higgins, Steve Yaeger
- o California Department of Water Resources, Water Rights; Winnie Rowland

- California State Historic Preservation Office; Nick Del Cioppo
- California State Reclamation Board
- California Water Quality Control Board, Central Valley Region; Wayne Pierson
- California Wildlife Conservation Board; Al Rutsch
- City of Sacramento, Flood Control and Sewer Division; Albert McCollum
- City of Sacramento Planning Department
- City of Sacramento Parks and Recreation; Michelle Rudic
- City of Sacramento Public Works Department
- Division of Dam Safety, California Department of Water Resources
- El Dorado County Community and Development Department; Edward Crowley
- Environmental Protection Agency; Nancy Dubbs and Laura Fujii
- Natomas Union School District
- Office of Planning Research, Office of Permit Assistance; David Nunenkamp and John Keene
- Placer County Planning Department; Fred Yeager
- Sacramento Area Council of Governments; Dave Young
- Sacramento Area Flood Control Agency; Tim Washburn
- Sacramento Board of Realtors
- Sacramento City Solid Waste Division
- Sacramento County Fire Department
- Sacramento County Housing and Redevelopment
- Sacramento County Parks and Recreation; Arran Nickel, Gene Andal, Lois Woodruff
- Sacramento County Public Works Department; Jim Dixon
- Sacramento Municipal Airport, Department of Planning and Development
- Sacramento Police Department
- State Board of Equalization; Research and Statistics Division; Dave Hayes
- State Lands Commission; Herb Maricle
- Sutter County Planning Department; Peter Bridges
- U.S. Fish and Wildlife Service; Gary Taylor

The following State agencies received a copy of the Notice of Preparation:

- Air Resources Board
- California Energy Commission
- Department of Conservation
- Department of Food and Agriculture
- Department of Forestry
- Department of Health

- Office of Historic Preservation
- California Waste Management Board
- Caltrans, District 3
- Department of Fish and Game
- State Water Resources Control Board, Division of Water Quality
- State Water Resources Control Board, Division of Water Rights

The following organizations received copies of and commented on the DEIR Notice of Preparation.

- City of Sacramento, Department of Public Works; Donald M. Dodge
- American River Flood Control District; Walter C. Pennington
- County of San Joaquin, Department of Public Works; Henry M. Hirata
- County of El Dorado, Water Agency; Robert J. Reeb
- Native American Heritage Commission; William Anthony Johnson
- Department of Boating and Waterways; David Johnson
- Department of Water Resources, Central District; Jerry Vayder
- Department of Parks and Recreation, Resource Protection Division; Richard Rayburn
- California Regional Water Quality Control Board, Central Valley Region; David Brent

COMMENTS ON DRAFT EIS/EIR

The public comment period on the draft EIS/EIR extended from release of the report on April 5, 1991, to June 14, 1991. During that period, the Corps and The Reclamation Board held 14 public workshops and 3 public hearings to discuss the flood problems in the Sacramento area and potential solutions to those problems.

In response to the public review period, the Corps received approximately 2,000 letters on the draft feasibility report/joint EIS/EIR. The comments received and responses to these are detailed in the Comments and Responses Appendix (T). This final EIS/EIR reflects changes made to respond to public comments received on the draft EIS/EIR.

As a result of the public review, including resolutions passed by The Reclamation Board and Sacramento Area Flood Control

Agency (see Appendix A), several refinements were made in the plan recommended for implementation. Principal among these, and reflected in the final EIS/EIR, are:

- o A selected plan to provide a 200-year level of protection (instead of a 400-year level) to the Sacramento metropolitan area. The project cost will be lower than originally proposed.
- o Use of the environmentally preferable Old Cool Quarry (instead of the gravel bars of the Middle Fork American River) as the aggregate source for the flood control dam near Auburn.
- o A shift in the proposed mitigation area for the detention dam from existing Federal lands adjacent to the damsite to the South Fork American River.
- o Development of a detention basin in the northeastern Natomas basin (instead of modification of Fremont Weir) to offset a small increase in flood elevations in the Pleasant Grove area caused by Natomas levee improvements.
- o Selection of a mitigation site within the Natomas basin (instead of near Fremont Weir) to offset adverse impacts to Natomas area fish and wildlife resources caused by Natomas levee improvements.

These and other refinements in the selected plan and other flood control alternatives evaluated are detailed in the Comments and Responses Appendix and in the appropriate discussions of this final document.

The final EIS/EIR was reviewed to determine whether the public had an opportunity for meaningful participation and analysis. It has been determined that the document refinements were specifically or generally referenced in the draft EIS/EIR. The comments received were applicable to the refinements and were directly related to the document improvements. Indeed, the refinements were calculated to respond to the environmental concerns indicated in the comments. Further, the vast majority of these refinements are capable of being mitigated to a level below significance.

As part of the public review process, The Reclamation Board, in cooperation with the Corps and the Sacramento Area Flood Control Agency, held a series of four consultations during the final phase of revising the feasibility report/joint EIS/EIR. The consultations, conducted between October 1 and December 19, were held to provide clarification and to answer questions or issues presented in the draft document and to present a preview of recent study efforts expended to complete the final report.

CHAPTER 27

INTENDED USES OF EIS/EIR

In January 1988, the Corps of Engineers conducted an Environmental Assessment of the project study area. Several potentially significant adverse impacts were identified and an environmental impact statement was deemed necessary, pursuant to CEQA regulations for implementing NEPA procedural provisions [40 CFR 1502.4, 1508.18, and 1508.28]. The Department of Water Resources and The Reclamation Board, as the State lead agencies for the study, required preparation of an environmental impact report, pursuant to CEQA [Section 21200]. This EIS/EIR was prepared to satisfy both Federal and State environmental reporting requirements, pursuant to Section 40 CFR 1506.2(b) of NEPA implementation regulations and Section 21083.5 of CEQA.

Under CEQA, an Initial Study is prepared to determine whether to prepare a negative declaration or an EIR and to identify impacts to be analyzed by an EIR. The Environmental Assessment, which is a more comprehensive evaluation of the project area environment, was used in place of the Initial Study.

CEQA EIR content requirements differ somewhat from those required for an EIS under NEPA by requiring analysis of growth-inducing impacts, a discussion of feasible mitigation measures, and additional public noticing requirements (Remy et al., 1991). Additionally, NEPA requires that all alternatives be analyzed equally and compared (Bass, undated).

To fully comply with Federal and State requirements, all mandatory elements are included in this joint EIS/EIR.

This EIS/EIR is an informational document. Its purpose is to inform public agency decision-makers and the general public of the significant effects of the project. It also identifies ways to minimize significant effects and describes reasonable alternatives to the project (CEQA Guidelines, Section 15121 (a) and NEPA Regulations, Section 1502.1). Under CEQA Guidelines (Section 15151), the standard for adequacy is:

> An EIR should be prepared with sufficient degree of analysis to provide decision-makers with information which enables them to make a decision which intelligently takes account of environmental consequences. An evaluation of the environmental effects of a proposed project need not be

> exhaustive, but the sufficiency of an EIR is to be reviewed in the light of what is reasonably feasible. Disagreement among experts does not make an EIR inadequate, but the EIR should summarize the main points of disagreement among experts. The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure. [Emphasis added.]

The draft EIS/EIR was circulated for agency and public review and comment, and comments and responses have been incorporated into this document.

The final EIS/EIR will be submitted first to the Secretary of the Army, who will issue a Record of Decision regarding the adequacy of the document and the desirability of going forward with the project. If the Secretary reaches a decision in favor of construction, the EIS/EIR and accompanying Section 404(b)(1) report will go to Congress, which will decide whether or not to authorize the project. The analyses of the EPA will be considered in the authorization process.

On the State and local levels, the document must be approved first by the Sacramento Area Flood Control Agency, which functions as a "responsible agency" [CEQA Guidelines, Section 15381] and which represents the interests of the affected city and county governments. The California Department of Water Resources and the State Reclamation Board, acting jointly as the project's "lead agency" [CEQA Guidelines, Section 15367] will then submit the EIS/EIR to the State legislature for authorization. If authorization is received on both the State and Federal levels, the project can go to construction.

Several other agencies may use the final EIS/EIR as they consider permit applications associated with the project. A preliminary list of entities from whom approvals may be required is provided in Table 27-1. If the project is authorized, further (or different) approvals may also be necessary. The agency authority and permitting or approval requirements are discussed in greater detail in Chapter 23 in the section on State Laws, Regulations, and Policies.

Table 27-1. Regulatory Permits, Licenses, and Other Entitlements

AGENCY	REGULATORY REQUIREMENT	TIMING
DWR/Reclamation Board	Reclamation Plan and Permit	Prior to any surface mining activity such as aggregate or borrow material extraction
DWR, Division of Safety of Dams	Certificate of Approval	Following final design of the flood control dam, prior to construction
Department of Fish and Game	Stream Alteration Agreement	(Not required for Federal project.)
Department of Fish and Game	Endangered Species Take Permit	Incorporated into Endangered Species Mitigation Program, prior to project construction
State Historic Preservation Officer	Programmatic Agreement	Prior to project construction in areas of historic/cultural sensitivity
Department of Parks and Recreation	Right-of-Way Permit	Prior to activity within park lands
Department of Transportation	Encroachment Permit	Prior to any activity within DOT's right-of-way (e.g., the I-80/Hwy 99 corridors)
Department of Transportation	Route Adoption Study and Route Agreement	Post-authorization changes to Highway 49 relocation element of selected plan
Air Pollution Control Districts • El Dorado County • Placer County • Yolo-Solano County • Sacramento Metropolitan AQMD	Authority to Construct; Permit to Operate	Prior to construction and operation

DISTRIBUTION LIST

This section provides a list of Federal, State, regional, and local public agencies and private agencies and organizations to whom a copy of the draft EIS/EIR was distributed for review and comment. In addition to the regulatory agencies are agencies with special expertise or interest in evaluating environmental issues related to the project. Private agencies, and organizations that may be affected by the project or that have expressed an interest in the project through the public scoping process, are also included.

ELECTED OFFICIALS AND REPRESENTATIVES

Governor of California
- Honorable Pete Wilson

United States Senate
- Honorable Alan Cranston
- Honorable John Seymour

House of Representatives
- Honorable Vic Fazio
- Honorable Robert Matsui
- Honorable John Doolittle

California Senate
- Honorable Patrick Johnston
- Honorable Leroy Greene
- Honorable Tim Leslie

California Assembly
- Honorable B. T. Collins
- Honorable Lloyd Connelly
- Honorable Philip Isenberg
- Honorable David Knowles

UNITED STATES GOVERNMENT DEPARTMENTS AND AGENCIES

Department of Commerce
- National Marine Fisheries Service
- Environmental Science Services Administration
- National Oceanic and Atmospheric Administration
- National Weather Service

Department of Energy
- Federal Energy Regulatory Commission
- Division of NEPA Affairs

Department of the Interior
- Bureau of Indian Affairs
- Fish and Wildlife Service
  - Division of Ecological Services
- Columbia Fisheries Program Office
- Fish and Wildlife Service
  - Endangered Species
- Geological Survey
- Bureau of Land Management
- Bureau of Mines
- National Park Service
- Office of Environmental Project Review
- Bureau of Reclamation

Advisory Council on Historic Preservation
Smithsonian Institution
  Bureau of American Ethnology
Department of Agriculture
  Agricultural Research Service
  Soil Conservation Service
  Agricultural Stabilization and
    Conservation Service
  Forest Service
Department of Health and Human Services
  Public Health Service
  Consumer Protection, Environmental
    Health Services
  Center for Environmental Health
  Water Resources-Mosquito Control
Department of Housing and Urban Development
  Federal Housing Administration
    Housing Development Division
    Housing Management Division
  Urban Renewal Administration
Department of the Interior
  Bureau of Reclamation
  Bureau of Land Management
  Fish and Wildlife Service
  National Park Service
Department of Labor
  Manpower Administration
Department of Transportation
  Federal Highway Administration
  Federal Aviation Agency
  Maritime Administration
  U.S. Coast Guard
Council on Environmental Quality
Environmental Protection Agency
Federal Emergency Management Agency

STATE OF CALIFORNIA GOVERNMENT AGENCIES

State of California
  Office of Attorney General
  Department of Justice
  Senate Committee on Natural Resources and Wildlife
  Assembly Committee on Natural Resources
  Assembly Committee on Water, Parks and Wildlife
  The Resources Agency
    Department of Fish and Game
    Department of Conservation
    Department of Boating and Waterways

Department of Forestry and Fire Protection
Department of Water Resources
The Reclamation Board
California Water Commission
State Water Resources Control Board
Regional Water Quality Control Board (Region 5)
State Lands Commission
State Clearinghouse

LOCAL GOVERNMENT

County Boards of Supervisors
El Dorado County
Placer County
Sacramento County
Sutter County
Yolo County
County Air Pollution Control Districts
El Dorado County
Placer County
Sacramento County
Sutter County
Yolo County
Central California Irrigation District
RD 1000 American River Flood Control District
RD 1001

SPECIAL INTEREST GROUPS

American Fisheries Society
American River Coalition
Auburn Dam Task Force
Auburn Dam Council
California Trout
California Native Plant Society
California Waterfowl Association
Defenders of Wildlife
Environmental Defense Fund
Friends of the River
National Wildlife Federation
National Audubon Society
Planning and Conservation League
Sierra Club
The Wildlife Society
The Nature Conservancy

SUMMARY TABLES OF DIRECT AND INDIRECT IMPACTS

SUMMARY TABLES

Direct Impacts of the Selected Plan and Project Alternatives:

Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives:

TABLE 1-2. Summary of Direct Land Use Impacts of the Selected Plan and Project Alternatives

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	**Impact** The potential long-term disruption of existing agricultural activities at the 71-acre borrow site due to removal of nutrient-rich top soils. **Significance** Potentially significant. **Mitigation** Develop and implement a reclamation/restoration plan for the borrow site including provisions to ensure top soil is stockpiled and replaced following borrow activities. **Residual Impact** Not significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.
		Impact Design of new Main Avenue bridge would eliminate several access points from Main Avenue and Del Paso Blvd. to adjacent businesses. **Significance** Significant **Mitigation** Construct frontage roads and re-route traffic using East Levee Road onto Sorento Road. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-2. Summary of Direct Land Use Impacts of the Selected Plan and Project Alternatives

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 AND LOWER AMERICAN RIVER	**Impact** Storms larger than a 70-year event could cause damage and destruction of existing residential/commercial property in the floodplain. **Significance** Short-term physical disruption considered less than significant. **Mitigation** None proposed. **Residual Impact** Unavoidable, short-term land use impacts.	**Impact** Frequency of flood impacts (physical land disruption) would be reduced to 200-year or greater storm events. **Significance** Same as no action. **Mitigation** None **Residual Impact** Unavoidable disruption in 200-year or greater event.	**Impact** Frequency of flood impacts would be reduced to 400-year or greater storm events. **Significance** Same as no action. **Mitigation** None **Residual Impact** Unavoidable in 400-year event.	**Impact** Frequency of flood impacts would be reduced to a 150-year event. **Significance** Same as no action. **Mitigation** None **Residual Impact** Unavoidable in 150-year or greater storm.	**Impact** Frequency of flood impact would be reduced to 100-year or greater event. **Significance** Same as no action. **Mitigation** None **Residual Impact** Unavoidable in 100-year or greater storm.	Same as 100-year (FEMA) levee alternative.	Same as 100-year (FEMA) levee alternative.
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Conversion of land from natural vegetation to levee structures and riprapping viewscape would adversely affect recreational use of the American River Parkway. **Significance** Significant **Mitigation** • Establish revegetation program for impacted areas. • Choose darker type rocks for riprap. **Residual Impact** Significant	Substantially the same as 150-year alternative.	No impact	Substantially the same as 150-year alternative.

TABLE 1-2. Summary of Direct Land Use Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	**Impact** Reduction of recreation access resulting from inundation-related erosion or replacement of major roads and trails in the canyon area. **Significance** Significant **Mitigation** • Include provisions requiring repair of specified roads and trails in the inundation zone as part of the maintenance and operation program for the flood control dam. **Residual Impact** Less than significant.	Same as selected plan.	No impact	No impact	No impact	No impact

TABLE 1-3. *Summary of Direct Hazardous and Toxic Waste Impacts of the Selected Plan and Project Alternatives*

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
ENTIRE STUDY AREA	No impact	**Impact** Hazardous waste spills or leaks occurring during construction. **Significance** Potentially significant. **Mitigation** Contractor must acquire submittal of a hazardous material handling plan (including petroleum products), and submit a plan for properly disposing of construction waste. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.
NATOMAS AND LOWER AMERICAN RIVER	**Impact** Floodwaters could seep into the soils surrounding HTW sites in the flood plain. 334 of the sites pose a significant contamination threat, if inundated; 175 sites pose potential public health impacts. **Significance** Significant adverse impact. **Residual Impact** Significant	Same as the no action alternative except impacts would be reduced to events greater than 200-years.	Same as the no action alternative except impacts would be reduced to events greater than 400-years.	Same as the no action alternative except impacts would be reduced to events greater than 150-years.	Same as the no action alternative except impacts would be reduced to events greater than 100-years.	Same as the no action alternative except impacts would be reduced to events greater than 100-years.	Same as the no action alternative except impacts would be reduced to events greater than 100-years.

TABLE 1-3. Summary of Direct Hazardous and Toxic Waste Impacts of the Selected Plan and Project Alternatives

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 AND LOWER AMERICAN RIVER	No impact	**Impact** Contamination of water, soil and/or air in the vicinity of construction sites could occur due to disturbance of existing hazardous conditions such as abandoned vehicles, chemical storage, underground cables, railroad tracks, yards, residual pesticides, and trash debris. **Significance** Potentially significant. **Mitigation** • Restrict public access to construction sites. • Complete a Phase I site assessment for each construction location. • Collect and appropriately dispose of all debris and trash which could be a source of pollutants. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
ENTIRE STUDY AREA	No impact	**Impact** Increased sediment loading and pollution of water channels in the Natomas and upper American River areas due to construction activities and rain storms during construction. **Significance** Potentially significant. **Mitigation** • Develop and implement an erosion and sediment control plan including: *Temporary diversion structures such as ditches, dikes, berms, piping, etc., to divert flows into temporary settling basins.* Revegetating and stabilizing exposed soils from erosion. **Residual Impact** Less than significant.	Same as selected plan.	**Impact** Same as the selected plan; however, the areas affected would be Natomas and the lower American River area. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	Same as 150-year alternative.	Same as 150-year alternative.	Same as 150-year alternative.

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
ENTIRE STUDY AREA	**Impact** Flooding may cause storm drains and sewage treatment plants to overflow and discharge untreated or partially treated effluents into the Sacramento and American Rivers. Pollutants on the ground, such as oils, grease, heavy metals, and pesticides, as well as toxic and hazardous materials from waste sites, could also be discharged into rivers.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 200-year event.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater then 400-year event.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 150-year event.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 100-year event.	Same as the 100-year (FEMA) levee alternative.	Same as the 100-year (FEMA) levee alternative.
	Significance Significant for rainstorms greater than 70-year event.	**Significance** Significant for rainstorms greater than 200-year event.	**Significance** Significant for rainstorms greater than 400-year event.	**Significance** Significant for rainstorms greater than 150-year event.	**Significance** Significant for rainstorms greater then 100-year event.		
	Mitigation None proposed.	**Mitigation** In the construction areas require proper storage of tanks containing potentially hazardous substances. Also see the spill prevention plan required for dealing with hazardous materials.	**Mitigation** None proposed.	**Mitigation** None proposed.	**Mitigation** None proposed.		
	Residual Impact Significant	**Residual Impacts** Significant in the event of floods greater than 200-year.	**Residual Impact** Significant in the event of floods greater than 400-year.	**Residual Impact** Significant in the event of floods greater than 150-year.	**Residual Impact** Significant in the event of floods greater than 100-year.		

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
ENTIRE STUDY AREA	No impact	**Impact** Spills of construction materials (gravel, cement) and petroleum products (from construction vehicles) would degrade water quality in Natomas and in the upper American River. **Significance** Significant in the event of a major spill. **Mitigation** Use proper construction methods to prevent accidents or spills and to minimize erosion of sedimentation to wetlands and streams. See erosion control plan described above. • Prepare an emergency response plan for use in the event of a major spill. **Residual Impact** Less than significant.	Same as selected plan.	**Impact** Same as the selected plan; however, the areas affected would Natomas and lower American River. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	Same as 150-year alternative.	Same as 150-year alternative.	Same as 150-year alterative.

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** The proposed operation of Folsom Reservoir would affect seasonal water temperatures downstream. Aquatic biota could be adversely affected in the reservoir and in the river channel. **Significance** Significant impact on aquatic biota. **Mitigation** See Fisheries. **Residual Impact** See Fisheries.	No impact	**Impact** Increased flood control volume in Folsom Reservoir would result in temperature changes causing fisheries impacts. Similar to the 150-year alternative. **Significance** Significant impact on aquatic biota. **Mitigation** See Fisheries. **Residual Impact** See Fisheries.	Substantially the same as the 150-year alternative.

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
UPPER AMERICAN RIVER	No impact	**Impact** Based on a worst-case estimate, up to 8,000 tons of sediment could be generated by construction of the flood control dam in the American River near Auburn. **Significance** Significant adverse impact. **Mitigation** • Implement the sediment erosion control plan described. **Residual Impact** Mitigation measures should significantly reduce the level of water-quality impairment; however, some short-term water quality decline is unavoidable.	**Impact** Overall construction impacts on water quality would be slightly more than the selected plan due to the increased size of the dam and longer construction period. **Significance** Significant adverse impact. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	No impact	No impact	No impact	No impact

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
UPPER AMERICAN RIVER	No impact	**Impact** Increasing production rates at the Old Cool Quarry would create a greater amount of waste material and related disposal requirements. In addition, construction and operation of temporary conveyor transport system could cause accelerated erosion of topsoil which could enter the river channel and cause sediment loading. **Significance** Potentially significant. **Mitigation** Route all runoff near production operations through settlement basins; increase size of ponding settlement basins as necessary; monitor river sediment levels and wash water disposal operations on a regular basis. **Residual Impact** Less than significant.	Same as selected plan.	No impact	No impact	No impact	No impact

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
UPPER AMERICAN RIVER	No impact	**Impact** Concentrations of dissolved calcium, sulfate, chloride, total iron, manganese and asbestos in the American River may increase significantly during construction of the dam. **Significance** Significant adverse impact. **Mitigation** • Implement construction methods described previously to reduce sediment loading. • Monitor constituent concentrations in the river and in settling basin effluents on a regular basis. **Residual Impact** Mitigation measures should significantly reduce the level of water-quality impairment; however, some short-term water-quality decline is unavoidable.	Same as selected plan.	No impact	No impact	No impact	No impact

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
UPPER AMERICAN RIVER	No impact	**Impact** Relocation of Hwy 49 and Ponderosa Way would generate similar water quality concerns as identified under dam construction. Increased erosion potential of exposed soils and potential spillage of construction materials. **Significance** Significant short-term construction impact. **Mitigation** The erosion and sediment control plan will also be applicable for the Hwy 49 and Ponderosa Way components of the project. **Residual Impact** Less than significant.					

TABLE 1-4. Summary of Direct Water Quality and Drainage Impacts of the Selected Plan and Project Alternatives.

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
UPPER AMERICAN RIVER	No impact	**Impact** Spoils disposal at the dam construction site. **Significance** Due to the close proximity to the river, and Salt Creek banking of spoils in the Salt Creek area is considered a potentially significant water-quality impact. **Mitigation** • Implement the erosion and sediment control plan described previously. Contour or divert Salt Creek during placement and stabilization of the area. **Residual Impact** Not significant.	No impact	No impact	No impact	No impact	No impact

TABLE 1-5. Summary of Direct Fish, Vegetation, and Wildlife Impacts of the Selected Plan and Project Alternatives

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 FISHERIES	**Impact** Continued flooding would occur over the 63-year event under the no-action scenario. Disruptions to riparian zones are capable of affecting fish and aquatic insect populations. impact would likely be short-term as recovery term would be expected within a few years. **Significance** Potentially significant for floods greater then 63-year event. **Mitigation** None required.	**Impact** Changes in water quality due to levee construction and pump installation would temporarily lower the fish habitat quality during construction. The operation of the pump facility during flood events could trap fish. **Significance** Potentially significant. **Mitigation** Implement the construction mitigation measures recommended in the water quality section. Also, limit construction activity in the NEMDC channel to June 1 through August 31 and install fish screens on the pump. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-5. Summary of Direct Fish, Vegetation, and Wildlife Impacts of the Selected Plan and Project Alternatives

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 VEGETATION AND WILDLIFE	**Impact** Continued flooding would occur with floods greater than the 63-year event. Flooding outside the growing season is not known to cause extensive damage to the riparian community. Long-term damage to upland communities is not expected. Wildlife species could be temporarily displaced. These impacts would likely be temporary and recovery and recolonization would be expected within a few years. **Significance** Potentially significant for floods greater than a 63-year event. **Mitigation** None required.	**Impact** Vegetation cover impacts due to construction includes the loss of 18 acres of wetland habitat and 272 acres of upland habitat for a total loss of 290 acres. **Significance** Significant adverse impacts. **Mitigation** Acquire 280 acres of land in Natomas near the NEMDC to be managed as a wetland/upland complex, in coordination with USFWS, to compensate for permanent and temporary project losses. **Residual Impact** Direct project impacts would be mitigated through creation and/or restoration of habitat.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-5. Summary of Direct Fish, Vegetation, and Wildlife Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER FISHERIES	**Impact** Continued flooding would occur with floods greater than the 63-year event. Additionally increase of in-basin water damage, Delta water quality releases and an increase 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 percent decline. **Significance** Significant adverse impact. **Mitigation** None required.	Same as no action	Same as no action	**Impact** Bank stabilization work would impact fisheries; riprap placement would cause loss of spawning habitat. 21 percent reduction in fish resources due to changes in temperature and seasonal flows resulting from Folsom reoperation. **Significance** Potentially significant impacts from reoperation of Folsom and bank stabilization work. Loss of spawning habitat is a significant adverse impact. **Mitigation** Bank stabilization impacts can be offset by limiting construction to non-spawning times of the year. No mitigation measures identified for loss of spawning. See mitigation discussion in EIS for reoperation impact mitigation measures. **Residual Impact** Less than significant for bank stabilization impacts. Spawning habitat losses leave a significant adverse residual impact while the residual impact is undetermined for reoperation impacts.	**Impact** Bank stabilization impacts and loss of spawning habitat same as 150-year alternative. Folsom reoperation not included in this alternative; therefore no impacts. **Significance** Potentially significant impacts due to bank stabilization work. Significant adverse impacts due to loss of spawning habitat. **Mitigation** Same as the 150-year alternative for bank stabilization and spawning impacts. **Residual Impact** Less than significant for bank stabilization impacts. Spawning habitat losses leave a significant adverse residual impact.	**Impact** No riprapping or bank stabilization measures in this alternative, 19% reduction in fish resources due to reoperation of Folsom reservoir. **Significance** Potentially significant. **Mitigation** See mitigation discussion in EIS for reoperation impact mitigation measures. **Residual Impact** Undetermined	**Impact** Bank stabilization impacts, spawning losses 17% reduction in fish resources due to reoperation. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative. **Residual Impact** Same as 150-year alternative.

TABLE 1-5. Summary of Direct Fish, Vegetation, and Wildlife Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER VEGETATION AND WILDLIFE	**Impact** Continued flooding would occur from floods greater than the 63-year event. Short-term temporary displacement could affect wildlife. Flooding is not expected to affect vegetation. Additionally without the project, vegetation along the lower American will continue to change as it has since the construction of folsom Dam. Estimated acreage loss is 1480 acres. **Significance** Potentially significant. **Mitigation** None required.	Same as no action	Same as no action	**Impact** Vegetation cover impacts due to construction includes the loss of 679 acres of wetland habitat. **Significance** Significant adverse impact. **Mitigation** Acquire 1439 acres of land in lower American River floodway to be managed as a wetland/upland complex in coordination with USFWS. **Residual Impact** Undetermined	**Impact** Vegetation cover impacts due to construction includes the loss of 462 acres of wetland habitat. **Significance** Same as 150-year alternative. **Mitigation** Acquire 979 acres of land in the lower American River floodway to be managed as a wetland/upland complex in coordination with USFWS. **Residual Impact** Undetermined	**Impact** Vegetation cover impacts due to reoperation includes the loss of 143 acres of wetland habitat. **Significance** Same as 150-year alternative. **Mitigation** Acquire 303 acres of land in the lower American River floodway to be managed as a wetland/upland complex in coordination with USFWS. **Residual Impact** Undetermined	**Impact** Vegetation cover impacts due to construction includes the loss of 454 acres of wetland habitat. **Significance** Same as 150-year alternative. **Mitigation** Acquire 962 acres of land in the lower American River floodway to be managed as a wetland/upland complex in coordination with USFWS. **Residual Impact** Undetermined

TABLE 1-5. Summary of Direct Fish, Vegetation, and Wildlife Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER FISHERIES	**Impact** Potential disruptions from flooding to riparian zones and insect and fish population would continue without a dam. Water quality problems associated with increased development, public use, increased water diversions, would continue, adversely impacting the instream habitat and fish population. **Significance** Potentially significant. **Mitigation** None required.	**Impact** Sedimentation and sloughing during flood events may affect fish resources. **Significance** Undetermined **Mitigation** None necessary since this is a naturally occurring phenomenon.	Same as selected plan.	Same as no action	Same as no action	Same as no action	Same as no action

TABLE 1-5. Summary of Direct Fish, Vegetation, and Wildlife Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER VEGETATION AND WILDLIFE	**Impact** Potential disruptions to vegetation and wildlife from flooding would continue. Otherwise the vegetation and wildlife components within the study area would remain much as they are today. The project lands would remain in government ownership and managed like they are today. **Significance** Not a significant impact. **Mitigation** None required.	**Impact** Vegetation and associated wildlife will be impacted by dam construction, relocation of Highway 49, and Ponderosa Way Bridge, inundation and associated sloughing events. An estimated 1,927 acres will be impacted. **Significance** Potentially *significant*. **Mitigation** The implementation of an operation and maintenance post-flood adaptive management plan and the acquisition and management of 2,685 acres along the South Fork American River. **Residual Impact** *Undetermined*	**Impact** Vegetation and associated wildlife will be impacted by construction, relocation of Hwy 49 and Ponderosa Way Bridge, inundation and associated sloughing events. An estimated 700 acres will be impacted. **Significance** Potentially significant. **Mitigation** The implementation of an operation and maintenance post-flood adaptive management plan and the acquisition of land along the South Fork of the American River similar to the selected plan. **Residual Impact** *Undetermined*	Same as no action	Same as no action	Same as no action	Same as no action

TABLE 1-6. Summary of Direct Endangered Species Impacts of the Selected Plan and Project Alternatives

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	<u>SWAINSON'S HAWK</u> Impact Approximately 626 acres would be temporarily disturbed due to construction activities, 20 acres permanently lost. Significance Potentially significant Mitigation Accomplish construction in a manner consistent with negotiated agreement with DFG.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-6. Summary of Direct Endangered Species Impacts of the Selected Plan and Project Alternatives

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	<u>GIANT GARTER SNAKE</u> Impact 3,000 linear feet of toe drain along Sankey Road relocated. These toe drains used for irrigation and drainage providing GGS habitat. Significance Potential adverse impacts. Mitigation Limit construction, dewater existing habitat. Establish new habitat.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-6. Summary of Direct Endangered Species Impacts of the Selected Plan and Project Alternatives

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	<u>GIANT GARTER SNAKE</u> **Impact** 3,000 linear feet of toe drain along Sankey Road relocated. These toe drains used for irrigation and drainage providing GGS habitat. **Significance** Potential adverse impacts. **Mitigation** Limit construction, dewater existing habitat. Establish new habitat.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-6. Summary of Direct Endangered Species Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER		<u>VALLEY ELDERBERRY LONGHORN BEETLE</u>		**Impact** Changes in the river's hydrology may affect elderberry plants. Levee construction would also affect elderberry plants, possibly resulting in the permanent loss of plants and habitat.	**Impact** Substantially the same as 150-year alternative.	**Impact** Substantially the same as 150-year alternative.	**Impact** Similar to 150-year alternative.
	No Impact	No Impact	No Impact				
				Significance The extent of habitat that could be lost is undetermined. The loss of any critical habitat would be significant, possibly unavoidable.	**Significance** Same as 150-year alternative.	**Significance** Same as 150-year alternative.	**Significance** Same as 150-year alternative.
				Mitigation Undetermined.	**Mitigation** Same as 150-year alternative.	**Mitigation** Same as 150-year alternative.	**Mitigation** Same as 150-year alternative.

TABLE 1-6. Summary of Direct Endangered Species Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	BALD EAGLE						
	No Impact	No Impact	No Impact	**Impact** Reoperation/modification to Folsom Reservoir could affect the fish population which, in turn, could affect the food supply for bald eagles. **Significance** Potentially significant. **Mitigation** The study suggests that a fish planting program would offset the loss of fish. **Residual Impact** Less than significant if a fish planting program is implemented.	No Impact	**Impact** Similar to the 150-year alternative; however, the impact would likely be less severe as the proposed alterative of flow is less. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative. **Residual Impact** Same as 150-year alternative.	**Impact** Similar to the 150-year alternative; however, the impact would likely be less severe as the proposed alteration of flow is less. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative. **Residual Impact** Same as 150-year alternative.

TABLE 1-6. Summary of Direct Endangered Species Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	<u>Valley Elderberry Longhorn Beetle</u> **Impact** Inundation of elderberry shrubs behind flood control dam, possibly destroying beetle habitat in the detention area. **Significance** Potential adverse impacts. **Mitigation** Acquire 2,700 acres of lands adjacent to lands needed for project mitigation, plant 32,336 elderberry shrubs. Maintain and monitor for 10 years, to assure 80% survival at the end of that time. Replace lost vegetation as needed to meet 80% survival requirement.	Same as selected plan.	No impact	No impact	No impact	No impact

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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	**Impact** • Modification to NEMDC, NCC, PGCC levees would result in loss of architectural and historical integrity for existing structures. **Significance** Significant **Mitigation** Historical, architectural, and engineering documentation would reduce the severity of the impact. **Residual Impact** Potentially significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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	**Impact** Construction of levee improvements could damage or destroy archeological sites. **Significance** Significant **Mitigation** Avoid significant sites through redesign of project. Where redesign is infeasible, archeological (data recovery) documentation. **Residual Impact** Potentially significant dependent on site.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	**Impact** Current operation of Folsom Reservoir causes changes in the water levels that expose or damage cultural resources within the fluctuation zone. There are 32 prehistoric and 13 historic sites within the 395-466-foot elevation of Folsom Reservoir. Below the 395 elevation, there are additional recorded historic and prehistoric sites. **Significance** No direct project impacts. **Mitigation** None required	Same as no action.	Same as no action.	**Impact** Same as no action except these sites would be affected to a greater extent by reservoir fluctuation, erosion, and vandalism due to changes in operation. **Significance** Significant **Mitigation** • Archeological and historic documentation. • Site burial and preservation. **Residual Impact** Less than significant.	Same as no action.	**Impact** Similar to 150-year alternative; however, fewer sites would be affected. There are 25 prehistoric and 10 historic sites within the 404-416-foot elevation. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative.	**Impact** Similar to 150-year alternative; however, fewer sites would be affected. There are 23 prehistoric and 9 historic sites within the 429-466-foot elevation. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative.

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Construction activities may uncover and damage prehistoric, historic,or submerged resources along the lower American River. **Significance** Potentially significant. **Mitigation** • Avoid known prehistoric and historic sites during construction. • Archeological and historical documentation. **Residual Impact** Less than significant.	**Impact** Substantially the same as 150-year alternative; however, the total area affected would be smaller. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative.	No impact	Same as 100-year (FEMA) levee alternative.

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Lengthening the Sacramento Weir 3,600 feet would adversely affect a National Register eligible property by altering its historical and architectural integrity. Impacts in Yolo Bypass not entirely known but could be minimal. **Significance** Impacts to weir significant. **Mitigation** Architectural, engineering, and historical documentation. **Residual Impact** Potentially significant.	**Impact** Same as 150-year alternative except lengthening of weir is 1,400 feet. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative.	No impact	**Impact** Same as 150-year alternative except lengthening of weir is 500 feet. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative.

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	**Impact** The proposed Hwy 49 route passes near or through known historic and prehistoric sites. Additional sites are known to exist within 1 mile of the proposed route. Sites may be destroyed by construction. **Significance** Potentially significant. **Mitigation** • Avoid known historic and prehistoric sites during construction. • Archeological, architectural and engineering, and historical documentation in accordance with stipulations resulting from signed Programmatic Agreement. **Residual Impact** Potential significant visual and aesthetic impacts.	Same as selected plan.	No impact	No impact	No impact	No impact

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER		**Impact** Construction activities could potentially cause damage to some of the 163 known historic sites and 17 known prehistoric sites. Additional sites may be located during future preconstruction studies. **Significance** Potentially significant impacts. **Mitigation** • Avoid cultural resources sites during construction. • Archeological, architectural and engineering, and historical documentation. • Preservation when feasible. **Residual Impact** Potentially significant.	**Impact** Same as selected plan except 268 historic and 23 prehistoric sites are located here. **Significance** Same as selected plan. **Mitigation** Same as selected plan. **Residual Impact** Same as selected plan.	Same as no action.	Same as no action.	Same as no action.	Same as no action.

TABLE 1-7. Summary of Direct Cultural Resources Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	**Impact** High riverflows in a large storm event may cause erode or flood of cultural resources. **Significance** No direct project impact. **Mitigation** None required.	**Impact** In a large storm event, impoundment of flood-waters (operation of the dam) may increase erosion and damage historic or prehistoric resources due to wave action and bank slumping. **Significance** Potentially significant. **Mitigation** Data recovery documentation, and structural protection if feasible. **Residual Impact** Significant unavoidable loss of sites due to sloughing.	**Impact** Similar to selected plan except more cultural resources are likely to be affected due to larger size of impoundment. **Significance** Same as selected plan. **Mitigation** Same as selected plan. **Residual Impact** Same as selected plan.	Same as no action.	Same as no action.	Same as no action.	Same as no action.

TABLE 1-8. Summary of Direct Agricultural Impacts of the Selected Plan and Project Alternatives

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	**Impact** Disruption of 71 acres of existing agricultural activities at the borrow site south of the airport. **Significance** Significant **Mitigation** Develop a restoration plan for the borrow site consistent with the lease agreement with the land owner which will include provisions to remove and replace topsoil. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-9. Summary of Direct Transportation/Traffic Impacts of the Selected Plan and Project Alternatives

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
ENTIRE STUDY AREA	No impact	**Impact** Construction vehicle parking and site access requires adequate roadway width and turning radius at major intersections. **Significance** Significant impact where inadequate road width and turning radii are identified. **Mitigation** Where necessary, contractors should select an appropriate route and parking location. If no alternate route is available, intersection geometrics should be improved prior to project construction. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-9. Summary of Direct Transportation/Traffic Impacts of the Selected Plan and Project Alternatives

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
ENTIRE STUDY AREA	No impact	**Impact** Cumulative construction traffic and large construction vehicles (legal and permit loads) on public roadways would cause capacity problems with existing traffic activity. Increases in delay at major intersections and along major arterials. The extent of impact depends upon timing of when large construction vehicles would be on the roadway. **Significance** Significant roadway capacity impact if construction traffic coincides with peak-hour traffic. **Mitigation** To the extent practicable, avoid construction-related vehicle trips on public roads during weekday peak traffic periods. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-9. Summary of Direct Transportation/Traffic Impacts of the Selected Plan and Project Alternatives

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	**Impact** P.M. peak hour project added traffic on Northgate Blvd. between North Market Blvd and I-80 would incrementally add to existing level of service "F" traffic conditions. **Significance** Potentially significant during the P.M. peak hour. **Mitigation** Avoid project related haul trips during weekday peak traffic periods. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-9. Summary of Direct Transportation/Traffic Impacts of the Selected Plan and Project Alternatives

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	**Impact** Main Avenue bridge replacement would result in the elimination of existing access to land uses along Main Avenue and the permanent closure of East Levee Road at Del Paso Blvd. **Significance** Significant access and circulation impacts. **Mitigation** Construct new frontage roads from Northgate Blvd. and Pell Drive to access affected businesses and reroute East Levee Road traffic onto Sorento Road. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-9. Summary of Direct Transportation/Traffic Impacts of the Selected Plan and Project Alternatives

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	**Impact** Narrow levee road width, inadequate turning radius, and impaired line of sight on East Levee Road between Sotnip Road and the NEMDC pump station site. **Significance** Significant safety impacts associated with operation of large trucks. **Mitigation** Close East Levee Road between Sotnip Road and the pump station site during construction periods; detour local traffic via Sorento Road and Del Paso Road. **Residual Impact** Less than significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-9. Summary of Direct Transportation/Traffic Impacts of the Selected Plan and Project Alternatives

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	**Impact** During Main Avenue bridge reconstruction, local traffic would detour primarily via Norwood Avenue, Interstate 80, and Northgate Boulevard, causing peak-hour capacity problems. **Significance** Significant level of service impacts to Northgate Boulevard between Interstate 80 and North Market Boulevard. **Mitigation** Develop an ad campaign to advise motorists of alternative routes and modes of transportation around the construction site. **Residual Impact** Significant short term.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.
NATOMAS AND LOWER AMERICAN RIVER	**Impact** Flooding may damage local roadways and transportation facilities, including the Sacramento Metropolitan Airport, and impair the use of these facilities for a considerable period of time. **Significance** Significant for rainstorms greater than 70-year event. **Mitigation** None proposed. **Residual Impact** Potentially significant.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 200-year event. **Significance** Significant for rainstorms greater than 200-year event. **Mitigation** None proposed. **Residual Impact** Potentially significant.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 400-year event. **Significance** Significant for rainstorms greater than 400-year event. **Mitigation** None proposed. **Residual Impact** Potentially significant.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 150-year event. **Significance** Significant for rainstorms greater than 150-year event. **Mitigation** None proposed. **Residual Impact** Potentially significant.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 100-year event. **Significance** Significant for rainstorms greater than 100-year event. **Mitigation** None proposed. **Residual Impact** Potentially significant.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 100-year event. **Significance** Significant for rainstorms greater than 100-year event. **Mitigation** None proposed. **Residual Impact** Potentially significant.	**Impact** Same as the no-action alternative except impacts would be reduced to instances of rainstorms greater than 100-year event. **Significance** Significant for rainstorms greater than 100-year event. **Mitigation** None proposed. **Residual Impact** Potentially significant.

TABLE 1-9. Summary of Direct Transportation/Traffic Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Import of borrow materials required for levee improvements could cause potential capacity, road bed damage, and neighborhood nuisance impacts as well as temporary closure of the road across Folsom Dam, resulting in peak hour traffic impacts. **Significance** Potentially significant during peak hours. **Mitigation** Limit construction vehicle access to non-peak commute and recreational periods. **Residual Impact** Less than significant	Same as 150-year alternative.	No impact	Same as 150-year alternative.

TABLE 1-10. Summary of Direct Air Quality Impacts of the Selected Plan and Project Alternatives

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
ENTIRE STUDY AREA	No impact	**Impact** Project-related construction in Natomas and at the dam site, gravel extraction site and along the conveyor route in the upper American River area would cause a substantial increase in PM_{10} and ozone precursor emissions. **Significance** Although short-term, project emissions are not consistent with emissions reduction goals contained in local air quality attainment plans and would contribute to the continued nonattainment status of PM_{10} and ozone which is considered a significant air quality impact. **Mitigation** • Reduce dust and particulate generation by requiring the use of water trucks at work sites and on unpaved roads, using tarpaulins on transport trucks, and limit speeds on unpaved roads. • Transport aggregate materials to damsite via conveyor or rail system. **Residual Impact** Significant short term.	**Impact** Substantially the same as the selected plan; however, the impacts due to dam construction would be of longer duration. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	**Impact** Same as the selected plan for Natomas; increased emissions due to required Lower American River construction activities when compared to the selected plan; no impacts in the upper American River area. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	**Impact** Substantially the same as 150-Year alternative. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	**Impact** Substantially the same as 150-year alternative. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	**Impact** Substantially the same as 150-year alternative. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.

TABLE 1-11. Summary of Direct Noise Impacts of the Selected Plan and Project Alternatives

Location	No Action	Selected Plan	400-Year Alternative	15-Year Alternative	100-Year (FEMA) Levee Alternative	100-Year (FEMA) Storage Alternative	100-Year (FEMA) Levee/Storage and Spillway Alternative
ENTIRE STUDY AREA	No impact	**Impact** Construction-related truck traffic would generate increased noise levels along travel routes. **Significance** Short-term adverse noise nuisance for nearby residences or other sensitive receptors along haul routes. **Mitigation** • Fit heavy equipment with mufflers and engine enclosures. Limit dumptruck haul trips through residential areas between the hours of 8:00 am to 6:00 pm. **Residual Impact** Adverse but less than significant.	Same as selected plan.	Same as selected plan however, impacts in the Upper American River area would be avoided.	**Impact** Substantially the same as 150-year alternative. **Significance** Same as 150-year alternative. **Mitigation** Same as the selected plan. **Residual impact** Same as the 150-year alternative.	**Impact** Substantially the same as 150-year alternative. **Significance** Same as 150-year alternative. **Mitigation** Same as the selected plan. **Residual impact** Same as the 150-year alternative.	**Impact** Substantially the same as 150-year alternative. **Significance** Same as 150-year alternative. **Mitigation** Same as the selected plan. **Residual impact** Same as the 150-year alternative.

TABLE 1-11. Summary of Direct Noise Impacts of the Selected Plan and Project Alternatives

Location	No Action	Selected Plan	400-Year Alternative	15-Year Alternative	100-Year (FEMA) Levee Alternative	100-Year (FEMA) Storage Alternative	100-Year (FEMA) Levee/Storage and Spillway Alternative
NATOMAS AND LOWER AMERICAN RIVER	No impact	**Impact** construction activities at the NEMDC east and west levees, NEMDC pump station, Sankey Road, Dry and Arcade Creeks, and the borrow site would produce substantial noise. **Significance** Short-term significant noise impacts for adjacent sensitive receptors located within approximately 1,200 feet of improvement site. **Mitigation** Limit construction activities to daytime hours; site stationary noise sources at least 300 feet from occupied residences or provide noise reducing engine housing enclosures. **Residual Impact** Significant short-term for sensitive receptors located immediately adjacent to construction sites.	Same as selected plan.	**Impact** Same as selected plan with similar noise generation also occurring at levee improvement sites along the Lower American River. **Significance** Same as selected plan. **Mitigation** Same as selected plan. **Residual Impact** Same as selected plan.	Same as 150-year alternative.	Same as 150-year alternative.	Same as 150-year alternative.

TABLE 1-11. Summary of Direct Noise Impacts of the Selected Plan and Project Alternatives

Location	No Action	Selected Plan	400-Year Alternative	15-Year Alternative	100-Year (FEMA) Levee Alternative	100-Year (FEMA) Storage Alternative	100-Year (FEMA) Levee/Storage and Spillway Alternative
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Specific location, design, and noise generation for the American River pump station near Mayhew Drain is unknown. **Significance** Potentially significant intermittent noise impacts to nearby sensitive receptors during pump station operation. **Mitigation** Conduct acoustical studies once specific pump station design is known and site so as to avoid impacts to sensitive receptors. **Residual Impact** Not significant.	Same as 150-year alternative.	No impact	Same as 150-year alternative.

TABLE 1-11. Summary of Direct Noise Impacts of the Selected Plan and Project Alternatives

Location	No Action	Selected Plan	400-Year Alternative	15-Year Alternative	100-Year (FEMA) Levee Alternative	100-Year (FEMA) Storage Alternative	100-Year (FEMA) Levee/Storage and Spillway Alternative
UPPER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Increased noise resulting from lowering the spillway and replacing the gates. **Significance** Short-term adverse noise impacts to nearby sensitive receptors. **Mitigation** Limit construction related activities 50 8:00 am to 6:00 pm. **Residual Impact** Short-term less than significant.	No impact	No impact	same as 150-year alternative.

TABLE 1-11. Summary of Direct Noise Impacts of the Selected Plan and Project Alternatives

Location	No Action	Selected Plan	400-Year Alternative	15-Year Alternative	100-Year (FEMA) Levee Alternative	100-Year (FEMA) Storage Alternative	100-Year (FEMA) Levee/Storage and Spillway Alternative
UPPER AMERICAN RIVER	No impact	**Impact** Increased aggregate production at Old Cool Quarry, operation of the conveyor system within the American River Canyon, and construction activities at the dam site would increase ambient noise levels in adjacent areas. **Significance** Short-term adverse noise impacts to adjacent sensitive receptors. **Mitigation** Limit blasting hours at the Old Cool Quarry. **Residual Impact** Short-term significant and unavoidable.	Same as selected plan but slightly prolonged.	No impact	No impact	No impact	No impact

TABLE 1-12. Summary of Direct Recreation Impacts of the Selected Plan and Project Alternatives

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	**Impact** Increased demand on existing recreation facilities. **Significance** Possible adverse impacts. **Mitigation** None required.	**Impact** Provides 9.5 miles of additional trails connecting to American River Parkway. **Significance** Potentially beneficial impact. **Mitigation** Mitigation is provided in the 280-acre mitigation area in Natomas.	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	**Impact** Extensive levee construction could affect the Wild and Scenic Rivers designation along the lower American River. The placement of riprap and permanent loss of vegetation in areas along the lower American River would reduce the quality of the recreation experience (also, see Visual). **Significance** Significant unavoidable impact. **Mitigation** Revegetate the affected areas where possible use darker colored riprap. Use a mix of size to create a more natural look. **Residual Impact** Partially mitigated.	Same as 150-year alternative	No Impact	**Impact** Similar to 150-year alternative; however, the extent of levee modification is reduced. **Significance** Same as the 150-year alternative. **Mitigation** Same as 150-year alternative. **Residual Impact** Same as 150-year alternative.

TABLE 1-12. Summary of Direct Recreation Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	No Impact	No Impact	No Impact	**Impact** Reoperation of Folsom Reservoir would alter the flow patterns of the lower American River, potentially affecting water-dependent recreation. **Significance** Boating activities would be adversely affected (loss of user days) during below-normal and dry water years. Swimming and wading would be adversely affected (loss of user days) during dry water years. Significant and unavoidable. **Mitigation** No feasible mitigation. **Residual Impact** Significant	No Impact	Similar to 150-year alternative.	Similar to 150-year alternative.

TABLE 1-12. Summary of Direct Recreation Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No Impact	**Impact** Recreation activities would be affected by aggregate mining conveyance route during construction. The Tevis Cup and Western States Endurance Run would need to be rerouted around areas closed for construction. **Significance** Potentially significant during the 2-3 year mining phases. **Mitigation** Reroute special events around construction areas. Repair damage after construction. **Residual Impact** Less than significant.	Same as selected plan.	No Impact	No Impact	No Impact	No Impact
	No Impact	**Impact** Construction of a new bridge and access roads at Ponderosa Way would impede public access to the North Fork due to road closures or construction-induced delays. **Significance** Potentially significant during spring or summer high-use periods. **Mitigation** Contractors will follow accepted industry practices during the construction period. **Residual Impact** Less than significant.	Same as selected plan.	No Impact	No Impact	No Impact	No Impact

TABLE 1-12. Summary of Direct Recreation Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No Impact	**Impact** Abandonment of the existing Highway 49 alignment would substantially reduce existing access to upper American River. **Significance** Significant **Mitigation** Maintain existing alignment as a local access. This is an optional feature and a non-project cost which may be implemented by a local sponsor.	Same as selected plan.	No Impact	No Impact	No Impact	No Impact
	No impact	**Impact** Periodic temporary inundation of the canyon could cause major changes in the appearance of the area and degrade the quality of the recreation experience in the area. **Significance** Potentially significant. **Mitigation** Inclusion of an adaptive management plan as part of the maintenance and operation of the flood control facility would reduce some visual impacts. **Residual Impact** Significant	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-12. Summary of Direct Recreation Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	**Impact** Periodic temporary inundation of the canyon would cause debris deposition on some roads and trails and washouts of others thus disrupting access to and use of the area for recreation. **Significance** Significant **Mitigation** Include road and trail maintenance and repair as part of the maintenance and operation of the flood control facilities. **Residual Impact** Less than significant	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-13. Summary of Direct Socioeconomic Impacts of the Selected Plan and Project Alternatives

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 AND LOWER AMERICAN RIVER	**Impact** Potential for loss of life if a flood occurs. **Significance** Potentially significant. **Mitigation** None proposed. **Residual Impact** Potentially significant.						
	Impact Loss of structures which have been damaged more than 50 percent of the value and are not able to rebuild. **Significance** Potentially significant. **Mitigation** None proposed. **Residual Impact** Potentially significant.	No impact	No impact	No impact	No impact	No impact	No impact

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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	**Impact** Construction of levees along north and south Dry Creek would block open space views from existing residences **Significance** Significant visual impact to adjacent residential and recreational areas. **Mitigation** Establish grass on levee slopes. **Residual Impact** Significant and unavoidable.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.
	No impact	**Impact** Excavation of material from the Garden Highway borrow site. **Significance** Adverse short-term visual impact to adjacent viewing locations, particularly from the Garden Highway. **Mitigation** Implement a reclamation plan for the borrow site immediately following commencement of borrow activities. **Residual Impact** Adverse short term; not significant long term.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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	**Impact** Views from homes located on West 6th Street of the NEMDC pump station should the station be elevated several feet above the height of finished levees. **Significance** Adverse visual impact to residents on West 6th Street and motorists on East Levee Road. **Mitigation** Require plantings to screen views of the facility from East Levee Road and West 6th Street. **Residual Impact** Not significant.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.
	No impact	**Impact** Construction of a high bridge at Main Avenue/NEMDC. **Significance** Adverse but less than significant visual impact. **Mitigation** None available. **Residual Impact** Adverse but less than significant visual impacts; increased viewing opportunities from the top of the completed bridge.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.	Same as selected plan.

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Construction activities along the lower American River and at Folsom Dam would result in significant short-term impacts on visual resources. **Significance** Significant short-term impact. **Mitigation** • Revegetate site upon completion of construction. • Maintain equipment properly during construction to avoid nuisance impacts. **Residual Impact** Less than significant.	**Impact** Construction along the lower American River levees would affect local views. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative. **Residual Impact** Same as 150-year alternative.	Same as 150-year alternative.	Same as 150-year alternative.

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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
LOWER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Visual impacts imposed by levee modifications would cause the semi-natural appearance of the levees to have a more manmade appearance; the reflective nature of the riprap will be visually dominant, and the loss of plant life will cause the parkway to have a stark appearance. **Significance** Significant visual impact. **Mitigation** Partial levee bank mitigation could be accomplished through a revegetation program which includes mixed grasses, oak trees, and riparian trees and shrubs. Partial riprap mitigation could be accomplished by using a mix of minimum size and larger rock to project a more natural appearance. **Residual Impact** Significant and unavoidable.	**Impact** The levee work along the lower American River is similar to, but less extensive than, that of the 150-year alternative. **Significance** Same as 150-year alternative. **Mitigation** Same as 150-year alternative. **Residual Impact** Same as 150-year alternative.	No impact	Same as the 100-year (FEMA) levee alternative.

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	No impact	No impact	**Impact** Low surface-water elevations at Folsom Reservoir would expose a larger area of reservoir bottom during the winter and during dry years than is currently exposed. Also an increase of dust storms resulting from high winds would obstruct view of the reservoir. **Significance** Significant unavoidable impact. **Mitigation** None proposed. **Residual Impact** Unavoidable impact.	No impact	Same as the 150-year alternative.	Same as the 150-year alternative.

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	**Impact** The completed dam would present minimal visual disruptions due to limited public vantage points. However, the manmade form would provide moderate contrast to the bare rock and construction areas. The dam would become more visually prominent as vegetation grows on adjacent sites. **Significance** Significant visual impact. **Mitigation** None **Residual Impact** Significant and unavoidable.	**Impact** Same as the selected plan; however, the visual prominence of the dam will be greater, due to the higher overall height. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	No impact	No impact	No impact	No impact

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	**Impact** Temporary placement and operation of a conveyor system and graded 20-foot right-of-way along a mostly natural 5-mile reach of the American River **Significance** Significant short-term visual impact to recreational users and motorists at certain locations along Highway 49. **Mitigation** Reroute the conveyor away from high-use areas. **Residual Impact** Potentially significant depending on relocation alignment.	Same as selected plan.	No impact	No impact	No impact	No impact
	No impact	**Impact** Construction of a new bridge as part of the Hwy 49 relocation would require grading cuts along the wall of the canyon, resulting in significant visual impacts. The bridge itself would alter the existing views. **Significance** Significant visual impact. **Mitigation** Avoid large single plane cuts through rock areas during road development. **Residual Impact** Significant and unavoidable.	Same as selected plan.	No impact	No impact	No impact	No impact

TABLE 1-14. Summary of Direct Visual Resources Impacts of the Selected Plan and Project Alternatives

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
UPPER AMERICAN RIVER	No impact	**Impact** Infrequent views of flood debris clutter in the detention area and river, landslides and stripped vegetation or other damage following a large storm event. **Significance** Infrequent but significant and unavoidable. **Mitigation** Implementation of the adaptive management plan will replace lost vegetation at slide areas. **Residual Impact** Short term significant and unavoidable, but ultimately mitigated to less than significant.	**Impact** Flood-related inundation impacts would be the same as the selected plan; however, they would not extend as far up the canyon walls. **Significance** Same as the selected plan. **Mitigation** Same as the selected plan. **Residual Impact** Same as the selected plan.	No impact	No impact	No impact	No impact

TABLE 1-15. Summary of Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives

Impact Category	Impact	Significance	Mitigation	Residual Impact
Land Use	Conversion to urban uses of 9,800 acres of open space and agricultural land in the Natomas, Meadowview and Pocket areas of the City of Sacramento.	Significant.	None.	Significant.
Hazardous and Toxic Wastes	Industrial development in Natomas could involve use of hazardous materials that would generate hazardous wastes.	Potentially significant.	Require Hazardous Substance Management Plans of all appropriate industries.	Less than significant.
Drainage and Water Quality	Project-related development would increase storm runoff volumes and result in localized flooding if the affected areas are not properly drained.	Significant.	Provide appropriate drainage facilities in connection with new development in the Natomas basin and in the Meadowview and Pocket areas of the City.	Less than significant.
Drainage and Water Quality	Increased discharges of urban stormwater runoff into local and regional waterways would adversely affect water quality and degrade aquatic resources.	Significant.	Implement Best Management Practices (BMPs) to improve stormwater quality and reduce the volume of stormwater runoff as required under the City's NPDES permit. BMPs include: on-site retention and detention storage of stormwater runoff; design storm drainage to slow water flows and depress peak volumes; minimize impervious surfaces; and maximize percolation and evaporation of stormwaters.	Potentially significant.

TABLE 1-15. Summary of Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives

Impact Category	Impact	Significance	Mitigation	Residual Impact
Air Quality	Project-related development would increase direct and indirect sources of air pollution and result in increased emissions of carbon monoxide, oxides of nitrogen and reactive organic gases, thereby delaying attainment of Federal and State ozone and carbon monoxide standards in the Sacramento Metropolitan Air Quality Maintenance Area.	Significant.	Implement the measures suggested in SACOG's Interim Regional Air Quality Plan including: adoption of local land use and transportation control measures by the City; adoption of regional stationary and mobile source control measures by the Sacramento Metropolitan Air Quality Management District; and adoption of statewide emission control measures by the State Air Resources Board.	Potentially significant.
Fish, Vegetation, and Wildlife	Development in Natomas would result in a loss of riparian and wetland habitat bordering existing drainage canals and could threaten important riparian and wetland habitat along Fisherman's Lake.	Significant.	Avoid impacts to the extent feasible through careful design and implementation of the North Natomas Community Drainage Plan, and implement a "no net loss of wetlands" policy to complement the Corps' administration of Section 404 of the Clean Water Act. Where avoidance is infeasible, compensate for losses by acquiring and managing suitable replacement habitat.	Less than significant.
Fish, Vegetation, and Wildlife	Development in Natomas would result in losses of 7,280 acres including seasonal wetland habitat provided by rice fields.	Significant.	Compensate for losses through acquisition and management of suitable replacement habitat as discussed in the Memorandum of Agreement.	Less than significant.

TABLE 1-15. Summary of Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives

Impact Category	Impact	Significance	Mitigation	Residual Impact
Fish, Vegetation, and Wildlife	Development-related increases in urban stormwater runoff would adversely affect fisheries occupying affected regional and local waterways.	Significant.	Implement BMPs to improve stormwater quality and reduce the volume of stormwater runoff as required under the City's NPDES permit (see above).	Potentially significant.
Endangered Species	Development in Natomas could result in a loss of nesting habitat for the Swainson's hawk.	Significant.	Avoid existing nest sites and preserve and restore stands of riparian trees along Fisherman's Lake and elsewhere in Natomas.	Less than significant.
Endangered Species	Development in Natomas and Meadowview would result in losses of agricultural and open space areas providing Swainson's hawk foraging habitat.	Significant.	Compensate for lost habitat by acquiring preservation easements or other suitable entitlements designed to preserve remaining habitat on an acre-for-acre basis.	Less than significant.
Endangered Species	Development in Natomas could adversely affect the giant garter snake through impeding movement corridors, reducing wetland and other suitable habitat, increasing toxic substances in local waterways, and increasing the potential for road kills.	Significant.	Avoid existing habitat to the extent feasible, adhere to DFG guidelines in construction of the North Natomas Drainage System, restore habitat in the new drainage canals, and implement BMPs to control water quality in local waterways.	Less than significant.
Endangered Species	Development in Natomas would result in losses of riparian habitat that supports the valley elderberry longhorn beetle.	Potentially significant.	Replant elderberry plants in disturbed areas.	Less than significant.
Cultural Resources	Development in Natomas could result in disturbance or destruction of significant archaeological and historic sites.	Significant.	Develop programmatic agreement between State Historic Preservation Officer and local land use/development agencies specifying procedures for identifying, evaluating and avoiding impacts to sensitive sites.	Less than significant.

TABLE 1-15. Summary of Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives

Impact Category	Impact	Significance	Mitigation	Residual Impact
Agriculture	Project-related development will result in conversion to urban uses of approximately 7,913 acres of productive agricultural land in the Natomas area. Much of this land would be prime or unique farmland, or farmland of statewide importance.	Significant.	The loss of these lands would be unavoidable.	Significant.
Transportation	Project-related development would increase the volume of traffic on local roadways and regional freeway systems causing many local streets and intersections in the Natomas, Meadowview and Pocket areas of the City to be significantly congested during peak hours, and contributing to existing peak hour congestion on regional freeways.	Significant.	Widen local roadways where feasible; construct new freeway segments; expand public transportation systems, including light rail; and implement transportation control measures such as HOV lanes, vanpooling, carpooling, and staggered work hours to reduce peak hour congestion.	Significant.

TABLE 1-15. Summary of Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives

Impact Category	Impact	Significance	Mitigation	Residual Impact
Noise	Development would expose residents in portions of the project area to noise levels in excess of locally adopted standards. Areas along I-5 in Natomas and Meadowview, near the Western Pacific Railroad in Meadowview and along various roadway segments throughout the project area would experience significant surface transportation noise. The area west of I-5 in Natomas would experience significant airport noise. The area near the proposed stadium in North Natomas would experience significant stadium noise.	Significant.	Development exposed to surface transportation noise should be designed to be consistent with the noise goals of the City General Plan. Development exposed to airport and stadium noise should be designed to minimize noise impacts to the extent feasible. However, the City has determined that it is infeasible to prohibit residential uses west of I-5 or in the proximity of the proposed stadium.	Significant.
Recreation	Growth in Natomas and along the lower American River would lead to higher recreation use of the American River Parkway, increasing congestion.	Significant	None required.	Potentially significant.
Recreation	Growth in Natomas would result in permanent loss of bird hunting and watching activities on agricultural lands.	Significant	Exploring the establishment of new hunting area with DFG.	Potentially significant.
Visual Resources	Views of existing open space agriculture and riparian corridors, especially in Natomas, would significantly diminish as project-related growth converts the study area to an urban/suburban condition.	Significant.	None.	Significant.

TABLE 1-15. Summary of Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives

Impact Category	Impact	Significance	Mitigation	Residual Impact
Population	Project-related development will add approximately 80,000 residents to the City by the year 2010. 61,000 would be added in Natomas, with most of the remainder being absorbed in Meadowview.	Not significant, per se, because regional growth is expected to be about the same with or without the project. The project permits this growth to occur in specific areas.	None required.	
Housing	Project-related development would add approximately 32,000 housing units to the existing housing stock in the City. 24,500 units would be added in Natomas, 5,600 in Meadowview and the remainder in the Pocket area.	Not significant, per se, however, new housing could exacerbate existing transportation and air quality problems if the City's goal of creating an appropriate jobs-housing balance is not achieved.	None required.	
Water	Added residents in the Natomas, Meadowview and Pocket areas will generate a need for approximately 15,000 acre-feet of water per year. This demand could have a significant impact on existing delivery systems.	Significant.	Expand existing water treatment facilities and construct delivery systems necessary to provide water to new residents.	Less than significant.
Sewage	Project-related residential development would increase existing (1992) sewage flows by about 10,000 gallons per day.	Significant.	The City and County will need to expand existing sewage facilities to handle this increased volume.	Less than significant.
Solid Waste	Development in the project area will increase the volume of solid waste disposal by about 330,000 pounds per day.	Significant.	The City and County have implemented a recycling program aimed at reducing solid waste and they are continuing to search for new landfill sites to accommodate the anticipated increase in disposal.	Less than significant.

TABLE 1-15. Summary of Major Indirect (Growth-Inducing) Impacts Common to Project Alternatives

Impact Category	Impact	Significance	Mitigation	Residual Impact
Emergency Services	Development facilitated by the project will necessitate additional police and fire services, including an additional fire station in North Natomas.	Significant.	The City will have to hire approximately 150 new police officers and construct and staff a new fire station in North Natomas.	Less than significant.
Schools	Increased population in the project area will require additional classrooms and facilities at the elementary, junior high school and high school levels.	Significant.	Incorporate the appropriate number of elementary, junior high and senior high school sites into development plans based on expected student enrollment.	Less than significant.
Growth-inducing Impacts	Possible development of approximately 17,000 acres in the northern portion of the Natomas basin pursuant to a General Plan Amendment being contemplated by Sutter County. Possible acceleration of regional growth pressures in the Upper American River area due to the replacement of Highway 40 based on a width and alignment different than the replacement identified for the selected plan.	Significant.	Undertake appropriate mitigation for identified impacts as part of the local planning process.	Less than significant.

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