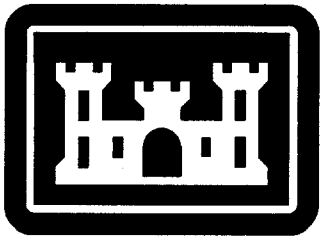
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

WATER CONTROL MANUAL

APPENDIX VIII TO
MASTER WATER CONTROL MANUAL
SACRAMENTO RIVER BASIN, CALIFORNIA



US ARMY CORPS
OF ENGINEERS
Sacramento District

DECEMBER 1987

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TO
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DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

The pertinent data page is not available in this version of the Folsom water control manual. For additional information, contact the U.S. Army Corps of Engineers Sacramento District Office of Counsel at (916) 557-5290.

NOTICE TO USERS OF THIS MANUAL

Regulations specify that this Water Control Manual be published in looseleaf form, and only those sections, or parts thereof, requiring changes will be revised and printed. Therefore, this copy should be preserved in good condition so that inserts can be made to keep this manual current.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

WATER CONTROL MANUAL

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I - INTRODUCTION

1-01. AUTHORIZATION

The Folsom Dam and Lake Water Control Manual, American River, California, is an appendix to the Sacramento River Basin Master Water Control Manual. It is prepared in accordance with instructions contained in ER 1110-2-241, EM 1110-2-3600 and ETL 1110-2-251, all pertaining to requirements for reports on reservoir regulation for projects subject to the provisions of Section 7 of the Flood Control Act of 1944 (58 Stat 890). The pertinent portion of that act reads as follows:

> "Hereafter it shall be the duty of the Secretary of War to prescribe regulations for use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with..."

1-02. PURPOSE AND SCOPE

This manual provides a detailed plan for flood control and management at the Folsom Dam and Lake Project which is located on the American River about 20 miles northeast of Sacramento, California. A map of the Folsom Lake area is shown on Plate 1. A general area map of the American River Basin is shown on Plate 2. A portion of the material used in preparation of this report was furnished by the U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, California. A description of the overall Sacramento River Basin plan for flood control is given in the Master Manual of Reservoir Regulation, Sacramento River Basin, California.

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Manuals

Title		Date
Master Manual of Reservoir Regulation Sacramento River Basin, California		March 1959
Appendix I	Shasta Dam and Lake	Rev. January 1977
Appendix II	(Cottonwood Creek)	
Appendix III	Black Butte Dam and Lake	Rev. May 1987
Appendix IV	Oroville Dam and Reservoir	Rev. August 1970
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Appendix VI	(Marysville Dam and Lake)	
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I - INTRODUCTION

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Related Reports
(Corps of Engineers)

1. Office Report, Standard Project Rain Flood
   Auburn and Folsom Reservoirs — July 1961
2. Office Report, Folsom Dam and Lake
   Spillway Adequacy Studies — September 1980

Related Reports
(Bureau of Reclamation)

1. Standing Operating Procedures for Folsom Dam and Lake
2. Standing Operating Procedures for Nimbus Dam and Lake

Design Memoranda
(Corps of Engineers)

	Title	Date
Part I	Hydrology	28 June 1946
Part II	Reservoir and Flowage	1 July 1948
Part IV	Dam and Appurtenances with Appendix A thru D	20 February 1950
Part VI	Malaria Control	15 January 1946
Part VII	Recreation Facilities with Appendix A	20 April 1949
Part VIII	Fish and Wildlife Facilities with Appendix A and B	10 November 1952
Part IX	Reservoir Clearing	15 August 1951
Planning Report		January 1955

1-04. PROJECT OWNER

Folsom Dam and Lake is owned by the U.S. Bureau of Reclamation. The Bureau also owns Nimbus Dam and Lake Natoma, the afterbay to Folsom.

1-05. OPERATING AGENCY

The U.S. Bureau of Reclamation is the operating agency for Folsom and Nimbus Dams. The Regional Director, Mid-Pacific Region, Sacramento, California, has overall operation responsibility. The Central Valley Operations Coordinating Office located at the Regional Office in Sacramento is the supervisory office for the Central Valley Project. The recreational features at Folsom and Natoma Lakes are operated by the State of California Division of Parks and Beaches. The Nimbus Fish Hatchery is operated by the State of California Department of Fish and Game.

1-06. REGULATING AGENCIES

Folsom Dam and Lake is operated in such a manner as to secure the greatest practicable benefits from flood control and other authorized purposes.

a. The U.S. Bureau of Reclamation plans and regulates the comprehensive operation of Folsom Dam and Lake as part of the Central Valley Project.

b. The flood control operation principles for Folsom Dam and Lake were mutually agreed upon by the Bureau of Reclamation and the Corps of Engineers (COE). However the COE is responsible for providing the flood control regulations (operating criteria) and has the authority for final approval. Any deviation from the flood control operating instructions must be authorized by the COE.

c. Irrigation and water supply releases will be determined by the Bureau of Reclamation in accordance with agreements with users.

d. Fishery releases will be made in accordance with agreements between the U. S. Bureau of Reclamation and the California State Department of Fish and Game and the U.S. Fish and Wildlife Service.

e. The California State Division of Parks and Beaches is responsible for regulating and administrating recreation programs and facilities.

f. Agencies responsible for hydrologic forecasts include the Bureau of Reclamation, the National Weather Service, the California Department of Water Resources and the Corps of Engineers.

II - DESCRIPTION OF PROJECT

2-01. LOCATION

Folsom Dam and Lake is located on the American River about 26 miles upstream from its confluence with the Sacramento River. The dam is in Sacramento County while the lake spans three counties including Sacramento, Placer and El Dorado Counties. It is 20 miles northeast of the City of Sacramento and 2 miles north of the City of Folsom. Nimbus Dam is located 7 miles downstream of Folsom Dam. Access to the various features of the project is provided by a network of county roads which connect with U.S. Highway 50 near the City of Folsom. The location of Folsom Dam and Lake with respect to the American River Basin is shown on Plate 2.

2-02. PURPOSE

The Folsom Project is operated as an integral part of the Bureau of Reclamation Central Valley Project. The reservoir provides flood protection for the Sacramento metropolitan area, water supplies for irrigation, domestic, municipal and industrial use, and hydropower purposes, and in addition provides extensive water-related recreational opportunities. Releases from Folsom also are used to provide water quality control for project diversions from the Sacramento-San Joaquin Delta and to maintain anadromous fish runs in the American River below the dam.

2-03. PHYSICAL COMPONENTS

Some portions of this chapter are not available in this version of the Folsom water control manual. For additional information, contact the U.S. Army Corps of Engineers, Sacramento District, Office of Counsel at 916-557-5290.

f. Nimbus Dam. Nimbus Dam is an afterbay structure, constructed and operated by the Bureau of Reclamation to reregulate the flows of the American River through the Folsom Powerplant, to act as a diversion dam to direct water into the proposed Folsom South Canal and to create a forebay for the Nimbus generators.

2-04. RELATED CONTROL FACILITIES

The American River is one of the two major tributaries of the Sacramento River and the Folsom Project is a unit of the comprehensive plan of development for the Sacramento Basin. The Folsom Project is related to the Sacramento River Flood Control Project in that flows from the reservoir will affect stages in the Sacramento River. Because of these affects, when the stage in the Sacramento River at the "I" Street Bridge, downstream of the American River confluence, exceeds 27.5 feet, gates are opened at the Sacramento Weir. The weir provides a route to the Yolo Bypass by way of the Sacramento Bypass.

2-05. REAL ESTATE ACQUISITION

Project lands comprise a total of 15,754 acres acquired in fee. A map of project boundaries is shown on Plate 7.

2-06. PUBLIC FACILITIES

The California Department of Parks and Recreation has a management agreement with the Bureau of Reclamation to develop, operate, and maintain the Federal land around Folsom Lake and Lake Natoma.

The purpose of the Folsom Lake State Recreation Area, as stated by the Department of Parks and Recreation, is to make available the great recreational opportunities afforded by the reservoirs impounded at Nimbus and Folsom Dams on the American River, including aquatic features,

environmental amenities, and historic values of locality. Recreation activities include boating, water skiing, swimming, fishing, hiking, camping, picnicking, horseback riding and nature study. The public use areas in the State Recreation area are described in Table 1. Recreation facilities are shown on Plate 8.

The American River Parkway has been designed by Sacramento County to preserve its natural beauty and open space. The parkway includes a 12-square mile area of recreational and open space greenbelt along 30 miles of the American River within the floodplain from Folsom Dam to the Sacramento River. The easterly 7 miles of the parkway within Sacramento County are included in the Folsom Lake State Park. The lower American River portion for which Sacramento County has primary responsibility includes approximately 5,400 acres. This park complex provides diverse recreational opportunities and open space for the urban community.

Since the parkway is within cycling distance of many, and within easy driving distance of all residents in Sacramento County, it has become an increasingly important focal point for recreational activities. Facilities for boating, fishing, swimming, hiking, cycling, horseback riding, nature study, picnicking, camping, golf, archery and many other recreational pastimes are provided for an increasing number of people.

TABLE 1. FOLSOM LAKE STATE RECREATION AREA

LOCATION	CAMPSITES	PICNIC TABLES	BEACH	R&H TRAILS [b]	MARINA	BOAT RAMP	FOOD CONCESSION	INTERPR. PROGRAM	UTILITY SERVICE SYSTEMS SANITATION Perm. [e]	SANITATION Temp. [d]	WATER	DEVELOPED ROADS	DEVELOPED PARKING	ELECTRICITY
FOLSOM LAKE														
Beal's Point	30	40	Yes	Yes		No	Yes	Yes	P	T	Yes	Yes	Yes	Yes
Brown's Ravine	–	50 [a]	No	Yes	600 slips	Yes	Yes		P		Yes	Yes	Yes	Yes
Dyke 8	–	50	No	No		Yes	No			T	No	Yes	Yes	Yes
Granite Bay	–	530	Yes(2)	Yes		Yes	Yes		P	T	Yes	Yes	Yes	Yes
Jack's Shack (Sal. Falls)	–	0	No	Yes		No	No		T	T	No	No	No	No
New York Cr. Cove	On Boat	0	No	Yes		No	No		Floating		No	No	No	No
Observation Overlook	–	0	No	No		No	No			T	No	Yes	Yes	No
Peninsula	100	0	No	Yes [c]		Yes	No	Yes	P		Yes	Yes	No	Yes
Rattlesnake	–	0	No	Yes		Yes	No			T	No	No	Yes	No
LAKE NATOMA														
Rainbow Bridge	–	0	No	No		No	No		No	No	No	No	No	No
Mississippi Bar	–	0	No	Yes		No	No		No	No	No	No	No	No
Negro Bar	20	30	No	Yes		Yes	No	Yes	P	T	Yes	Yes	Yes	Yes
Nimbus Overlook	–	0	No	Yes		No	No			T	No	Yes	Yes	No
Nimbus Flat	–	0	No	No		Yes	No			T	No	Yes	Yes	No
Willow Creek	–	0	No	No		No	No			T	No	No	No	No
Power House	–	10	No	No		No	No	Yes		T	Yes	No	Yes	Yes
	150	710												

[a] Not on State Inventory; [b] Total 50 miles of trails; [c] Interpretive Trail-1.2 mi.; [d] 75 Temporary; [e] 15 Permanent

III - HISTORY OF PROJECT

3-01. AUTHORIZATION

The Folsom Dam and Lake Project on the American River was originally authorized by the Flood Control Act of 1944, approved December 22, 1944, the pertinent portion of which follows:

> "... The Folsom Reservoir on the American River, California, is hereby authorized substantially in accordance with the plans contained in House Document Numbered 649, Seventy-eighth Congress, Second Session, with such modification thereof as in the discretion of the Secretary of War and the Chief of Engineers may be advisable ..."

The plan set forth in House Document Numbered 649 included construction of a dam at the Folsom site to create a reservoir with a gross storage capacity of 355,000 acre-feet, and the installation of outlet facilities for future power generation.

These features were reauthorized by the American River Basin Development Act of 14 October 1949 which again provided for construction by the Corps of Engineers but at a larger size than that considered in the Act of 1944. The 1949 Act also provided for construction of a powerplant at the dam by the Bureau of Reclamation and stipulated that, upon completion, the project would be operated by the Bureau of Reclamation. The Act reads in part as follows:

> "Sec. 2. The American River Development shall consist of: Folsom Dam and Reservoir having a storage capacity of approximately one million acre-feet, to be constructed by the Corps of Engineers ... and the following features for the development and use of water, to be constructed, operated, and maintained by the Secretary of Interior through the Commissioner of Reclamation: A hydroelectric powerplant with a generating capacity of approximately one hundred and twenty thousand kilowatts, and necessary hydroelectric afterbay powerplants and necessary electric transmission lines ..."

> "Folsom Dam and Reservoir upon completion of construction by the Corps of Engineers, to the extent where water from said reservoir is ready to be turned either into the powerplant or conduits, shall be transferred to the Bureau of Reclamation for operation and maintenance under the supervision of the Secretary of Interior ... After the transfer as provided herein, the dam shall be operated for flood control in accordance with criteria established by the Secretary of the Army as provided for in Section 7 of the Flood Control Act of 1944 ..."

3-02. PLANNING AND DESIGN

Planning and design of Folsom Dam was accomplished by the U.S. Army Corps of Engineers, Sacramento District, and reviewed by authorities at higher levels including the office of the Chief of Engineers in Washington, D.C.

3-03. CONSTRUCTION

Under contracts supervised by the U.S. Army Corps of Engineers, road construction and excavation for Folsom Dam were initiated in November 1948. Construction of auxiliary earth dikes was initiated in May 1950 and completed in April 1951. Construction of Mormon Island auxiliary dam was initiated in 1951 and completed in July 1952. Canal relocations, initiated in 1951, were completed in November 1953. The project was completed and transferred to the Bureau of Reclamation for operation and maintenance on May 15, 1956.

Contractors, supervised by the Bureau of Reclamation, initiated construction of Folsom Powerplant on April 28, 1952. Although this work was not completed until March 14, 1956, the first generator began production of electric power on May 20, 1955. The plant entered full capacity power production with all generators functioning on December 6, 1955. Rewinding of its three generators in 1974 increased the generating capacity from 162,000 kilowatts to the current rating of 198,720 kilowatts. Power produced is absorbed into the Central Valley Project system through the Folsom-Elverta 230-kv transmission line.

3-04. RELATED PROJECTS

Projects associated with Folsom Dam and Lake include levees along the Lower American River, Natomas East Main Drainage Canal, Arcade Creek, Dry Creek, Sacramento River and the Yolo Bypass (See Sections 4-09 and 4-11). In addition, many reservoirs exist upstream from Folsom all of which are used for water supply and/or hydroelectric power generation (See Section 4-10).

Folsom Dam and Lake, being part of the Central Valley Project (CVP), is operated as one component in a system of water control projects. The main objective of the CVP is to store the surplus flood water of the Sacramento River Basin and provide for its use as irrigation water in the San Joaquin Valley. The CVP also provides river regulation for salinity control, fresh water for municipal and industrial purposes, generation and distribution of power, flood control, and navigation. Project features include Shasta Dam and Powerplant, Keswick Dam and Powerplant, Friant Dam, Delta Cross Channel, Contra Costa Canal, Delta-Mendota Canal, Tracy Pumping Plant, Friant-Kern Canal, Madera Canal, Folsom Dam and Powerplant, Nimbus Dam and Powerplant, and Sly Park Dam and Camp Creek Diversion Dam. Other project features include the San Luis Dam and Pump/Generating Plant, the San Luis Canal, O'Neill Forebay and Pump/Generating Plant, New Melones Dam and Powerplant, the San Felipe Division of the CVP, and Sugarpine Dam. Additional construction includes the Sacramento Valley canals and several features in the Trinity River division. Other units are under investigation to meet the valley's needs as they develop.

3-05. MODIFICATION TO REGULATION

The original flood control diagram (effective date 24 May 1956) was modified effective 8 July 1977. The rainflood parameters of the 1956 diagram define the flood control space reservation on any given day from the weighted accumulation of the preceding 60-days basin mean precipitation. The 1977 flood control diagram, however, bases the flood control space reservation on the weighted accumulation of seasonal basin mean precipitation. Since then the diagram has again been modified in 1986 due to the February flood of that year (largest of record), which emphasized a need to maintain the maximum flood control space later into the season.

3-06. PRINCIPAL REGULATION PROBLEMS

a. The limited spillway capacity at Folsom Dam is a principal regulation problem because the channel capacity of 115,000 cfs cannot be released through the 5 main spillway gates in combination with powerplant releases until elevation 445.6 (790,000 acre-feet). At this elevation approximately 180,000 acre-feet of flood control space would be utilized.

b. Usage of the marina at Browns Ravine is severely impacted when the lake stage is at or below 427.0 feet, the bottom of the flood control pool.

c. The limitations of the downstream levees were evident during the February 1986 Flood when considerable erosion and a number of boils developed due to several days of flows which equalled or exceeded the levee design capacity of 115,000 cfs. In addition, at the time of Folsom Dam construction, Folsom Dam was believed to provide greater than a one hundred year level of protection. However, primarily because of additional years of records, flows at or above the levee design capacity are now estimated to occur much more frequently thereby endangering the developed and populated areas downstream.

d. There are in excess of 800,000 acre-feet of storage capacity in reservoirs upstream of Folsom Lake in the American River Basin (See Section 4-10). None of the storage is dedicated to flood control and very little of it is under the control of either the Bureau of Reclamation or the Corps of Engineers. While this storage has at times proved beneficial in attenuating inflow to Folsom Lake, it is not operated as a system, nor is it operated specifically for the purpose of controlling floods on the Lower American River. Realtime operations data for these reservoirs may be difficult to obtain or may not exist at all. This adds to the difficulty of predicting inflow to Folsom Lake during rain floods.

IV - WATERSHED CHARACTERISTICS

4-01. GENERAL CHARACTERISTICS

Folsom Dam and Lake is located on the American River at the foothill line about 20 miles northeast of Sacramento. The watershed area comprises 1,875 square miles of mostly rugged mountains along the westward face of the Sierra Nevada. The area has a well developed drainage system comprising three principal streams, North Fork, Middle Fork, and South Fork which flow generally westward. There is considerable variation in vegetative cover over the watershed, ranging from a light to medium density at low elevations, heavy over most of the intermediate area and decreasing to moderate and light over the high areas, and practically non-existent in severely glaciated areas around the high peaks. The watershed area is suitable for grazing, lumbering, mining, and to a limited extent fruit orchards. The area above 3,000 feet MSL is sparsely populated with most of the population residing along two all-year transcontinental highways, U.S. 50 and Interstate 80. Placerville is the largest town in the drainage area.

4-02. TOPOGRAPHY

The American River drainage basin above Folsom Dam is very rugged with precipitous rocky slopes, V-shaped canyons and very little flat valley or plateau area. Elevations range from 10,400 feet MSL at the headwaters to about 200 feet MSL at the dam with an average basin slope of approximately 80 feet per mile. The upper third of the basin has been intensely glaciated and is alpine in character with bare peaks and ridges, considerable areas of granite pavement, and only scattered areas of timber. The middle third is intensely dissected by profound canyons which have reduced the interstream areas to narrow ribbons of relatively flat land. The lower third consists of low rolling mountains and foothills. The area is drained by the three large branches which rise near the crest of the range and flow directly down the slope of the range in a fan-shaped pattern to unite into one main channel within the reservoir area. A topographic map of the American River Basin is presented on Plate 9. Stream profiles of the American River are shown on Plate 10. An area-elevation curve of the basin is shown on Plate 11.

4-03. GEOLOGY AND SOILS

The geologic features of the drainage area above Folsom Dam is characteristic of the Sierra Nevada-foothill region. The formations consist of a wide variety of metamorphic rocks into which granitic rocks of various types have intruded. Massive granitic outcroppings 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 Sierra Foothills. The area is characterized by weathered granites, mine tailings and stream clastics. Soil cover in the area ranges from moderate to heavy.

4-04. SEDIMENT.

Sedimentation rates in the American River Basin and adjacent basins are relatively low due to limited development, the general shallowness of soils and a low rate of upstream erosion. Estimates of the annual sediment yield ranges from 0.10-0.30 acre-feet per square mile. However, the sediment load of Folsom Lake has also been impacted by the failure of the partially completed Hell Hole Dam in 1964, and the failure of the Auburn Coffer Dam in 1986.

4-05. CLIMATE

a. General. The climate of the American River Basin is closely associated with the topography of the area and there is a marked difference in temperature and precipitation within short distances. Climate is characterized by cool, wet winters and hot, dry summers. The major portion of the seasonal rainfall occurs in 2 or 3 of the winter months. 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.

b. Temperature. 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. Observed temperature extremes are 119 and 15 degrees at Folsom, 114 and 8 degrees at Placerville, 110 and 8 degrees at Colfax, 93 and 5 degrees at Blue Canyon, 88 and -28 degrees at Soda Springs, and 91 and -26 degrees at Twin Lakes. Except for extremely high elevations, these temperatures are representative for the whole watershed area. The monthly distribution of mean temperatures at representative stations is in Table 2.

c. Precipitation. Precipitation varies throughout the drainage area, ranging from 18 to 20 inches on the valley floor to about 70 inches in the higher mountains, and averages about 53 inches over the watershed 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 and snowfall occurs as low as the valley floor at rare intervals. About 90 percent of the runoff producing precipitation occurs during the winter months of November through April. The areal distribution of normal annual precipitation is shown on Plate 12. The normal monthly distribution at selected stations is given in Table 3.

d. Snowfall. Winter snowfall above 5,000 feet elevation normally accumulates until the first of April when increasing temperatures mark the beginning of the snowmelt season. Snow falling at lower elevations usually melts within a relatively short time. Basin snowpack data for a wet year (1983), normal year (1985) and dry year (1977), and the average water equivalent for 1 April at representative snow courses are given in Table 4. Location of snow courses are shown on Plate 12.

TABLE 2

MEAN MONTHLY TEMPERATURES
(in degrees F)

Month	Sacramento (El. 25′)	Colfax (El. 2418′)	Blue Canyon (El. 5280′)	Twin Lakes (El. 7829′)
January	47.1	44.5	37.1	26.7
February	52.2	47.2	38.1	27.7
March	55.3	48.9	38.2	28.3
April	60.1	54.0	43.3	33.0
May	66.3	61.5	51.5	40.8
June	72.2	70.1	60.1	49.2
July	76.6	77.6	68.3	56.6
August	75.6	75.7	66.9	55.5
September	72.9	71.3	62.8	51.8
October	65.3	62.0	54.2	43.6
November	54.7	51.1	44.3	34.6
December	47.5	45.4	39.5	29.2
Average Annual	62.1	59.1	50.3	39.8

Source: NOAA, 1951-1980.

TABLE 3

MEAN MONTHLY PRECIPITATION

	Sacramento (El. 25′)		Colfax (El. 2418′)		Blue Canyon (El. 5280′)		Twin Lakes (El. 7829′)	
Month	Inches	%	Inches	%	Inches	%	Inches	%
July	0.05	0.3	0.18	0.4	0.30	0.4	0.81	1.6
August	0.09	0.5	0.24	0.6	0.55	0.8	0.89	1.8
September	0.30	1.7	0.63	1.5	0.97	1.4	1.02	2.0
October	0.90	5.0	2.75	6.5	3.93	5.8	2.44	4.9
November	2.31	12.9	6.00	14.3	8.41	12.4	5.84	11.7
December	3.00	16.8	2.45	5.8	11.70	17.2	8.42	16.9
January	4.18	23.4	10.29	24.4	14.11	20.8	9.35	18.8
February	2.94	16.5	7.10	16.9	9.93	14.6	6.93	13.9
March	2.18	12.2	6.37	15.1	8.96	13.2	6.20	12.5
April	1.44	8.1	3.98	9.5	5.45	8.0	4.38	8.8
May	0.35	2.0	1.62	3.9	2.70	4.0	2.40	4.8
June	0.13	0.6	0.51	1.1	0.86	1.4	1.10	2.3
TOTALS								
Nov-Apr	16.05	89.8	36.19	85.9	58.56	86.3	41.12	82.6
Annual	17.87	100.0	42.12	100.0	67.87	100.0	49.78	100.0

Source: NOAA, 1951-1980.

TABLE 4

1 APRIL SNOW SURVEY DATA
AMERICAN RIVER BASIN, CALIFORNIA

Snow Course	Snow Depth (inches)			Water Equivalent (inches)			% of Average			Average* (in.)
	1983	1985	1977	1983	1985	1977	1983	1985	1977	1APRIL
Carson Pass (Elev. 8400')	183.4	103.7	30.6	74.2	37.3	11.0	193	97	29	38.4
Echo Summit (Elev. 7450')	153.0	98.0	34.4	64.0	31.6	11.7	171	85	31	37.4
Tamarack Flat (Elev. 6550')	151.4	68.5	30.4	62.6	27.8	12.5	216	96	43	29.0
Onion Creek (Elev. 6100')	119.0	43.5	8.2	41.0	18.1	2.4	183	81	11	22.4
Strawberry (Elev. 5700')	73.0	20.9	1.2	32.3	7.6	0.4	371	87	5	8.7
Carpenter Flat (Elev. 5300')	86.0	38.2	6.1	33.5	17.0	2.0	177	90	11	18.9

* Average 1 April water equivalent is for each snow courses period of record up to and including 1986.

e. **Evaporation.** The average historical monthly gross evaporation at Folsom Lake is listed in Table 5. All data were obtained from a class "A" pan.

TABLE 5

HISTORICAL MONTHLY EVAPORATION

Month	Evaporation Inches	
	Mean	Standard Deviation
January	0.90	.34
February	1.61	.49
March	3.50	.87
April	5.43	1.43
May	8.07	1.22
June	10.08	1.23
July	11.50	.82
August	10.20	.83
September	7.64	.56
October	5.00	.77
November	2.05	.60
December	0.94	.42
TOTAL	66.92	

Source: DWR Bulletin No. 73-79, November 1979.

f. **Wind.** Peak wind velocities in California 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 American River Basin is from the south and southeast during the months of April through September, and from the north during the months of October through March. A continuous recording ground level anemometer is located at Folsom Dam. Total wind movement is measured and daily movements are recorded. Table 6 is a compilation of the mean and peak monthly wind velocities for Mather Air Force Base and the Sacramento Executive Airport.

TABLE 6

MEAN AND PEAK MONTHLY WIND VELOCITIES
(in knots)

	Mather Air Force Base		Sacramento Executive Airport	
Month	Mean	Peak	Mean	Peak
January	6	61	7	60
February	6	62	7	51
March	7	62	8	66
April	6	53	8	45
May	7	43	8	35
June	7	45	9	47
July	7	33	8	36
August	7	32	8	38
September	6	50	7	42
October	5	63	6	68
November	5	56	6	70
December	5	64	6	70

Source: DWR Bulletin No. 185, January 1978.

4-06. STORMS AND FLOODS

The American River Basin lies on the seaward face of the Sierra Nevada which rise directly across the path of storms moving inland from the Mid-Pacific Ocean. The low barrier of the Coast Range which intervenes between the ocean and the Sierra Nevada is pierced by the large San Francisco Bay Gap westward from the American River Basin so that considerable volumes of moist maritime air reach the basin at low levels.

The most important storms affecting this area are cyclonic wave disturbances along the polar front that usually originate in the vicinity of the Aluetian Islands. The normal trajectory of the waves along this front is to the south and east from the Pacific Ocean to the west coast. In the summertime, this frontal zone is located far to the north and the accompanying precipitation seldom reaches as far south as California. During the summer the air which reaches the region is generally stable and the thunderstorm type of rainfall rarely occurs. During the wintertime, from October to April, the frontal zone moves southward and the cyclonic wave disturbances move over California.

The annual precipitation is concentrated almost entirely during the winter storm season from November through March. Precipitation normally falls as snow above the 5,000 foot level, but during extremely warm winter storms rain has fallen over the entire basin melting some of the snow and at times stripping most of the snow from the basin. By the end of the winter most of the area above 5,000 feet is covered by a compact snow pack which often averages more than 10 feet in depth over large areas. Occasionally depths reach 30 feet. Because of this deep snow pack in the higher areas, storm rainfall therein is largely absorbed in the mass of the snow and appreciable storm runoff from such areas is prevented.

Studies of storms and floods of record indicates that critical flood producing conditions on the American River Basin will exist only during the winter season when there may be a prolonged series of general storms covering the entire basin. Usually storm precipitation amounts are distributed areally in the same general pattern as normal annual precipitation amounts, although there are large departures from this rule. On occasion a storm series may last 2 to 5 days. During such stormy periods, groundwater levels rise, infiltration capacities decline, and the natural and artificial storage within the basin is progressively filled. Outside the winter season, storms are less severe, cover only one portion of the basin at a time, and are so widely separated in time that basin storages have an opportunity to drain away with resulting lower runoff factors. Thunderstorms lasting up to three hours can occur over small areas at higher elevations from late spring through early fall. The resulting runoff is characterized by high peaks of short duration with low volumes. For small tributaries, peak flows from thunderstorms can approach those which occur during major winter rain floods, but flows on the mainstem are barely affected.

Floods in the American River Basin are typical of those occurring on the other Sierra Nevada streams. Floods are rather frequent and of two general types, winter rain floods and spring snowmelt floods. However, only rain floods, resulting from intense rainfall over the foothills and mountains during the winter season, cause serious flooding because the highest rate of snowmelt runoff is well below that corresponding to the damaging stage of the river. Rain floods have a high peak discharge, are flashy, and of only a few days in duration; but when antecedent rainfall has resulted in saturated ground conditions or when the ground is frozen, the volume of runoff is much greater and flooding more severe. These floods may occur in rapid succession with succeeding peaks occurring before flows from the preceding floods have completely subsided.

Unimpaired flows and volumes for the American River at Fair Oaks for the ten largest rain floods of record are listed in Table 7. A discussion of the December 1964 and February 1986 floods follows.

TABLE 7

RAIN FLOODS - UNIMPAIRED FLOWS

Date	Peak Flow (cfs)	Maximum Mean Daily Flow (cfs)	7-Day Volume (AcFt)
23 Dec 1964	260,000*	183,000	1,218,000
18 Feb 1986	255,000*	204,000	1,366,000
1 Feb 1963	240,000*	153,000	682,000
23 Dec 1955	219,000*	189,000	986,000
21 Nov 1950	180,000	132,000	858,000
14 Jan 1980	175,000*	125,000	886,000
25 Mar 1928	163,000	119,000	815,000
19 Mar 1907	156,000	105,000	915,000
16 Feb 1982	152,000*	113,000	629,000
22 Jan 1943	152,000	73,800	460,000

* Estimated Value.

On the weekend of December 19-20, 1964, a combination of factors; a warm mass of moist Pacific air, a flow of cold air from an Alaskan high, a low pressure trough off the coast, and a strong westerly flow completed the meteorological picture to provide almost optimum conditions for heavy precipitation. The potential of the meteorological situation was realized when the North Coast received very heavy rainfall accompanied by strong gusty winds. As the storm moved inland, precipitation was centered primarily in the basins of the Feather, Yuba and American Rivers. The heaviest rains occured on December 22 and 23, however, the nine-day totals (December 19-27) were also quite high. Rainfall in the American River Basin created high stages on most tributaries above Folsom Lake. Hell Hole Dam, a small sloping-core rockfill structure being built on the Middle Fork, failed under the stress of the flood water. This partially-completed dam retained approximately 30,000 acre-feet before failure occurred. This volume of water added to the peak inflow to Folsom Lake which reached 280,000 cfs. Storage in Folsom Lake increased 322,000 acre-feet to a maximum of 899,000 acre-feet on December 23 and controlled releases were increased to a peak rate of 115,000 cfs and maintained for approximately fifty hours.

The Storms of February 1986 severely affected northern California and northwestern Nevada. Heavy precipitation reached record levels in many locations. The heaviest precipitation occurred 200 miles north to 100 miles south of a line from San Francisco to Sacramento to Lake Tahoe. Over much of this area the precipitation ranged between 100 to 350 percent of normal February Precipitation. In the American River Basin, the heavy rains began on February 12. With continued rains and storm runoff, water levels behind the Auburn cofferdam rose rapidly. On the afternoon of February 18, the Auburn cofferdam failed. The cofferdam was designed to store 120,000 acre-feet of water and fail with a 30-year frequency event. The failure was therefore anticipated and storage space in Folsom Lake was made available to absorb the water released by the cofferdam. With the failure of the cofferdam, Folsom Lake experienced a

peak inflow of 900,000 cfs. The releases from Folsom Dam at this time was increased to 125,000 cfs. On February 19, storage in Folsom Lake reached a high of 1,028,000 acre-feet with a water surface elevation of 467.56 feet. This was 1.56 feet into surcharge storage but 7.84 feet below the maximum design surcharge elevation of 475.4 feet. Releases were increased to a maximum of 130,000 cfs (releases at or above 115,000 cfs were maintained for approximately 64 hours during the storm). Approximately 318,000 acre-feet of flood control storage space was utilized at maximum storage in Folsom Lake (1,028,000 acre-feet) from February 12 to 19. During this same time interval, an additional 216,000 acre-feet was stored in the small non-dedicated flood control reservoirs located upstream of Folsom Lake.

Snowmelt floods can be expected any time from April through July. They are characterized by low peak flows, long duration of floodflow, and large volume of runoff. The snowmelt flood potential varies according to the depth and areal extent of the snowpack and temperature; the highest rates of snowmelt runoff usually occur during years with an unusually deep snowpack. High flows are sustained during May and June when rising daily temperature cause the snowpack to melt. Unimpaired flows and volumes at Fair Oaks for the ten largest snowmelt floods of record are shown in Table 8.

TABLE 8

SNOWMELT FLOODS - UNIMPAIRED FLOWS

Water Year	Maximum Mean Daily Flow (cfs)	120-Day Volume (AcFt)
1938	27,200	2,310,000
1906	26,600	2,982,000
1983	26,400	2,921,000
1967	24,550	1,696,000
1911	23,800	2,580,000
1922	23,200	2,220,000
1958	22,830	2,936,000
1942	22,800	1,873,000
1969	21,950	2,359,000
1952	21,700	2,962,000

4-07. RUNOFF CHARACTERISTICS

Flood-producing runoff occurs during the months of October through April and is most extreme during the months of November through March. The rain flood season is followed during the months of April through July by a period of moderately high runoff from snowmelt. Such runoff generally does not result in flood-producing flows, but is ordinarily adequate to fill reservoir space maintained empty during the winter months for flood control. Greatest water demands occur during the months June through September. Thus in years of normal or above normal snowmelt, flood control operation does not interfere with the filling of the reservoir for subsequent water deliveries.

Unimpaired flows at Fair Oaks and historical monthly inflows to Folsom Lake are presented on Plates 13 and 14, respectively.

4-08. WATER QUALITY

The chemical, physical and biological properties of surface water at any given point are the product of a multitude of factors including geography; geology; climatic conditions; discharge; floral and faunal communities; ground water supply; and of major significance-the effect of man, his activities, and his domestic animals. Generally the quality of surface waters above Folsom Lake is good. As the waters of the American River descend from the headwaters towards Sacramento, water quality is gradually degraded primarily by natural geochemical processes and the influence of small, localized areas of human habitation or utilization.

The lower American River is presently a clean stream with water of excellent quality and clarity for all beneficial uses. Some algal growths do occur in most of the reaches at various times of the year.

Since 1966, the Bureau of Reclamation has conducted a monthly water quality sampling program on the lower American River. Table 9 summarizes some of the physical, chemical and biological data collected at three locations on the river: Rainbow Bridge, below Nimbus Dam and the 16th street Bridge. The data indicate that dissolved oxygen (DO) is usually close to saturation. The total dissolved solids, chloride and hardness concentrations are low. And the maximum concentrations of chemical constituents are within the limits recommended in the Environmental Protection Agencies Primary Drinking Water Regulations.

Water quality objectives for the American River from Folsom Dam to the Sacramento River have been set by the Water Resources Control Board in July 1971. Most of the objectives are summarized below:

a. Water temperature - Water shall be maintained free from adverse temperature changes resulting from waste discharges or other activities of man;

b. Turbidity - Not to exceed 10 JTU, except as a result of floodwater inflows;

c. Dissolved Oxygen - Greater than or equal to 7.0 mg/1 from Nimbus Dam to the Watt Avenue Bridge and greater than or equal to 5.0 mg/1 from Watt Avenue to the Sacramento River;

d. pH - Minimum value of 6.5 and maximum value of 8.5;

e. Total dissolved solids - Less than or equal to 125 mg/1;

f. Total nitrogen - Less than 1.0 mg/1;

g. Bacteria - Most probable number (MPN) densities of fecal and standard coliform per 100 ml shall not exceed historical values;

TABLE 9. WATER QUALITY SUMMARY, LOWER AMERICAN RIVER

(Based on data collected USBR from January 1956 to October 1972)

Location	Statistic	Water temp. (°F)	Turbidity (JTU)	Dissolved oxygen (MG/L)	pH	Conductivity (Micro MHOS)	Total dissolved solids (MG/L)	Total hardness as CACO (MG/L)	Nitrate as N (MG/L)	Ammonia as N (MG/L)	Total phosphate as PO (MG/L)	Silica (MG/L)
Folsom	Mean	57.5	3.5	10.6	7.1	53.5	44.5	21.7	.19	.12	.13	10.6
Bridge	Max.	66.2	20	13.0	7.8	90	61	28	1.70	.62	.58	12
	Min.	46.4	1	7.5	6.5	33	33	13	.00	.00	.02	9
	No.	51	49	51	51	43	15	16	33	46	13	14
Below	Mean	58.2	3.9	10.8	7.2	55.5	46.2	22.0	.17	.08	.11	10.4
Nimbus	Max.	68.9	20	13.9	7.9	85	67	31	1.00	.38	.37	12
Dam	Min.	46.4	1	8.5	6.6	34	34	13	.00	.00	.03	9
	No.	51	50	51	51	44	15	16	33	46	13	14
16th	Mean	59.6	5.6	10.3	7.1	61.6	46.9	23.8	.17	.16	.43	11.0
Street	Max.	71.6	25	13.0	7.7	102	73	35	1.00	1.10	.71	13
Bridge	Min.	44.6	1	8.3	6.7	38	27	16	.00	.00	.24	10
	No.	50	47	50	50	44	15	16	32	45	13	14

Note: "No." in Statistic column is number of samples.

h. Pesticides - Summation of individual concentrations shall not exceed 0.1 micrograms per liter.

In general, the present water quality of the American River is within these limits. The turbidity objective is exceeded only during flood periods.

4-09. CHANNEL AND FLOODWAY CHARACTERISTICS

The levee system along the lower American River for the protection of the Sacramento urban area is shown on Plate 15. Most of the American River Project Levees are designed to pass 115,000 cfs with at least 5 feet of freeboard. However, some facilities at Ancil Hoffman Park were not designed for flood releases above 115,000 cfs and have sustained substantial damages when flows are above that level. In the lower reaches of the system (Sacramento River upstream about 4.75 miles on the right bank), the levees are considered to be able to safely pass 180,000 cfs through the channel. As this portion of the levee system was designed and built as units of the Sacramento River Flood Control Project prior to construction of Folsom Dam, freeboard allowances were set at 3 feet for 180,000 cfs as an unregulated flow. These flows would have been of short duration and unconfined on the right bank upstream of North Sacramento.

Damages can occur at flows less than channel capacity (115,000 cfs). At 20,000 cfs, the Campus Commons Golf Course and Discovery Park are inundated; at 45,000 cfs, the Sacramento County bike bridge crossing the American River is inundated and damaged; at 65,000 cfs, bike trails in the American River Parkway are damaged; and at 115,000 cfs, damage has occurred at the Nimbus Fish Hatchery while bank erosion occurs in many places along the channel.

The American River levees are used to confine flows to a dedicated portion of the river's natural floodway. Therefore, they result in higher water levels and increased velocities of flows through the levee reaches. Higher water surface levels greatly increase the chance of quick and unexpected failure with potential catastrophic results to protected areas. Increased velocities of flow results in constant attack on the integrity of the levees through erosion and weakening of the levee by increased seepage.

The American River levees are considered safe, with proper maintenance and patrol, for sustained flows up to the design release of 115,000 cfs and for short duration flows over 115,000 cfs (130,000 cfs was released in 1986). Maintenance of the Sacramento River Flood Control Project, American River Unit, is performed by the American River Flood Control District. The American River Project Levees are maintained by the State of California, Department of Water Resources.

Water surface profiles on the Lower American River for selected flows are presented on Plate 16. Flood wave travel times for the reach of the American River from Nimbus Dam to the mouth are as follows:

Nimbus Dam to mouth	8 hours
Nimbus Dam to Howe Avenue	6 hours
Nimbus Dam to Watt Avenue	5 hours
Nimbus Dam to Town of Fair Oaks	2 hours

4-10. UPSTREAM STRUCTURES

Numerous reservoirs have been built in the upper American River Basin above Folsom Dam by the Pacific Gas and Electric Company (PG&E), the Sacramento Municipal Utility District (SMUD), the Georgetown Divide Public Utility District (GPUD), the Placer County Water Agency (PCWA), the Corps of Engineers (COE) and others. These agencies own and operate dams, reservoirs, canals and powerplants. Principal water uses are irrigation, municipal and industrial supplies, power generation, recreation and fish and wildlife. (See Table 10)

TABLE 10

EXISTING RESERVOIRS
(Above Folsom Dam)

Name	Stream	Owner	Storage Capacity* (ACFT)	Drainage Area (Sq. Mi)
Lake Clementine	NF American	COE	10,600	342.0
L.L. Anderson (French Meadows)	MF American	PCWA	136,400	47.0
Rubicon Springs	Rubicon River	SMUD	1,500	31.4
Hell Hole	Rubicon River	PCWA	207,600	114.0
Loon Lake	Gerle Creek	SMUD	76,500	8.0
Gerle Diversion	Gerle Creek	SMUD	1,380	24.0
Lake Edson (Stumpy Meadows)	Pilot Creek	GPUD	20,000	15.0
Ralston Afterbay	MF American	PCWA	850	112.0
Oxbow	MF American	PCWA	2,800	--
Ice House	SF Silver Creek	SMUD	46,000	27.2
Union Valley	Silver Creek	SMUD	271,000	83.7
Junction Diversion	Silver Creek	SMUD	3,250	--
Camino Diversion	Silver Creek	SMUD	290	171.0
Caples Lake	Silver F of SF Am	PG&E	20,400	13.5
Silver Lake	Silver F of SF Am	PG&E	8,600	15.2
Slab Creek	SF American	SMUD	16,600	497.0
Chili Bar	SF American	PG&E	3,140	597.0
Sugarpine	Shirtail Creek	USBR	6,890	9.5

* Where applicable, capacity represents storage with spillway gates up.

4-11. DOWNSTREAM STRUCTURES

Lake Natoma, behind Nimbus Dam, is an afterbay for the Folsom Powerplant. Nimbus Dam and Powerplant are operated to reregulate Folsom Dam releases to the lower American River. This dam also serves as a diversion structure for the Folsom South Canal.

The Folsom South Canal is presently under construction with the first two reaches completed and operational. The canal, which extends southward, paralleling and to the east of State Highway 99 through San Joaquin County, will terminate about 20 miles southeast of the City of Stockton. This concrete-lined canal has a capacity of 3,500 cfs for the first two reaches, a total of 27 miles. A reduced capacity that varies from 2,000 cfs to 125 cfs is now planned for the remaining three reaches, a total of 35 miles. The first 2 reaches were completed in 1973 to a point just south of State Highway 104. The remaining construction has been suspended pending reauthorization. When completed, the canal will serve industrial, municipal and irrigation users in Sacramento and San Joaquin Counties. The canal currently provides cooling water for Sacramento Municipal Utility District's Rancho Seco Nuclear Powerplant.

A system of levees associated with the American River Basin consist of levee improvements along the Lower American River (See Section 4-09), the Natomas East Main Drainage (NEMD) Canal and upstream along both banks of Arcade Creek and the south bank of Dry Creek, the Sacramento River and the Yolo Bypass. Levees along the east and west banks of the Sacramento River between the Sacramento Weir and the American River are designed to have 3 feet of freeboard at a flow of 107,000 cfs. Downstream of Sacramento to about Courtland, the design freeboard of the system is also 3 feet but at a flow of 110,000 cfs.

The Yolo Bypass is a complex series of levee and channel improvements from the terminus of the Sutter Bypass to near Rio Vista on the Sacramento River. The 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 the Yolo Bypass. Additionally, when flows in the Sacramento River at the "I" Street Bridge reach 94,000 cfs, gates at the Sacramento Weir are opened, allowing excess flow into the Yolo Bypass. During extremely high flow conditions, flows from American River will enter the Yolo Bypass via Sacramento Weir. The design capacity of the Yolo Bypass at a freeboard of 6 feet from Fremont Weir to Sacrameto Weir is 343,000 cfs, from Sacramento Weir to Putah Creek 480,000 cfs, and from Putah Creek to Sacramento River 500,000 cfs.

4-12. ECONOMIC DATA

The upper reaches of the American River Basin are rather sparsely populated and developed, with Placerville (population approximately 7,000) being the largest town above Folsom Dam. However, the floodplain of the lower American River, which includes the City of Sacramento, is highly developed in residential, commercial, industrial and public properties. Agricultural development is relatively minor.

The American River Basin includes much of El Dorado and Placer Counties and the northern portion of Sacramento County. The population growth rate in each of these counties is projected to exceed the growth rate of the State of California through the year 2020. Table 11 shows the current and projected population for these areas.

Estimates of flood damages in the 200-year flood plain which would result from inundation of properties, the costs incurred for fighting the floods, and the disruption caused by floods are shown in Table 12 for the four major flood plains in the lower American River Basin. The damageable property was estimated at about $13.8 billion (structures and contents). Property values and flood damages for most public property in each of the flood plains were based on other Corps studies with similar flood plain development and were estimated at about $1.1 billion.

Estimated damages caused and damages prevented during the 1955 flood, the 1964 flood and the 1986 flood are presented in Table 13. Damages prevented are due to the combined effects of the American River levee system and Folsom Dam operation.

TABLE 11

PROJECTED POPULATION 1986-2020

Location	1986 1/	1990	2000	2010	2020
City of Sacramento	322,500	337,769 2/	393,515 2/	458,493 2/	3/
Sacramento County	905,500	993,000 4/	1,184,000 4/	1,351,200 4/	1,511,700 4/
El Dorado County	106,100	123,100 4/	158,500 4/	193,900 4/	229,000 4/
Placer County	140,300	159,400 4/	203,700 4/	245,800 4/	288,000 4/

1/ 1-1-86 Department of Finance, State of California, May 1986.
2/ Sacramento Area Council of Governments, Sacramento City 1990-2020 Projections.
3/ Data not available.
4/ 1990-2020 Projections by Dept. of Finance, State of California December 1986.

TABLE 12

DAMAGEABLE PROPERTY VALUES IN THE
200-YEAR FLOOD PLAIN

Flood Plain Areas	Property Values ($ Millions) Private	Public *	Total
Natomas	790	330	1,120
North Sacramento	2,790	20	2,810
South Sacramento	7,010	280	7,290
Downtown Sacramento	3,260	490	3,750
TOTAL	13,850	1,120	14,970

* Excludes roads, bridges and utilities.

TABLE 13

SUMMARY OF FLOOD DAMAGES
AMERICAN RIVER BASIN

Flood	Damages *	Damages Prevented *
December 1955	$ 808,000	$ 20,000,000
December 1964	$4,445,000	$ 45,000,000
February 1986	$1,500,000	$4,700,000,000

* Costs based on price levels at time of flood.

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01. HYDROMETEOROLOGIC STATIONS

Hydrologic and meteorologic data are recorded and published for many sites throughout the American River Basin and adjacent basins as shown on Plates 9 and 12.

Those facilities located at the Folsom Project include:

a. Radio-reporting event or satellite stations which relay precipitation, temperature, and snow water content information to the Bureau of Reclamation through their American River Hydromet System.

b. A recording reservoir stage gage.

c. A non-recording precipitation gage.

d. A weather bureau Class-A evaporation pan with anemometer.

The American River Hydromet System includes eleven radio-reporting event stations and three satellite stations. Seven stations report snow water content data in addition to precipitation and temperature information.

The National Weather Service River Forecast Center operates a radio-reporting event stage gage at the "H" Street Bridge. Data from the Sacramento-American River gages are reported automatically to the Federal-State Flood Center at Sacramento. Readings for these data are reported twice daily or whenever a defined increment is accumulated. The information is stored on the National Weather Service computer and is usually accessed via computer data terminals.

Numerous non-reporting stations are available for record and planning purposes.

Outflow from Folsom Dam is computed by the summation of flows through the powerhouse, the river outlets, and over the spillway. Flows through the river outlets and spillway gates are calculated from the rating of these structures for various openings and heads. Outflow from Nimbus Dam is computed in a manner similar to that for Folsom Dam.

5-02. WATER QUALITY STATIONS

The Bureau of Reclamation has a program of water quality sampling on the lower American River as described in Section 4-08. The United States Geological Survey (USGS) currently collects samples for chemical analysis on the South Fork American River near Lotus. The USGS publishes all water quality data in their annual surface water reports for California. Provisional data are obtained from the USGS, as needed, by phone.

5-03. SEDIMENT STATIONS

Sedimentation ranges are shown on Plate 17. However, the movement of sediment in the Folsom Lake system is not presently monitored by means of actual sediment sampling in the river or by periodic surveying of sedimentation and degradation ranges upstream and downstream of the project.

5-04. RECORDING HYDROLOGIC DATA

The Bureau of Reclamation has direct responsibility for operation and maintenance of the American River Hydromet System described in Section 5-01. Records of all required observatons are entered in a computerized data base located at the Central Valley Operations Coordinating Office in Sacramento. Outflows and storages for the project are published by the United States Geological Survey (USGS) from the Bureau of Reclamation records. Storages for the numerous reservoirs above Folsom Dam (See Section 4-10) and continuous streamflow measurements at several locations throughout the American River watershed are recorded and published by the USGS. In addition, the National Weather Service and the Department of Water Resources record various hydrologic and hydrometeorologic data from the American River Basin.

5-05. COMMUNICATION NETWORK

Several modes of communications are used between the project office and personnel of the Central Valley Operations Coordinating Office (CVOCO). These modes include voice, digital and data communications, and are used by CVOCO system managers located in the regional office and by CVOCO system operators (Hydro System Controllers) located within the project facilities. CVOCO managers primarily use voice communications over commercial telephone facilities or dedicated voice facilities over gorvernment owned microwave. Operations orders from system managers are by digital communication methods using micro-computers connected in a network over commercial dial telephone system facilities (WOMNET). Back-up emergency voice communication from the regional office to the project office is provided by the Operations and Maintenance VHF radio network. Communications between the CVOCO system managers and the Corps of Engineers Reservoir Control Section, Sacramento District, is by commercial telephone or by the micro-computer digital network.

Project operations are normally conducted by the Hydro System Controllers by direct remote control using digital data facilities and process control computers. This process control system uses both government owned communications facilities and commercially dedicated leased data lines. This system also gathers system data for operations and provides emergency message handling capabilities between the regional office, control center and all controlled plant facilities. System operators conduct normal voice communications over commercial telephone voice facilities. Back-up voice communications are provided by the Operations and Maintenance radio network base station or portable equipment. Emergency operations of project facilities is by direct operations of project equipment by the Hydro System Controllers.

5-06. COMMUNICATION WITH PROJECT

Project operating instructions are transmitted from CVOCO system managers located in the Regional Office to the Central Valley Operations Control Center at Nimbus Dam. Normal means of communication would be via the digital communications network (WOMNET). The project office at Folsom Dam receives copies of all instructions. Commercial telephone may be used to confirm instructions. Back-up systems are mentioned in Section 5-05.

Notification calls to entities requiring warning of significant changes in project releases or other conditions are made by the project office during normal working hours when possible. During flood or other emergencies, notification calls may be made by CVOCO Hydro System Controllers from the Central Valley Operations Control Center which is staffed around the clock.

5-07. PROJECT REPORTING INSTRUCTIONS

During flood operations, project personnel are to report any unusual or unpredicted events or data that may affect operations at the project to the Central Valley Operation Coordinating Office as soon as possible. Important phone numbers and key operating personnel are shown on page iii in the front of this manual.

Data required by the Reservoir Control Section, Sacramento District, Corps of Engineers, are shown in Section 9-05.

5-08. WARNINGS

The National Oceanic and Atmospheric Administration (NOAA), through its National Weather Service (NWS), maintains year-round surveillance of weather conditions. NOAA storm forecasts for the American River Basin are issued by the NWS in Sacramento. These are distributed to agencies responsible for flood protection and, by way of local news media, to the public.

Personnel from the NWS Office in Sacramento and the California Department of Water Resources are assigned to the Joint Federal-State River Forecast Center in Sacramento, which monitors weather conditions and river stages on a year-round basis. When floods are imminent, the State Flood Operations Center is activated. It operates on a 24-hour basis in conjunction with the River Forecast Center. In addition, the center advises all interested parties of flood situations as they develop. The Flood Operations Center furnishes flood information and flood warnings for the American River to the local news media, law enforcement agencies, and other agencies for dissemination to the public.

Both Sacramento and Placer Counties have plans for emergency evacuation of the flood plain areas along the American River and its tributaries. The California Department of Water Resources, through the Flood Operation Center, coordinates flood fighting activities throughout the state and is authorized to receive requests for assistance from local public agencies during floods. The Corps of Engineers responds to

requests for flood fighting and rescue work from OES when the emergency is beyond the capabilities of state and local governmental agencies.

The Bureau of Reclamation's Emergency Preparedness Plan (EPP) is designed to provide information during emergencies to the following personnel and offices:

a. Folsom Control Operators;

b. Folsom Emergency Officer;

c. Central Valley Operation Coordinating Office (CVOCO);

d. Folsom Project Superintendent;

e. Sacramento County Emergency Operation Office (SCEOO) and their staff to respond to emergency situations and unusual occurrences which may develop at Folsom Dam and Folsom Lake;

f. Placer County Emergency Operations Office.

g. Manager, Folsom Lake State Recreation Area.

The Folsom Control Operator has absolute responsibility at the project until relieved during an emergency by the Folsom Emergency Officer. The Folsom Emergency Officer is to determine the severity of the emergency and inform CVOCO what action needs to be taken as directed by the EPP and initiate that action. During normal working hours the Folsom Operations and Maintenance personnel will be requested to assist in any emergency. However, for the rest of the day, the single control operator on duty is to request assistance from CVOCO in contacting the appropriate personnel or agencies as directed in the EPP.

Pursuant to the provisions of Section 8589.5, Government Code of California, emergency procedures must be established for the evacuation and control of areas of potential flooding in the event certain dams should suddenly fail. Under the law, the responsible agencies (Bureau of Reclamation and Corps of Engineers) prepared maps showing areas that would be inundated if Folsom Dam should fail and submitted it to the OES. On the basis of the maps, OES in cooperation with the California Department of Water Resources designated the evacuation area. Local jurisdictions have adopted emergency procedures that include, among other things, specific routes to be used for evacuation, traffic control measures, and movement of people without personal transportation, shelter of evacuees, perimeter and interior security and reoccupation of evacuation areas.

VI - HYDROLOGIC FORECASTS

6-01. GENERAL

The ultimate aim of the forecasting system for the basin above the reservoir is to forecast approximate rates of inflow to the reservoir for given periods and to estimate the total volume to be expected in order that outflow rates may be controlled, insofar as possible, without causing damages downstream. The present flood warning system consists of gages on the main stem and major tributaries of the American River. Flows in the American River are the result of snowmelt and rainfall, which are sampled at important stations in the basin.

a. Role of Corps. The Corps will monitor weather forecasts and keep track of quantitative forecasts.

b. Role of Other Agencies. In order to assure that the flood control operation of Folsom Dam will be as effective and reasonable as possible, it is essential that the Bureau of Reclamation, the operating agency, keep advised at all times of possible flood hazards, weather conditions, inflow to the reservoir, and flow in upstream tributaries. Inflow forecasting is coordinated by the Water Operations Branch of the Central Valley Operations Coordinating Office, Bureau of Reclamation. The National Weather Service (NWS) prepares weather and flood forecasts and makes the information available to Federal, State and local agencies and to the public through the Federal-State River Forecast Center (RFC).

Snowmelt forecasts are made by several agencies: the National Weather Service, the California Department of Water Resources and the Bureau of Reclamation.

6-02. FLOOD CONDITION FORECASTS

a. Requirements. Folsom Dam is operated for optimum control of flood flows through the Sacramento area. To achieve optimum control of flood flows, forecasts of runoff are necessary. For spring snowmelt floods, the runoff forecasts are generally adequate. However, the accuracy of winter rainfall flood forecasting hinges on the ability to forecast the weather over the basin.

b. Methods.

(1) Rain Floods. Precipitation amounts are forecast for the American River Basin by the National Weather Service in Sacramento. During periods of significant anticipated precipitation the NWS makes forecasts for six and twelve hour periods for the twenty-four hour period following the forecast. These short-term forecasts are updated at 4:00 am and at 4:00 pm or more often if necessary. These Quantitative Precipitation Forecasts (QPF) in association with precipitation and flow data obtained from realtime gages in the basin and adjacent basins are used for rain flood forecasting. The River Forecast Center and the Central Valley Operations Coordinating Office, when necessary, prepare inflow forecasts (inflow hydrographs).

(2) Snowmelt Floods. Measurements of snow water content from hydromet stations in the American River Basin and adjacent basins in conjunction with snow course data obtained by the California State Snow Survey are used for forecasting spring snowmelt. Seasonal precipitation measurements, antecedent runoff, and soil moisture indexes may also be used to forecast snowmelt runoff.

6-03. CONSERVATION PURPOSE FORECASTS

a. Requirements. Conservation operation of Folsom Dam is affected by decrees and agreements in connection with water rights on the American River. Conservation purpose forecasting requires estimation of available seasonal water supply in Folsom Lake and other Central Valley Project reservoirs. This information is combined with forecasts of water requirements for holders of water rights, long-term contracts, temporary contracts, instream flow requirements, and reservoir storage requirements to determine the conservation purpose operation of Folsom Dam and Lake.

b. Methods. The forecasts are made by the Bureau of Reclamation based on measurements of snow depth and water content at selected stations. The present procedure used is discussed in Section 6-02b. The National Weather Service River Forecast Center in Sacramento and the California Department of Water Resources also publish seasonal runoff forecasts for the American River Basin.

6-04. LONG RANGE FORECASTS

Long range forecasts are not made.

VII - WATER CONTROL PLAN

7-01. GENERAL OBJECTIVES

Folsom Lake is a multipurpose reservoir with the objectives of providing a high degree of flood protection to areas below Folsom Dam and supplying water needs for domestic, industrial and agricultural uses. Recreation, hydroelectric power generation and downstream fishery enhancement are also provided by the project.

7-02. MAJOR CONSTRAINTS

Releases from Folsom Dam, insofar as possible, will be restricted so that the flow below the dam does not exceed the channel capacity of 115,000 cfs. However, local flooding in the Campus Commons and Discovery Park areas does begin when flows exceed 20,000 cfs.

Bank sloughing and caving is more likely to occur when channel flows decrease rapidly; therefore, rates of changes in releases from Folsom Dam shall not be increased more than 15,000 cfs or decreased more than 10,000 cfs during any 2-hour period.

7-03. OVERALL PLAN FOR WATER CONTROL

Folsom Dam and Lake is operated to meet the following objectives:

a. To protect the City of Sacramento and other areas within the lower American River flood plain against reasonably probable rain floods.

b. To control flows in the American River downstream from Folsom Dam to existing channel capacites, insofar as practicable, and to reduce flooding along the lower Sacramento River and in the Sacramento-San Joaquin Delta in conjunction with other CVP projects.

c. To provide the maximum amount of water conservation storage without impairment of the flood control functions of the reservoir.

d. To provide the maximum amount of power practicable and be consistent with required flood control operations and the conservation functions of the reservoir.

e. To provide releases to enhance an anadromous fishery on the lower American River.

f. To provide acceptable water quality for users in the American River, and to meet water quality standards in the Sacramento-San Joaquin Delta.

7-04. STANDING INSTRUCTIONS TO DAMTENDER

During normal flood periods, the reservoir will be regulated in accordance with normal regulations for flood control operation in paragraph 7-05a and Exhibit A of this manual. Exhibit A is designed for

optimal separation from this manual and use as an emergency flood control regulation guide. To facilitate independent use of Exhibit A, charts required for the emergency flood control operation of Folsom Dam and Lake are included therein. Instructions for storage and discharge of floodwaters in the flood control space will be issued by the U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, California. In the event communications with the Bureau of Reclamation are disrupted, the reservoir will be regulated in accordance with the emergency regulation for flood control operation in paragraph 7-05b.

7-05. FLOOD CONTROL

a. Normal Regulation for Flood Control. Flood control regulation begins when storage in Folsom Lake exceeds the flood control space required at any particular time as determined from the Flood Control Diagram located in Exhibit A. The flood control diagram is the basic project document regarding operation for flood control. This diagram is the result of careful analysis of flood frequency, seasonal flood potential and downstream channel capacities consistent with project objectives and operating experience gained during the last 30 years.

When the reservoir pool elevation is below 448 feet MSL, flood control releases are made in accordance with the release schedule stated on the Flood Control Diagram. When the pool elevation is above 448 feet MSL and flood control releases are required by the diagram, releases will be made in accordance with the Emergency Spillway Release Diagram. Water stored in the flood control space will be released as rapidly as downstream conditions permit.

Releases from Folsom Dam affect the stage of the Sacramento River at the Sacramento Weir, however, flows in the Sacramento River are not normally considered when making flood control releases at Folsom.

b. Emergency Regulation. If communications with the project are disrupted the following procedures will be followed for project operation:

(1) Continue releases in accordance with the last instructions from the U.S. Bureau of Reclamation Office in Sacramento and make every attempt to re-establish communication;

(2) If communication cannot be re-established make releases in accordance with the release schedule and if necessary the emergency release schedule on the Emergency Spillway Release Diagram.

When the diagram indicates that emergency releases should be initiated, it is essential that these releases be made immediately and that subsequent changes in releases be made as soon as indicated.

7-06. RECREATION

The primary purposes of Folsom Lake is flood control and water conservation, including fishery enhancement in the lower American River. Even though numerous recreation areas exist around the lake there is no guaranteed minimum recreation pool. Recreation pursuits are therefore

dependent upon existing water levels. Normal conservation operation requires the pool to be drawn down over the summer recreation season. However, the pool has generally remained stable enough during the summer for boating, swimming and fishing.

7-07. WATER QUALITY

No specific project operation of Folsom Dam and Lake is required to enhance water quality. However, the multi-level outlet capability of Folsom Dam is used to provide adequate water temperature for the downstream fishery.

A water quality monitoring program exists on the lower American River to assure compliance with applicable water quality standards.

7-08. FISH AND WILDLIFE

The California State Department of Fish and Game is responsible for developing and maintaining a lake fishery in Folsom Lake by limiting influences of certain operational features of the reservoir, such as pool fluctuations during the spawning season.

The Nimbus Fish Hatchery and Ladder was built to mitigate the loss, due to the construction of Folsom and Nimbus Dams, of historical spawning grounds of several anadromous fish species including Chinook salmon and steelhead trout. In addition, minimum flow requirements below Nimbus Dam and a multi-level outlet capability at Folsom Dam help provide adequate flow and water temperature for downstream fishery resources. However, when Folsom Dam releases are expected to exceed 5,000 cfs, it is required that the pickets from the fish diversion structure be removed. If releases are expected to continue to increase and exceed 15,000 cfs, the picket frames must also be removed.

Folsom Lake must maintain a minimum downstream flow requirement for fish preservation and enhancement as established by the 1957 Memorandum of Operating Agreement with the California Department of Fish and Game which was later included in the State Water Resources Control Board Decision 893. Decision 893 provides for a minimum American River flow at the mouth of from 250 cfs to 500 cfs.

Wildlife species inhabiting the Folsom Lake area are characteristic of most areas in the foothills of the Central Valley. Bird species include migratory waterfowl, such as wood ducks and Canada Geese and predatory species such as hawks. Mammals inhabiting the area include deer, skunk, raccoon, beaver, mink, muskrat, river otter and coyote.

7-09. WATER SUPPLY

Operation of Folsom Dam is affected by various contracts and agreements in connection with water rights on the American River.

In June 1957, the Bureau of Reclamation and City of Sacramento executed a contract entitled, "Operating Contract Relating to Folsom and Nimbus Dam and their Related Works and to Diversions of Water by the City

of Sacramento." This contract recognized the City's right to obtain water under rights it had perfected or was perfecting and also provided for purchase of additional water supply from Folsom Lake. This and other existing contracts are shown in Table 14.

TABLE 14

EXISTING CONTRACTS - AMERICAN RIVER AND FOLSOM SOUTH CANAL

Water Service Contract	Maximum Contract Quantity (Acre-Feet)	Year to Occur	Present Use (Acre-Feet)
American River			
State of California Parks & Recreation	5,000	--	4
El Dorado Irrigation District	7,500	1985	6,200
Placer County Water Agency	117,000	2007	None
City of Roseville	32,000	--	11,000
San Juan Suburban	11,200	1985	11,200
El Dorado Co. Lake Hill Estates	50	--	138*
City of Sacramento	90,000	2030	12,500
El Dorado Co. Water Agency	None	--	None
Folsom South Canal			
East Bay MUD	150,000	2008	None
SMUD	60,000	2008	5,000
Water Rights			
Placer County Water Agency	120,000	--	9,000
North Fork Ditch Co.	33,000	--	33,000
City of Sacramento	140,000	2030	23,715
City of Folsom	22,000	-	15,000
So. California Water Co.	10,000	-	10,000
Folsom Prison	4,000	-	2,008
SMUD	15,000	1976	15,000

* Quantities tranferable.

7-10. HYDROELECTRIC POWER

Folsom Powerplant is located at the foot of Folsom Dam on the north side of the river. Its three generating units have a total capacity of 198,720 kilowatts (kw) and are tied into the Central Valley Project (CVP) power system through the 20 mile long Folsom-Elverta 230-kilovolt (kv) Transmission Line.

Nimbus Powerplant is located on the right abutment of Nimbus Dam on the north side of the river. The total capacity of its two generators

is 15,526 kw. Power is transmitted to Folsom for retransmission at 230 kv to the CVP at Elverta.

7-11. NAVIGATION

Navigation is not a project purpose and there are no navigation projects on the American River.

7-12. OTHER

Drought Contingency Plan. During droughts, flood control is not expected to be a principal factor in the operation of Folsom Dam. Conservation storage in Folsom Lake is managed by the Bureau of Reclamation in accordance with its water service contracts and other requirements for release of water. Folsom Lake serves as the sole source of Central Valley Project water for several Bureau of Reclamation water contractors. For many other CVP contractors, Folsom Lake water is co-mingled with releases from other Central Valley Project reservoirs before it is diverted in the Sacramento-San Joaquin Delta. Water contractors can be expected to conserve water to the best of their ability. In extreme cases it may be desirable to pump water from the sediment pool below the outlet invert of Folsom Dam.

7-13. DEVIATION FROM NORMAL REGULATIONS

Occasional deviations from normal operation are expected. Except as discussed below any deviations from normal flood control procedures must be approved in advance by the District Engineer, Sacramento District, Corps of Engineers.

a. Emergencies. Some deviations that can arise from emergency conditions include: drownings or other accidents; equipment in downstream channels; the dilution of pollutants or flushing of pollutants from the downstream channels; and failure of important operating facilities. The District Engineer, Sacramento District, Corps of Engineers, will be informed as soon as practicable of any emergency deviations.

No conditions exist which require the establishment of limits on the rate of reservoir filling or drawdown with the exception of the levees downstream (See Section 7-02). However, when periods of potentially rapid increases or decreases in releases are anticipated, a schedule will be developed through coordination between the Bureau of Reclamation, the Corps of Engineers, the California Department of Water Resources, the City of Sacramento and the County of Sacramento.

b. Unplanned Minor Deviations. Unplanned instances not considered emergencies can also create needs for temporary minor deviations from the normal regulation of the reservoir. Construction activities usually account for the greatest part of these minor deviations. Typical construction activities include: utility stream crossings, bridge work, bank protection work and major construction projects. Changes in releases are sometimes necessary for maintenance and inspection. Requests for changes of release rates are generally given for a few hours to a few days. Each request is analyzed on its own

circumstances. Consideration is given to upstream watershed conditions, flood potential, reservoir conditions and possible alternative measures. In the interest of maintaining good public relations, the requests are complied with, providing there are no adverse effects on the overall operation of the project for the authorized purposes. The District Engineer will be informed in advance, if possible, of all minor deviations proposed or anticipated.

c. **Planned Deviations.** Long-term deviations shall be analyzed on their particular circumstances and merits. Sufficient data on flood potential, reservoir and watershed conditions, alternative measures, expected benefits and probable effects on other projects will be presented by letter or telephone to the District Engineer, Sacramento District, Corps of Engineers, along with recommendations for review and approval.

7-14. RATE OF RELEASE CHANGE

Releases from Folsom Dam shall not be increased more than 15,000 cfs or decreased more than 10,000 cfs during any 2 hour period to permit orderly evacuation of personnel, property, etc., in advance of rising water downstream, and to minimize bank sloughing and caving as the flow recedes after an extended period of bankfull flows.

VIII - EFFECT OF WATER CONTROL PLAN

8-01. GENERAL

Folsom Dam and Lake regulates floodflows in the lower American River by controlling releases, insofar as possible, to obtain the maximum practical reduction in flood damages. The flood control storage in Folsom Lake is adequate to control the floods of record to existing channel capacites below the dam. Storage is provided for conservation, flood control, hydroelectric power generation, recreation and downstream fisheries.

8-02. FLOOD CONTROL

The principle objective of the flood control plan is prevention of inundation of areas in the lower American River Basin, including the City of Sacramento.

a. Spillway Design Flood. The spillway design flood is presented in Definite Project Report, Folsom Dam and Reservoir, American River, California, Part I-Hydrology, dated 28 June 1946. This flood was based on an analysis of the maximum possible precipitation prepared by the Hydrometeorological Section of the former Weather Bureau, now the National Weather Service. From this maximum possible precipitation a probable maximum flood was developed and adopted as the spillway design flood.

The probable maximum flood would result from a combination of the most severe meteorologic and hydrologic conditions considered possible in the basin above the dam. Routing of the spillway design flood (See Plate 18) through Folsom Dam and Lake with the following hydrologic parameters provided a freeboard of between 4 and 5 feet:

PMP (72-hour)	21.2 inches
Snowmelt	5.0 inches
Total Losses	8.4 inches
Peak Inflow	615,000 cfs
Inflow Volume	1,631,000 acre-feet

In 1969, the National Weather Service published Hydrometeorological Report No. 36 which contained revised precipitation amounts. These revised amounts were used to develop a new probable maximum flood. Routing of this probable maximum flood with the following hydrologic parameters caused overtopping of Folsom Dam by 2.7 feet with upstream dam failures and 1.6 feet without upstream dam failures:

	With Upstream Dam Failures	Without Upstream Dam Failures
PMP (72-hour)	32.83 inches	32.83 inches
Snowmelt	2.10 inches	2.10 inches
Total Losses	7.12 inches	7.12 inches
Peak Inflow	1,037,000 cfs	848,000 cfs
Inflow Volume	2,657,000 acre-feet	2,495,000 acre-feet

These routings were included in the report entitled "Spillway Adequacy Studies, Folsom Dam," published in September, 1980, and later revised in July, 1983.

b. **Standard Project Flood.** In 1986, an updated general rain standard project flood was developed to test the operation of Folsom Dam under extreme conditions. A standard project flood (SPF) is one that can be expected from the most severe combination of meteorologic and hydrologic conditions characteristic of the geographic region, excluding extremely rare combinations. The SPF was computed as a percentage of the Probable Maximum Flood (PMF). Sixty percent of the PMF was used for the revised SPF, based on SPF/PMF ratios used for similar basins in the Sierra Nevada. Under unregulated conditions, the revised SPF plots at about a 350-year frequency for a 1-day flow, 250-year frequency for a 3-day flow, and a 200-year frequency for a 4-day flow duration. This flood is about 15 percent larger in peak and 34 percent larger in volume than the SPF developed in 1961. Routing of the revised SPF through Folsom Dam and Lake is shown on Plate 19.

c. **Reservoir Design Flood.** The provision of a maximum of 400,000 acre-feet of flood control space in Folsom Lake was based on the control of the reservoir design flood with a maximum release of 115,000 cfs. The reservoir design flood was computed as the flood which would result from the occurrence, directly over the drainage basin, of the largest rainstorm of record within the region (December 1937 storm), at a time when ground and snow cover conditions are moderately conducive to high runoff. This flood, with a basin mean precipitation of 14.86 inches, has a peak flow of 340,000 cfs and a 6-day volume of 978,000 acre-feet, or 9.6 inches depth over the drainage basin. Routing of the reservoir design flood is shown on Plate 19.

d. **Flood of Record.** The February 1986 Flood is the flood of record in the American River Basin. This flood was one of three floods since the design and construction of the project that have exceeded the volume of the reservoir design flood. The floods of December 1955 and December 1964 also exceeded the RDF. The 1986 Flood, with a basin mean precipitation of 23.19 inches, had a maximum 6-day inflow volume of 1,140,000 acre-feet. A description of the 1964 and 1986 floods is included in Section 4-06. Routings of the 1955, 1964, 1986 and other floods are shown on Plate 19.

8-03. RECREATION

The Folsom Lake State Recreation Area has been described as the most popular unit in the California State Parks system. The area served by the State Recreation Area is primarily Northern California with about 90 percent of the day-users and 50 percent of the campers traveling no farther than 100 miles. The major population center served includes Placer, Yolo, El Dorado, San Joaquin and Sacramento Counties. An estimated 750,000 people in the Sacramento area are within one hour's travel time from the lake. The total annual recreational usage for 1973 broken down into day-use, camping, and boating is shown in Table 15. Peak day-use of the State Recreation Area is approximately 22,000 visitors.

TABLE 15

1973 RECREATIONAL USAGE
FOLSOM LAKE STATE RECREATION AREA

	Lake Natoma (Visitor-Days)	Folsom Lake
Day-Use	300,000	1,333,000
Camping	8,800	43,400
Boating:		
Launching (Day)	18,200	72,350
Mooring (Seasonal)	0	102,750*

* Moorings located at Brown's Ravine only.

The average Folsom Lake fishery use for the years 1971-1973 has been reported by the California Department of Parks and Recreation as 61,500 visitor-days/year.

The American River Parkway in the lower American River also experiences heavy recreational usage. Presently, the total annual use exceeds one million recreation-days, with a direct water-dependent use of over 200,000 days. Recreational usage along the river is expected to increase tremendously in the future with improved facilities and access, and more time available for leisure.

8-04. WATER QUALITY

Since 1956 when Folsom Dam began regulating American River flows, the quality of the water has been more uniform without the previous seasonal changes which resulted from large variations in streamflows. Data collected from the American River at Fair Oaks since 1951 by the Department of Water Resources indicate that American River water quality has generally improved since completion of Folsom Dam. Water quality in the basin is maintained in accordance with applicable State Water Resources Control Board permits.

8-05. FISH AND WILDLIFE

The impoundment of the American River at Folsom Dam has created a fishery which includes various species of bass, sunfish, bullhead, catfish and trout. In addition, the reservoir provides resting grounds for migratory waterfowl. The shallow water areas attract a variety of birds and animals which in turn attract species predatory on them. However, some animals are displaced or have their habitat altered when the reservoir level rises during floods.

At the present time and since the construction of Folsom Dam, flows in the river have been maintained principally in excess of 1,500 cfs which is above the minimum flow required by Decision 893. This is because, under current CVP operations, the Bureau of Reclamation is making interim beneficial use, both for power development at Folsom and Nimbus plants and downstream in other project areas, of the American River water supply developed and reserved for upstream areas and for

future diversion to Folsom South Canal. It is contemplated the present type flow conditions will not be modified for several years, since the build-up in the areas upstream from Folsom Dam and in the Folsom South service area will occur over an extended period of time.

The Nimbus Salmon and Steelhead Hatchery, with a capacity of 30 million eggs annually, aids in supplying part of the increasing commercial and sport fishing demands.

8-06. WATER SUPPLY

The average annual inflow to Folsom Lake for 32 years of record is 2,995,000 acre-feet (See Plate 14). The inflow records at Folsom Lake reflect the historical diversion and storage of water upstream of Folsom Dam. The average annual discharge of the American River at the Fair Oaks stream gage for 32 years of record (1955-1986) is 2,893,000 acre-feet. Average monthly flow data for the same location is given in Table 16.

TABLE 16

AVERAGE MONTHLY FLOWS
FAIR OAKS GAGE

Month	Amount (1,000 Acre-Feet)	Percent of Annual
October	115	4.0
November	160	5.5
December	278	9.6
January	358	12.4
February	344	11.9
March	336	11.6
April	279	9.6
May	271	9.4
June	228	7.9
July	209	7.2
August	174	6.0
September	141	4.9
Total	2,893	100

Period of Record: 1955-1986.

8-07. HYDROELECTRIC POWER

The principle purpose of the Folsom and Nimbus Powerplants is to use the releases mandated for downstream appropriators, flood control, fish and other uses to generate power while still meeting requirements of prior water rights. In addition, all water diverted by the power plants is to be returned to the river immediately downstream of the power plants. The current capabilities to operate for flood control are not changed by power generation.

8-08. NAVIGATION

None.

8-09. FREQUENCIES

a. Unregulated Flow Frequencies. Unregulated flows and statistical parameters for the American River at Fair Oaks for snowmelt and rain floods are tabulated on Plates 20 and 21, respectively. Flow frequency curves for peak, 1-day, 3-day, 7-day, 15-day,30-day, 60-day, 90-day and 120-day flows for snowmelt floods are shown on Plate 22. Flow frequency curves for peak, 1-day, 3-day, 5-day, 7-day, 10-day, 15-day and 30-day flows for rain floods are shown on Plate 23. The statistics were computed using the HEC Regional Frequency program.

b. Peak Flow Frequency Project Conditions. Peak flow frequency curves for the American River at Fair Oaks for project conditions for rain floods are shown on Plate 24. The curves reflect operation of Folsom Dam for the period 1955-1986 which includes both dry and wet periods and is representative of a longer period of record. In order to extend the flow frequency curves to include very rare events, such as the one percent and rarer floods, hypothetical floods were routed through Folsom Dam and Lake.

Peak flow frequency curves for snowmelt were not developed because the large channel capacity below Folsom Dam and the characteristic low peak flows and long durations of snowmelt floods do not pose a significant threat to the lower American River.

c. Stage-Frequency Curve. A stage-frequency curve is shown on Plate 25, and stage-duration curves are shown on Plate 26. The seasonal variation of reservoir storage frequency is shown on Plate 27. The level of storage is the highest in the spring at the beginning of the recreation season (May-September) as a result of storing runoff for water supply and flood control. Subsequent releases made through the summer for water supply and downstream rights draw the reservoir down for the beginning of the winter flood season.

d. Operation Record. The official operating record of Folsom Lake is published in Water Supply papers of the U.S. Geological Survey.

Operation of Folsom Dam began in February 1955 and is shown on Plate 28. A record of flood control requirements and storage and flows pertinent to flood control operation is contained in monthly reports submitted to the Chief of Engineers by the District Engineer, Sacramento District, Corps of Engineers, Sacramento, California.

e. Key Control Point. The reach of the American River from Folsom Dam to its confluence with the Sacramento River is of primary concern for urban protection, including the City of Sacramento. The existing channel capacity throughout this reach is 115,000 cfs. A discharge rating curve for the American River at Fair Oaks is shown on Chart A-6.

8-10. OTHER STUDIES

In June 1986, because of the need to reduce the threat of major flooding along the lower American River, the U.S. Bureau of Reclamation, the State of California, Department of Water Resources, and other entities requested the Corps of Engineers assistance in studying identified flood control alternatives along the American River. The objective of the study, completed in Fiscal Year 1987, was to provide information on the flood hydrology and evaluate the following flood control measures:

a. Increase flood control storage in Folsom Lake;

b. Increase downstream channel capacity through levee enlargement;

c. Modify the Folsom Dam spillway;

d. Credit existing upstream reservoir storage;

e. Construct additional upstream reservoirs, such as Auburn Dam;

f. Combinations of these measures.

A Spillway Adequacy Study (See Section 8-02a) was performed by the Corps of Engineers in September, 1980, and later revised in July, 1983. Presently the Corps of Engineers is doing a "hazard assessment" under the Dam Safety Assurance Program. This evaluation is scheduled for completion in Fiscal Year 1989.

In addition, The Sacramento Metropolitan Area Reconnaissance Study, scheduled for initiation in Fiscal Year 1988, will involve evaluation of approximately 1000 miles of levees along the Sacramento River including those in the Sacramento Metropolitan area.

IX - WATER CONTROL MANAGEMENT

9-01. RESPONSIBILITIES AND ORGANIZATION

a. General. Folsom Dam and Lake is operated by the Bureau of Reclamation, United States Department of the Interior, and is under the jurisdiction of their Regional Director, Mid-Pacific Region, Sacramento, California. Details concerning the responsibility for flood control operation are discussed in Exhibit A to this report. Flood control regulations prescribed by the Secretary of the Army under the authority of Section 7 of the Flood Control Act of 1944 and in accordance with rules and regulations contained in the Code of Federal Regulations Title 33 Part 208.11 (See Exhibit B) are reflected in the accompanying Flood Control Diagram and Field Working Agreement contained in Exhibits A and C, respectively. Responsibilities for flood control operation of Folsom Dam and Lake are summarized below. A list of personnel involved in the operation of the reservoir for flood control are provided at the front of the manual.

b. Corps of Engineers. The District Engineer, Sacramento District Corps of Engineers, is responsible for:

(1) Approving or disapproving deviations from the prescribed flood control criteria contained in Exhibit A on Chart A-8.

(2) Advising operating agencies and the Chief of Engineers of any departure from the flood control regulations.

(3) Preparing monthly operation and other special reports relative to operation of the reservoir required by the Office, Chief of Engineers.

(4) Preparing revisions to the flood control criterion found herein.

c. Bureau of Reclamation. The Bureau of Reclamation is responsible for:

(1) Accomplishing the physical operation of the reservoir and associated facilities in accordance with the official regulations.

(2) Advising the District Engineer, Sacramento District, Corps of Engineers, of any deviation from the flood control operation.

(3) Reporting to the District Engineer, Sacramento District, Corps of Engineers, any unusual condition in the reservoir or along downstream channels that might interfere with planned flood control operation of the reservoir.

(4) Taking reasonable steps to inform the public of significant changes in flood control releases.

(5) Making available for access by the Reservoir Control Section, Sacramento District, Corps of Engineers, data as outlined in paragraph 9-05 and other data that may be required from time to time.

(6) Keeping informed of the rules and regulations contained in the Water Control Manual and bringing to the attention of the District Engineer, Sacramento District, Corps of Engineers, any features of the manual that may require clarification or revision.

(7) Keeping the District Engineer, Sacramento District, Corps of Engineers, advised of any inaccuracies contained in the manual or that may develop as a consequences of changing conditions.

(8) Immediately after the end of each month, making available for access by the Reservoir Control Section, Sacramento District, Corps of Engineers, data specified in paragraph 9-05.

d. State of California. The State Water Resources Control Board is responsible for administration of water rights. The State Department of Fish and Game has the responsibility of calling for water releases required for downstream fisheries resources and operation of the Nimbus Fish Hatchery. The Department of Water Resources is responsible for maintaining and patrolling the American River Flood Control Project Levee (See Plate 15). In addition, the Department of Parks and Recreation has a management agreement with the Bureau of Reclamation to develop, operate and maintain the federal land around Folsom Lake and Lake Natoma that is within the Folsom Lake State Recreation Area.

9-02. INTERAGENCY COORDINATION

To insure that the flood control operation of Folsom Dam will be as effective as possible, it is essential that the operating agencies are continually advised of possible flood hazards, weather conditions, inflow to the reservoir, and flows at key locations in the American River. This requires close liaison between the Bureau of Reclamation, Corps of Engineers, National Weather Service, U.S. Geological Survey, Western Area Power Administration, California Department of Water Resources, California Department of Fish and Game, California Division of Parks and Beaches and other downstream interests on a daily or hourly basis as required.

a. Local News Bulletins. The Bureau of Reclamation notifies local agencies and property owners of scheduled changes in reservoir releases and coordinates the publication of these changes and other information of public interest regarding floods through the local news media.

b. National Weather Service. The Bureau of Reclamation cooperates with the National Weather Service in operation of a network of hydrometeorological stations throughout the American River Basin. The Weather Service office in Sacramento maintains year-round surveillance of weather conditions. The Weather Service also prepares and distributes weather forecasts to agencies responsible for flood protection and to the public by way of the local news media.

The Weather Service office furnishes meteorological data and weather forecasts on a 24-hour basis. Regular forecasts are made twice a day. When the meteorological situation indicates general area precipitation, quantitative forecasts are furnished.

The National Weather Service publishes water supply forecasts during the middle of each month from January through May indicating the forcasted volume of runoff for the remainder of the water year.

c. U.S. Geological Survey. The Geological Survey operates stream gaging stations on a cooperative basis with local, state and Federal agencies. The Geological Survey regularly measures services and publishes the records from stream gaging stations. Reservoir stage and contents are furnished by the Bureau of Reclamation and the Corps of Engineers to the Geological Survey for publication. Preliminary flow data are available from the Survey, if required.

d. Power Marketing Agency. The Western Area Power Administration is the marketing agency for power generated at Bureau of Reclamation facilities in the American River Basin.

e. Other Federal, State and Local Agencies.

(1) Federal-State River Forecast Center. Personnel from the California-Nevada River Forecast Center of the National Weather Service office in Sacramento and the California Department of Water Resources are assigned to the Joint Federal-State River Forecast Center which monitors weather conditions and river stages on a year-round basis. If floods on major streams become imminent, the Federal-State Flood Operations Center is activated.

(2) Federal-State Flood Operations Center. This center operates on a 24-hour basis and among other flood emergency activities, advises all interested parties of flood situations as they develop. The center furnishes flood warnings and forecasts of river stages to local news media, law enforcement agencies, and other responsible agencies for their use and for dissemination to the public.

9-03. INTERAGENCY AGREEMENTS

A Field Working Agreement between the Department of the Interior, Bureau of Reclamation, and Department of the Army, Corps of Engineers, for Flood Control Operation of Central Valley Project Dams and Reservoirs in California was finalized on 14 August 1978 by representatives of the Bureau of Reclamation and the Corps of Engineers. The agreement was initiated to insure that there exists a clear understanding of the flood control regulations and information exchange required for the project operation. A copy of the agreement is contained in this Water Control Manual as Exhibit C.

The United States and the State of California entered into an agreement on November 24, 1986, recognizing the need for coordinated operation of the Central Valley Project and the State Water Project both of which provide for the development, conservation, control and utilization of water resources in California. The United States and the

State agreed to observe reservoir operational criteria prescribed by the Corps of Engineers to minimize flood hazards and to meet all requirements and objectives of their respective projects and to coordinate operation so as not to adversely affect the rights of other parties and to conserve water. In addition, both the Central Valley Project and State Water Project are operated in conformity with the Sacramento-San Joaquin Delta standards established by the State Water Resources Control Board in Decision D-1485 (August 1978).

The California State Water Resources Control Board Decision D-893 (dated March 1958) states that minimum flows in the lower American River (250 cfs from January 1 to September 15 and 500 cfs from September 15 to January 1) apply to the river from Nimbus Dam to the Sacramento River. Therefore, Nimbus Dam releases must also include water to be diverted from the lower American River, which diversions may reach 300 cfs in the summer. This decision also estimated summertime releases needed from Nimbus Dam of 150 cfs for Delta salinity control and 100-200 cfs for Delta consumption. Decision D-1379 (dated July 1971) concerns flows to be maintained in the Delta for salinity control and for fish and wildlife. Releases from Nimbus Dam are affected by this decision since the American River contributes to flows through the Delta.

Decision D-1400 (dated April 1972) established release requirements for the lower American River to be met upon completion of Auburn Dam. The minimum flow is 1250 cfs from October 15 to March 14 and 1500 cfs from March 15 to October 14. These flow requirements, though not yet in effect, are treated as operation objectives. Even without Auburn Dam, the minimum releases of D-1400 are met in all but extremely dry years.

9-04. COMMITTEES AND COMPACTS

Management of the resources of the American River, including water supply and quality, hydroelectric power marketing, and storage utilization in general, has evolved through numerous court issued decrees and decisions. Related information is presented throughout this manual and contained in the "Agreement between the United States of America and the Department of Water Resources of the State of California for Coordinated Operation of the Central Valley Project and the State Water Project" (November 24,1986).

9-05. REPORTS

a. The reservoir operator or operating agency shall provide to the Reservoir Control Section, Sacramento District, Corps of Engineers and to the Department of Water Resources, State of California, each workday between 7:00 and 9:00 a.m. and at other times upon request, data as described in Exhibit A, Chart A-7, Operational Data Requirements. Data obtained on non-workdays will be furnished on the following workday.

b. Immediately after the end of each month, the operating agency will provide to the Reservoir Control Section, Sacramento District, Corps of Engineers, daily inflow, outflow, elevation, storage, precipitation and daily requirements of flood control space at Folsom Dam.

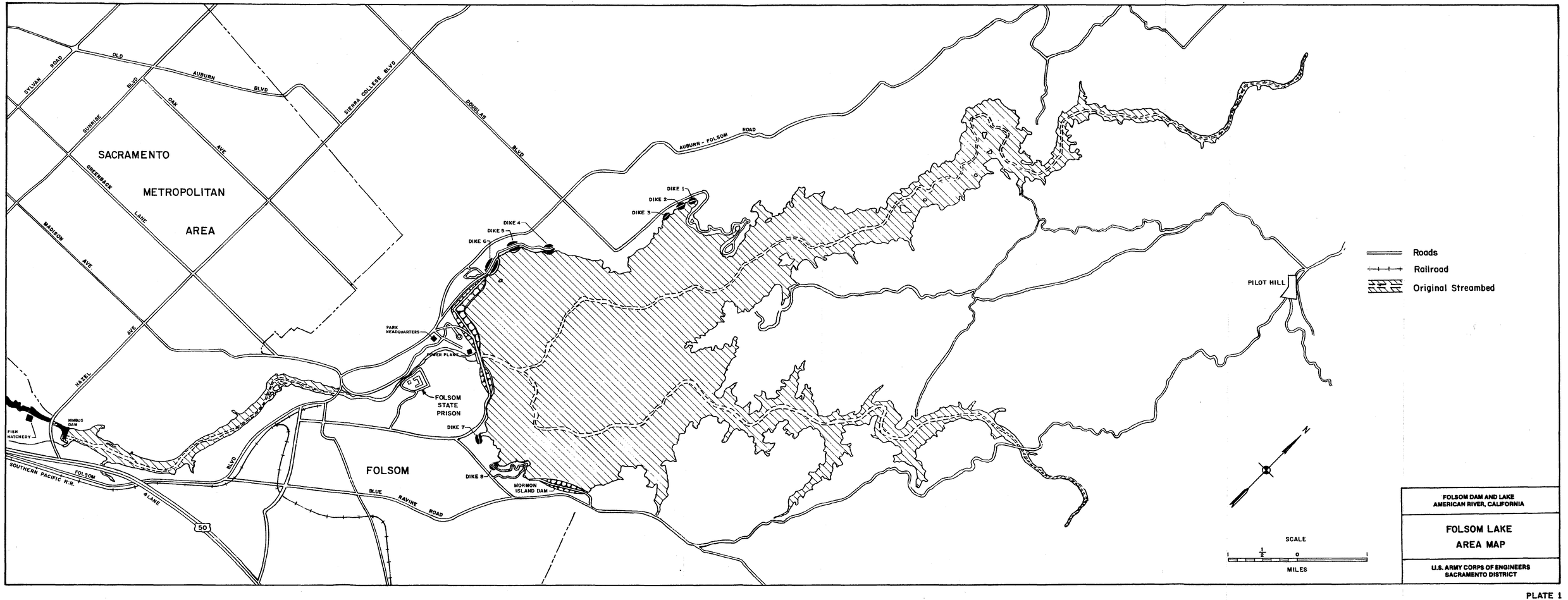
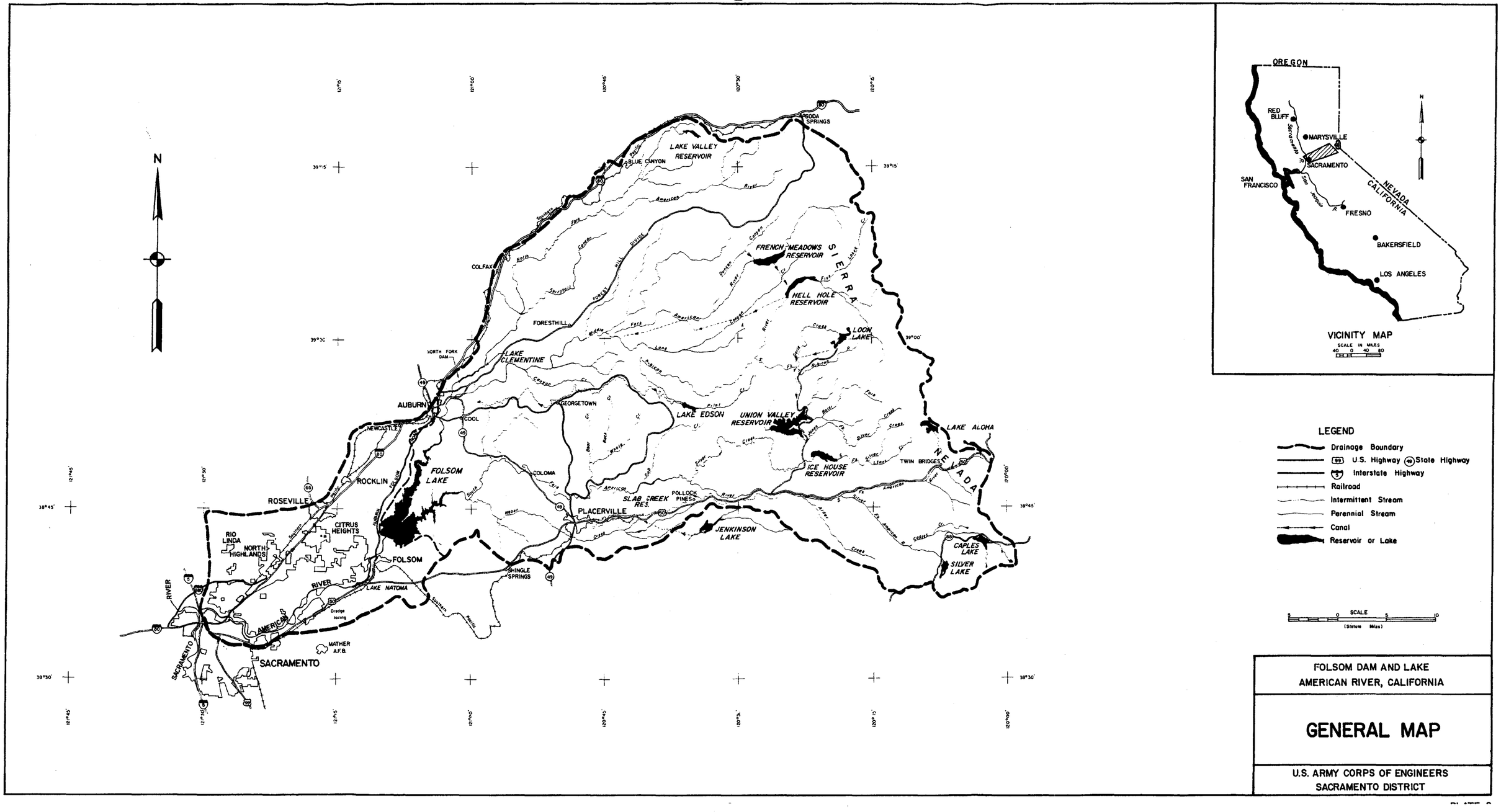

SACRAMENTO
METROPOLITAN
AREA
FOLSOM
SYLVAN ROAD
OLD AUBURN BLVD
SUNRISE BLVD
OAK AVE
GREENBACK LANE
MADISON AVE
HAZEL AVE
SIERRA COLLEGE BLVD
DOUGLAS BLVD
AUBURN - FOLSOM ROAD
FOLSOM BLVD
BLUE RAVINE ROAD
SOUTHERN PACIFIC R.R.
FISH HATCHERY
NIMBUS DAM
PARK HEADQUARTERS
POWER PLANT
FOLSOM STATE PRISON
MORMON ISLAND DAM
PILOT HILL
DIKE 1
DIKE 2
DIKE 3
DIKE 4
DIKE 5
DIKE 6
DIKE 7
DIKE 8
50
Roads
Railroad
Original Streambed
N
SCALE
1 0 1
MILES
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA
FOLSOM LAKE
AREA MAP
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 1



LEGEND

- Drainage Boundary
- 99 U.S. Highway 49 State Highway
- 5 Interstate Highway
- Railroad
- Intermittent Stream
- Perennial Stream
- Canal
- Reservoir or Lake

SCALE
5 0 5 10
(Statute Miles)

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

GENERAL MAP

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

Plate 3 is not available in this version of the Folsom water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Office of Counsel at (916) 557-5290.

Plate 4 is not available in this version of the Folsom water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Office of Counsel at (916) 557-5290.

Plate 5 is not available in this version of the Folsom water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Office of Counsel at (916) 557-5290.

Plate 6 is not available in this version of the Folsom water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Office of Counsel at (916) 557-5290.

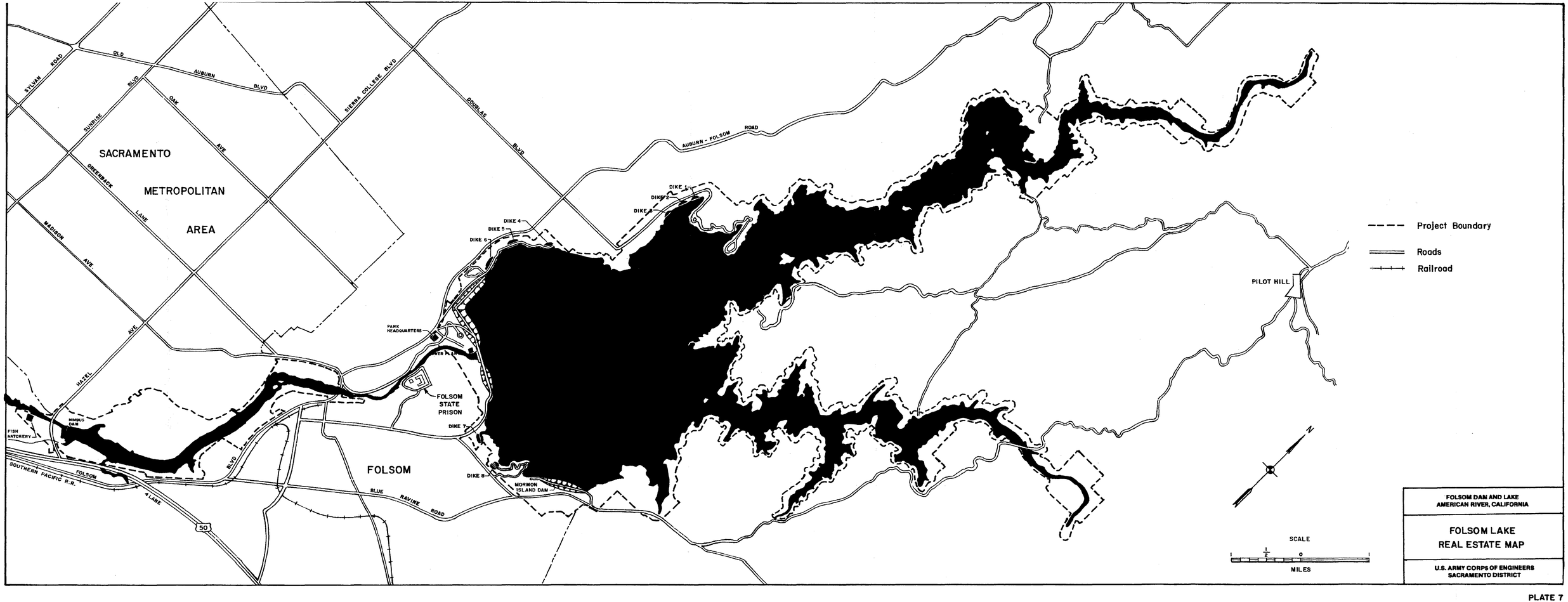
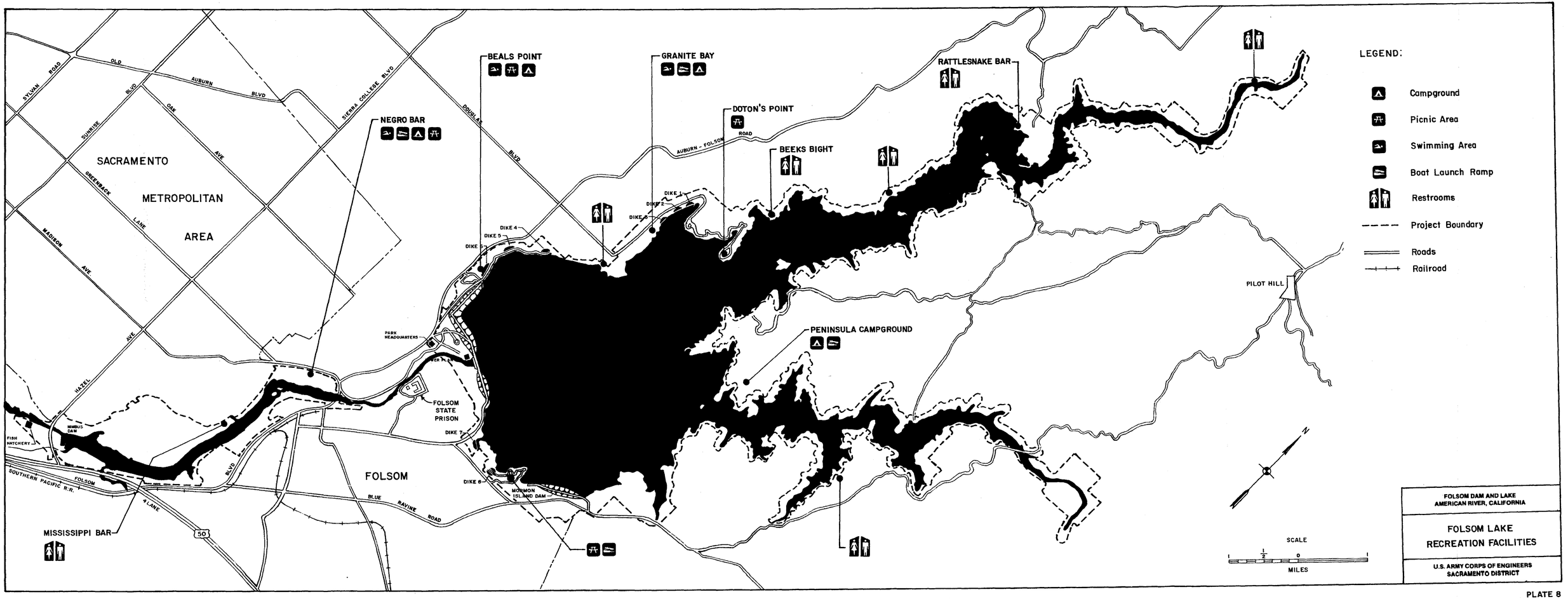

SACRAMENTO
METROPOLITAN
AREA
SYLVAN ROAD
OLD AUBURN BLVD
SUNRISE BLVD
OAK AVE
GREENBACK LANE
MADISON AVE
HAZEL AVE
SIERRA COLLEGE BLVD
DOUGLAS BLVD
AUBURN - FOLSOM ROAD
DIKE 1
DIKE 2
DIKE 3
DIKE 4
DIKE 5
DIKE 6
DIKE 7
DIKE 8
PARK HEADQUARTERS
FOLSOM STATE PRISON
PILOT HILL
NIMBUS DAM
FISH HATCHERY
SOUTHERN PACIFIC R.R.
FOLSOM BLVD
4 LANE
50
FOLSOM
BLUE RAVINE ROAD
MORMON ISLAND DAM
Project Boundary
Roads
Railroad
N
SCALE
0
MILES
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA
FOLSOM LAKE
REAL ESTATE MAP
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 7



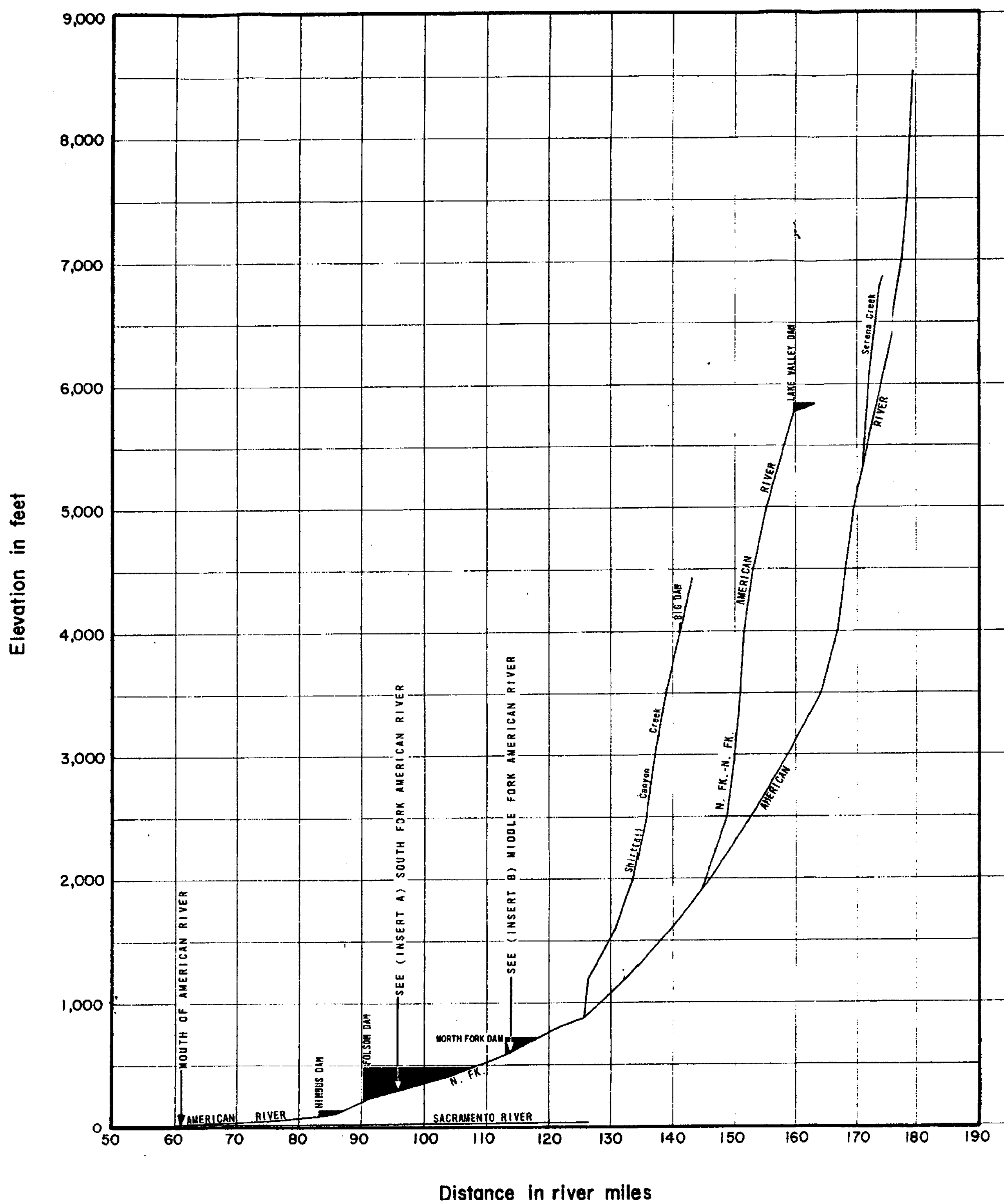
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

FOLSOM LAKE
RECREATION FACILITIES

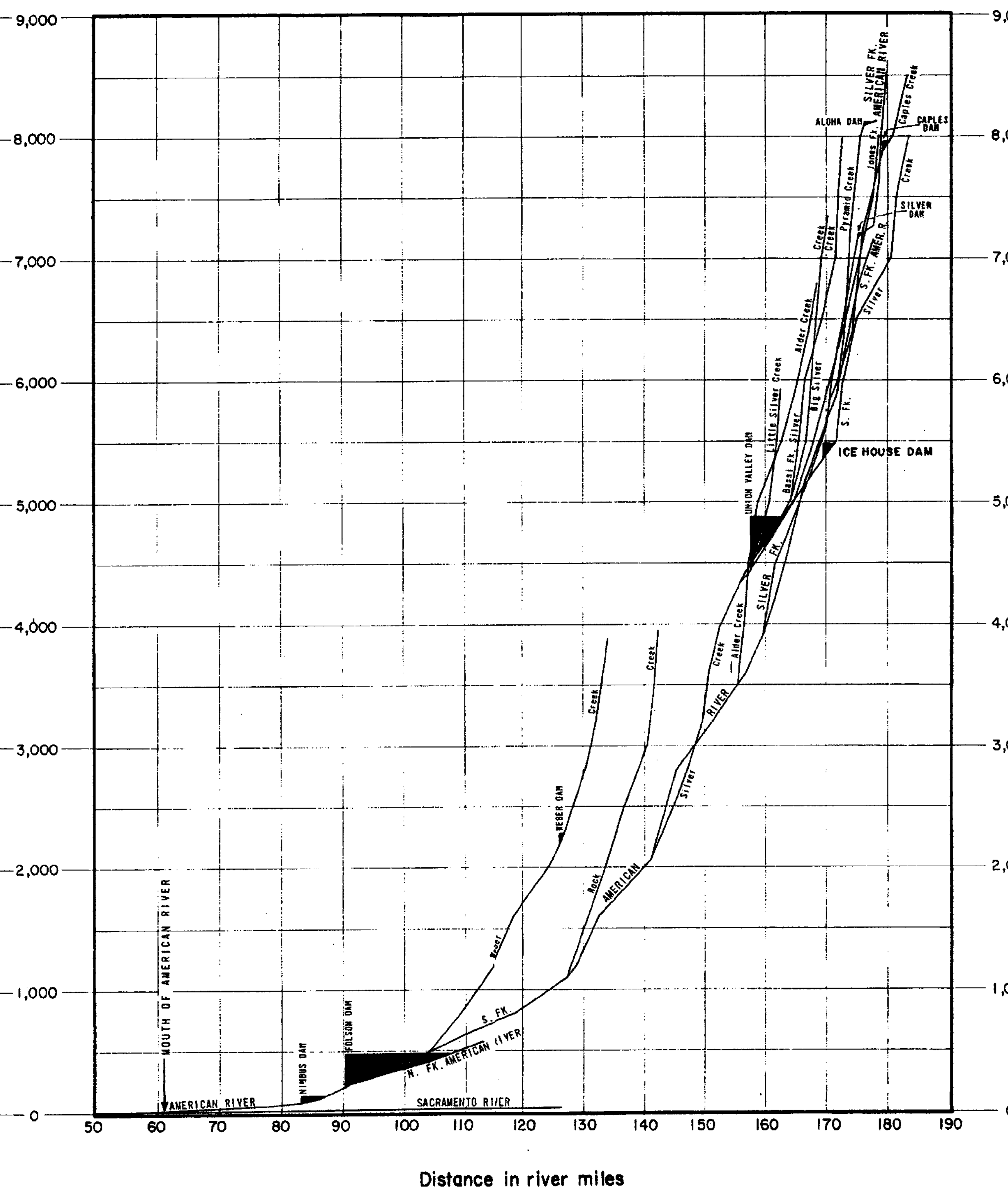
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 8

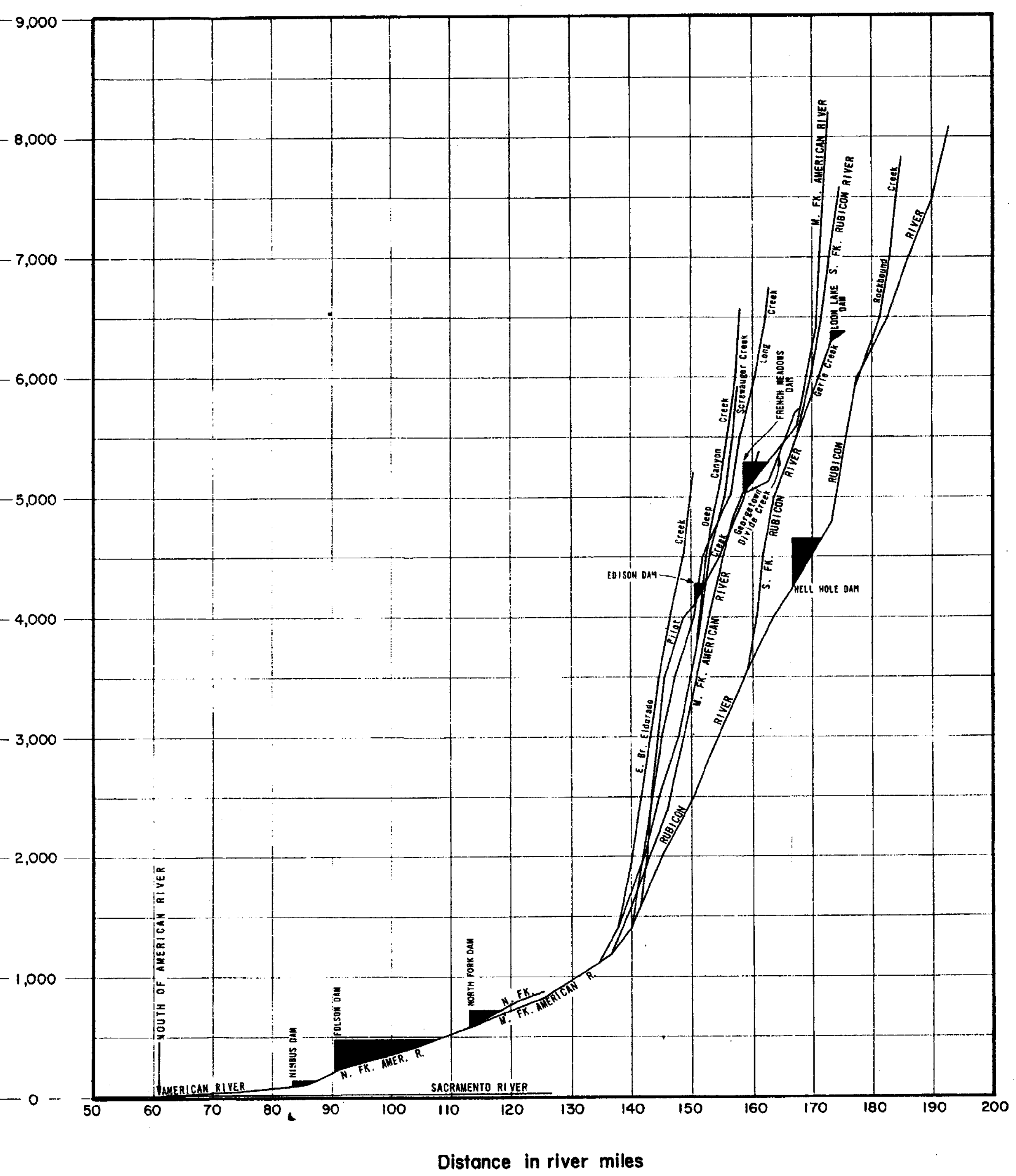
Plate 9 is not available in this version of the Folsom water control manual.
For additional information, contact the U.S. Army Corps of Engineers
Sacramento District Office of Counsel at (916) 557-5290



NORTH FORK AMERICAN RIVER



(INSERT A) SOUTH FORK AMERICAN RIVER



(INSERT B) MIDDLE FORK AMERICAN RIVER

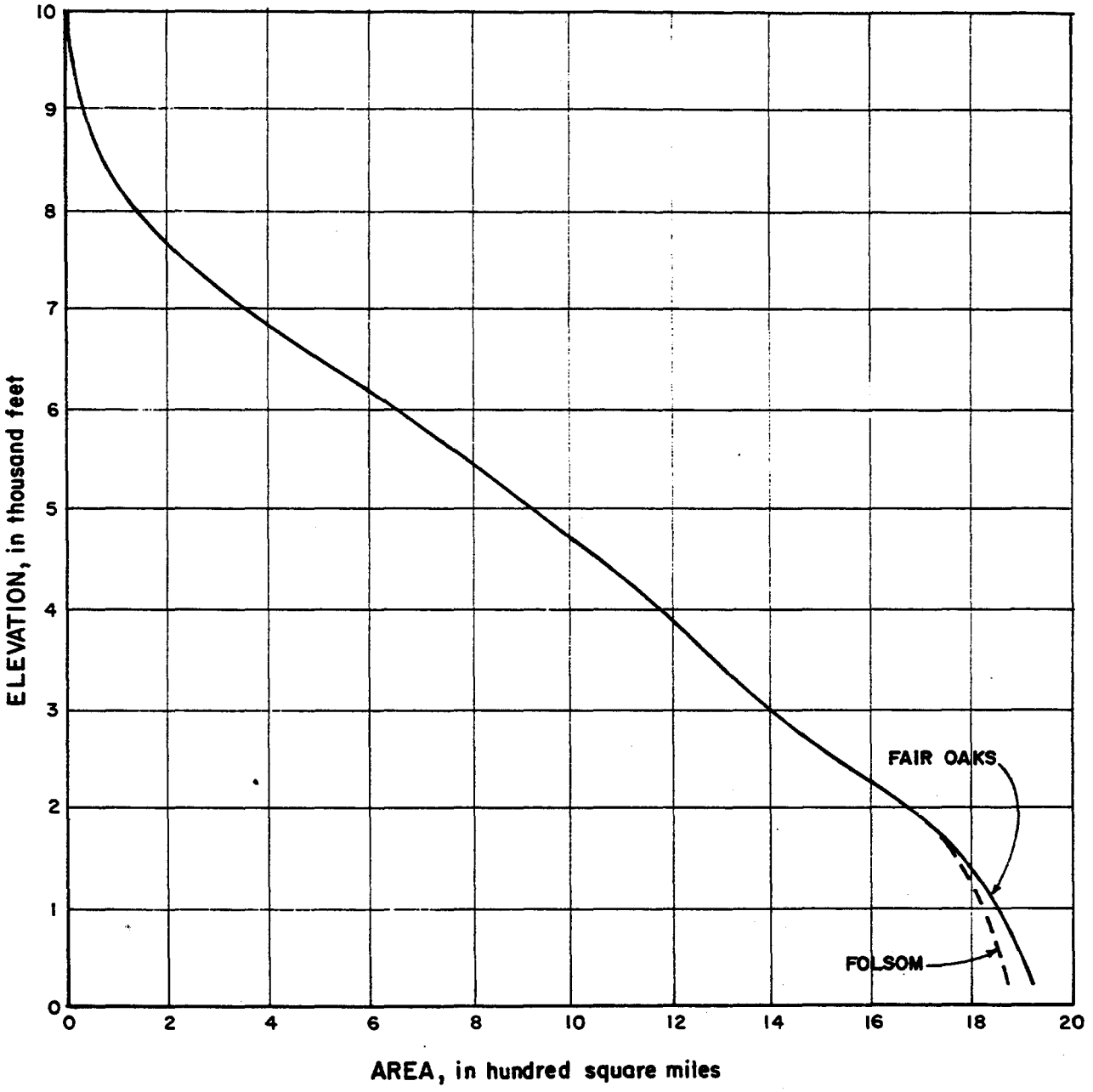
NOTE: MILE 0.0 ON SACRAMENTO RIVER AT COLLINSVILLE

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

STREAM PROFILES

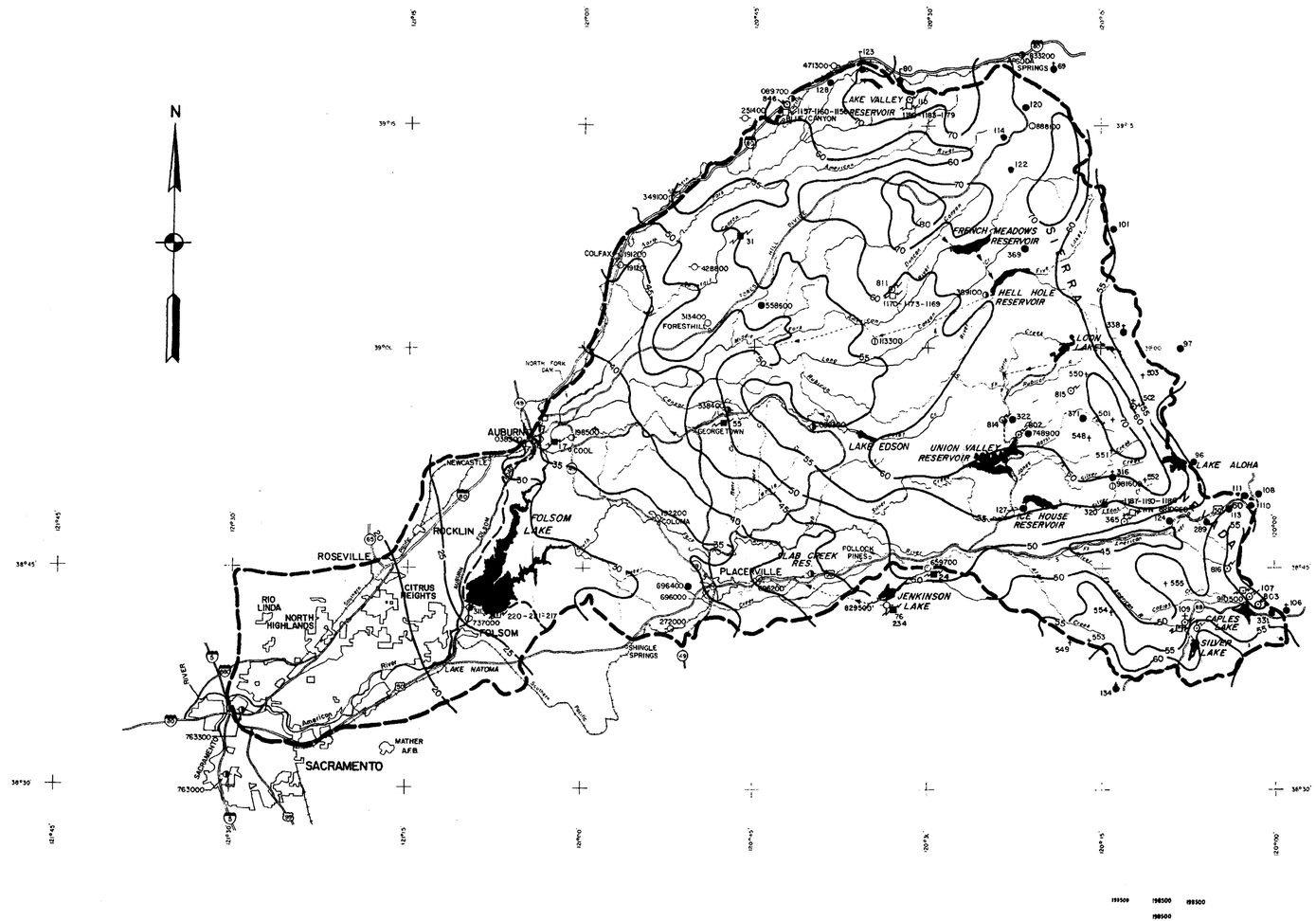
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 1(



FOLSOM DAM AND LAKE AMERICAN RIVER, CALIFORNIA
AREA–ELEVATION CURVE
U.S. ARMY CORPS OF ENGINEERS SACRAMENTO DISTRICT

PLATE II



HYDROMET STATIONS

Index Number	Station	Type Of Gage	Elev In Feet	Location Latitude Deg	Location Latitude Min	Location Longitude Deg	Location Longitude Min
17	Auburn Dam Ridge		600	38	53	121	03
220-221-217	Folsom Lake		500	38	41	121	08
55	Georgetown		3050	38	55	120	45
24	Pacific House		3440	38	45	120	30
76	Sly Park		3530	38	43	120	34
234	Sly Park 2		3530	38	43	120	34
31	Sugar Pine		3530	39	08	120	45
1157-1160-1156	Blue Canyon		5280	39	17	120	42
1170-1173-1168	Crest Store		5640	39	05	120	34
1180-1183-1179	Huysink		6800	39	17	120	32
1187-1190-1186	Fonni Ridge		7600	38	48	120	13
	Silver Lake		7100	38	41	120	07
	Caples Lake		8000	38	43	120	03

LEGEND FOR HYDROMET STATIONS
- Radio-reporting, precipitat on
- Radio-reporting, precipitat on, temperature and snow
- Radio-reporting, precipitat on, temperature and wind speed
- Satellite-reporting, precipitation, temperature and snow

CLIMATOLOGICAL STATIONS

Index Number	Station	Type Of Gage	Elev Feet	Location Latitude Deg	Location Latitude Min	Location Longitude Deg	Location Longitude Min	Record Begin	Record Published By
043300	Auburn		1292	38	54	121	04	1870	NOAA
046300	Blodgett Exp Forest		4414	38	55	120	40	1861	NOAA
046700	Blue Canyon WB AP		5280	39	17	120	42	1943	NOAA
113300	Brushy Springs G S		6880	39	00	120	35	1911	NOAA
181050	Colfax		2418	39	06	120	57	1970	NOAA
191201	Colfax Fire Station		2350	39	05	120	57	1960	DWR
192200	Coloma		770	38	48	120	54	1854	DWR
198500	Cool		1520	38	53	121	01	1953	NOAA
251400	Drum P H		3412	39	18	120	48	1973	DWR
272000	El Dorado FFS		1350	38	41	120	52	1955	NOAA
311300	Folsom Dam		350	38	42	121	10	1955	NOAA
313400	Foresthill R.S.		3180	39	01	120	49	1937	NOAA
338400	Georgetown R.S.		3001	38	55	120	47	1943	NOAA
348100	Gold Run		3350	39	10	120	52	1899	NOAA
389100	Hell Hole		4850	39	04	120	39	1966	NOAA
429800	Iowa Hill		3966	39	08	120	50	1878	NOAA
471300	Lake Spaulding		5158	39	19	120	44	1884	NOAA
550800	Michigan Bluff		3660	39	03	120	44	1940	NOAA
659700	Pacific House		3440	38	45	120	30	1841	NOAA
696000	Placerville		1890	38	44	120	48	1874	NOAA
696200	Placerville IFG		2155	38	44	120	44	1929	NOAA
696400	Placerville Disp Plt		1348	38	44	120	47	1893	NOAA
737000	Repress		298	38	42	121	10	1899	NOAA
748900	Robbs Peak		5175	38	54	120	22	1964	DWR
763000	Sacramento WB AP		17	38	31	121	30	1935	NOAA
763200	Sacramento WB City		25	38	35	121	29	1948	NOAA
829500	Sly Park		3532	38	43	120	34	1955	DWR
833200	Soda Springs IE		6680	39	20	120	22	1948	NOAA
886100	The Cedars		5900	39	15	120	21	1945	DWR
915500	Twin Lakes		7329	38	42	120	02	1919	NOAA
961800	Wrights Lake		6960	38	50	120	14	1948	NOAA

DWR - Department of Water Resources, State of California
NOAA - National Oceanic and Atmospheric Administration

LEGEND FOR CLIMATOLOGICAL STATIONS

RECORDING	RECORDING AND NON-RECORDING	NON-RECORDING	
●	◑	○	PRECIPITATION STATION
◒	◓	◐	PRECIPITATION STORAGE
●–	◑–	○–	PRECIPITATION AND TEMPERATURE
●	◑	○	PRECIPITATION AND EVAPORATION
●	◑	○	PRECIPITATION, TEMPERATURE, AND EVAPORATION
⊕	⊕	⊕	COMPLETE METEOROLOGICAL STATIONS

USED IN COMBINATION WITH OTHER SYMBOLS AS ◿ TO INDICATE RADIO EQUIPPED BASE

SNOW COURSES, AERIAL SNOW DEPTH MARKERS, AND SNOW SENSORS

CALIFORNIA INDEX NO.	STATION	TYPE OF GAGE	ELEVATION (FEET, MSL)	LOCATION LATITUDE DEG	LOCATION LATITUDE MIN	LOCATION LONGITUDE DEG	LOCATION LONGITUDE MIN	RECORD BEGAN	MEASUREMENT DATES /3	MEASURED BY	AVERAGE 1 APR WATER CONTENT (INCHES)
98	DONNER SUMMIT /1	●	6,800	39	18	120	20	1910	12345	P.G.E	40.2
80	CISCO /1	●	5,800	39	18	120	33	1918	12345	P.G.E	27.8
99	LAKE LUCILLE /1 2	●	8,200	39	20	120	07	1913	34	S.C.S.	61.9
97	RUBICON PEAK 1 /2	●	9,100	39	00	120	08	1910	34	S.C.S	90.4
101	WARD CREEK 2 /1	●	7,000	39	09	120	14	1913	1234	S.C.S	45.5
106	UPPER CARSON PASS	●	8,500	38	42	119	59	1930	12345	P.G.E	36.1
107	CAPLES LAKE	●	8,000	38	43	120	02	1938	12345	P.G.E	32.2
108	ECHO SUMMIT	●	7,450	38	50	120	00	1941	12345	U.S.F.S	37.5
109	SILVER LAKE	●/*	7,100	38	41	120	07	1830	2345	U.S.F.S	23.3
110	LAKE AUDRAIN	●	7,300	38	49	120	02	1941	12345	U.S.F.S	37.4
111	DARRINGTON	●	7,100	38	50	120	03	1941	12345	D.W.R.	31.5
113	PHILLIPS	●	6,800	38	49	120	04	1941	12345	D.W.R.	30.0
114	WABENA MEADOWS	●	6,300	39	14	120	34	1941	12345	P.C.W.A	40.3
115	HUYSINK	●	6,800	39	17	120	32	1937	2345	U.S.F.S	46.7
120	ONION CREEK	●	6,100	39	18	120	22	1937	2345	U.S.F.S	21.7
122	TALBOT CAMP	●	5,750	39	12	120	20	1940	12345	P.C.W.A	21.5
123	SIMMLE VALLEY	●	5,750	39	19	120	38	1930	4	P.G.E	29.2
124	STRAWBERRY	●	5,100	38	48	120	09	1942	12345	D.W.R.	8.5
127	ICE HOUSE	●	5,200	38	48	120	22	1932	2345	U.S.F.S.	8.2
128	CARPENTER FLAT	●	5,300	38	18	120	39	1946	4	P.G.E	17.8
129	BLUE LAKES /1	●	8,000	38	26	119	55	1918	12345	P.G.E	36.7
134	BEAR VALLEY RIDGE 1 /1	●/*	8,700	38	37	120	14	1930	12345	P.G.E	25.5
299	TAMARAK FLAT	●	6,550	38	48	120	06	1938	12345	D.W.R.	29.9
318	WRIGHTS LAKE	●	6,900	38	51	120	14	1958	2345	S.MU.D.	36.4
320	LYONS CREEK	●	6,700	38	49	120	15	1937	12345	D.W.R.	33.8
322	ROBBS VALLEY	●	5,800	38	55	120	23	1937	2345	U.S.F.S	21.8
331	LOWER CARSON PASS	●	8,400	38	42	120	00	1951	12345	P.G.E	38.9
338	LOST CORNER MOUNTAIN	●	7,800	39	01	120	13	1959	2345	S.MU.D.	36.7
350	ALPHA	●/*	7,800	38	48	120	13	1965	12345	D.W.R.	38.2
369	MIRANDA CABIN	●	6,200	39	07	120	22	1967	12345	P.C.W.A	41.2
371	DIAMOND CROSSING	●	6,050	38	57	120	17	1967	12345	P.C.W.A	24.8
501	LAKE NO. 3 /2	†	8,200	38	55	120	14	1963	-	S.MU.D.	58.1
502	LAKE LOIS /2	†/*	9,250	38	58	120	12	1963	-	S.MU.D.	91.8**
503	PHIPPS CREEK /2	†	7,800	38	58	120	11	1963	-	S.MU.D.	33.8
548	TWO PEAKS /2	†	7,380	38	54	120	16	1964	-	S.MU.D.	30.7
549	UPPER BASSI	†	8,350	38	60	120	17	1964	-	S.MU.D.	13.2
550	SHADOW LAKE /2	†	7,300	38	58	120	16	1964	-	S.MU.D.	41.9
551	WILLOW FLAT	†	7,480	38	53	120	14	1964	-	S.MU.D.	38.2
552	LYONS LAKE /2	†	8,500	38	51	120	11	1964	-	S.MU.D.	50.7
553	QUINNS CORRAL	†	6,800	38	60	120	16	1998	-	S.MU.D.	36.1
554	HELLS DELIGHT	†	5,750	38	62	120	14	1964	-	S.MU.D.	9.7
555	RIDGEY FLAT	†	8,500	38	64	120	09	1964	-	S.MU.D.	21.7
802	ROBBS POWER HOUSE	●	5,150	38	54	120	22	1998	2345	S.MU.D.	3.2
803	CAPLES LAKE (E B M U D)	●/*	7,800	38	43	120	02	1967	12345	P.G.E. for E B M U D	27.1
811	GREEK STONE	●/*	5,800	39	04	120	33	1999	4	P.G.E	21.0
814	ROBBS SADDLE	●	5,900	38	55	120	23	1971	2345	S.MU.D.	21.4
815	VAN VLECK	●/*	6,700	38	57	120	18	1971	2345	S.MU.D.	33.9
816	SCHNEIDERS	●/*	8,800	38	58	120	04	1971	2345		34.5
848	BLUE CANYON	●	5,300	39	17	120	42	1967	12345	N.W.S.	9.0

/1 STATION LOCATED OUTSIDE AMERICAN RIVER WATERSHED
/2 STATION LOCATED INSIDE WILDERNESS PRESERVATION AREA
/3 MEASUREMENT DATE NUMBERS INDICATE: 1. ON OR ABOUT 1 JANUARY, 2. ON OR ABOUT 1 FEBRUARY, ETC
* NOT CURRENTLY MEASURED
** PERIOD OF RECORD TOO SHORT FOR AVERAGE WATER CONTENT CALCULATION ON SNOW SENSOR

LEGEND
- ● — SNOW COURSE
- † — AERIAL SNOW DEPTH MARKER
- ●/* — SNOW COURSE WITH AERIAL SNOW DEPTH MARKER
- ◿/* — RADIO REPORTING SNOW SENSOR WITH SNOW COURSE

LEGEND

- Drainage Boundary
- (99) U.S. Highway (49) State Highway
- (5) Interstate Highway
- Railroad
- Intermittent Stream
- Perennial Stream
- Canal
- Reservoir or Lake
- Authorized Reservoir
- 70 Isohyets

SCALE
5 0 5 10
(Statute Miles)

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

NORMAL ANNUAL PRECIPITATION AND CLIMATOLOGICAL STATIONS

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 12

UNIMPAIRED MONTHLY FLOWS
AMERICAN RIVER AT FAIR OAKS
(FLOW IN 1000 ACRE-FEET)

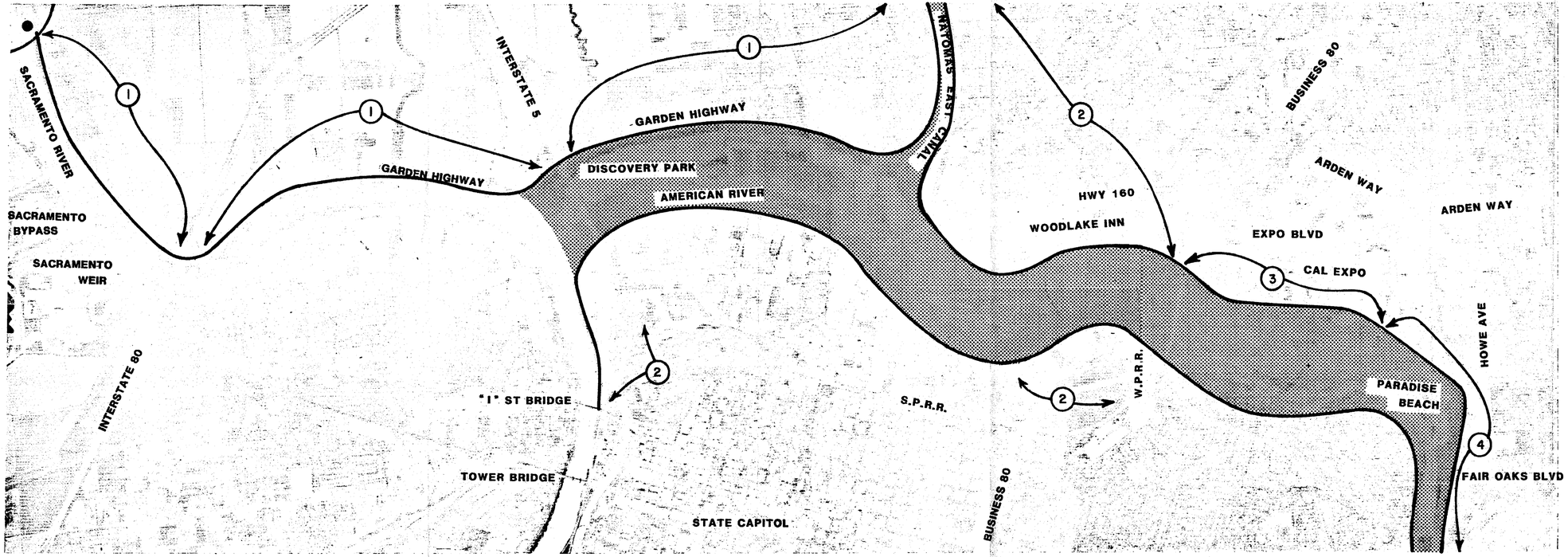
WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1905		55	82	201	235	378	409	376	179	43	17	8	1,983
1906	9	12	16	446	330	870	720	927	955	390	63	25	4,763
1907	18	34	244	255	825	1,520	931	750	661	339	92	48	5,717
1908	43	49	110	160	113	203	267	283	155	53	12	7	1,455
1909	24	26	37	1,494	863	397	476	585	455	143	37	17	4,554
1910	31	273	577	524	291	646	624	489	135	32	13	12	3,647
1911	21	32	98	853	589	798	898	892	1,055	197	28	18	5,479
1912	22	26	25	70	46	118	171	421	284	51	13	20	1,267
1913	15	87	37	97	71	107	359	444	151	38	17	9	1,432
1914	10	29	132	1,052	390	499	561	717	392	130	28	11	3,951
1915	20	22	42	95	512	286	507	954	478	109	24	13	3,062
1916	13	22	81	476	584	807	700	607	399	121	21	13	3,844
1917	38	39	124	98	407	275	549	633	531	103	23	12	2,832
1918	11	11	32	17	124	313	441	307	115	20	4	25	1,420
1919	58	48	48	42	361	314	562	594	96	17	9	8	2,157
1920	10	9	42	39	37	238	361	439	162	34	11	9	1,391
1921	35	152	272	473	316	534	432	527	372	76	20	15	3,224
1922	25	47	136	118	371	338	488	1,018	671	98	22	16	3,348
1923	31	63	399	268	175	218	566	613	278	97	22	22	2,752
1924	40	28	29	38	115	54	119	92	12	2	1	1	531
1925	14	57	99	94	604	319	606	603	258	66	20	17	2,757
1926	27	32	55	49	259	194	475	197	48	15	10	12	1,373
1927	22	174	138	223	770	441	727	602	412	76	23	20	3,628
1928	28	117	103	104	135	992	536	381	80	25	14	13	2,528
1929	22	34	43	44	102	150	214	341	158	30	10	8	1,156
1930	6	5	155	137	144	320	343	274	144	25	11	14	1,578
1931	16	34	20	53	70	132	155	118	39	8	4	6	655
1932	15	31	171	176	332	295	388	639	402	92	19	13	2,573
1933	23	31	43	48	55	143	238	352	329	39	15	9	1,325
1934	25	39	117	165	175	253	184	98	39	12	12	9	1,128
1935	13	70	72	174	145	209	804	647	345	62	17	13	2,571
1936	29	42	46	413	777	428	624	573	344	84	28	25	3,413
1937	30	34	42	55	349	409	507	667	217	54	19	18	2,401
1938	34	70	442	144	552	809	718	1,003	586	129	35	29	4,551
1939	42	57	61	67	86	236	310	159	47	10	7	6	1,088
1940	28	31	42	479	613	847	622	494	192	45	24	24	3,441
1941	26	56	264	359	485	461	452	703	276	81	28	21	3,212
1942	29	64	336	596	573	305	625	714	545	148	33	23	3,991
1943	22	163	293	706	392	946	599	439	258	78	22	15	3,933
1944	26	37	48	77	161	250	227	461	185	39	13	13	1,537
1945	28	130	142	111	566	259	408	550	272	65	17	16	2,564
1946	41	153	541	306	151	343	509	534	193	46	18	22	2,857
1947	34	99	103	65	174	295	284	242	86	17	11	9	1,419
1948	50	53	41	178	84	158	522	625	439	80	19	14	2,263
1949	28	50	73	67	101	364	507	518	155	23	11	10	1,907
1950	15	35	39	317	349	347	586	588	319	73	17	20	2,705
1951	57	979	1,067	594	434	433	425	457	149	38	18	16	4,667
1952	42	113	334	556	559	502	818	1,119	660	238	57	31	5,029
1953	28	33	120	470	157	232	467	489	500	158	28	24	2,706
1954	34	63	87	140	220	451	547	358	104	27	15	21	2,067
1955	27	46	132	164	107	168	239	467	202	23	12	19	1,606
1956	31	46	1,250	963	338	319	410	747	411	110	29	23	4,677
1957	51	56	71	76	298	447	301	557	277	42	13	12	2,201
1958	43	58	118	182	618	562	860	1,041	520	120	32	26	4,180
1959	30	47	38	164	220	199	274	191	64	3	0	12	1,242
1960	20	25	29	74	360	435	359	275	104	6	0	0	1,687
1961	16	53	75	44	130	157	236	264	99	0	0	0	1,074
1962	8	25	68	66	428	253	546	403	221	41	13	8	2,080
1963	322	69	199	247	743	238	661	764	275	51	8	20	3,597
1964	47	213	97	175	120	133	292	390	180	22	9	1	1,679
1965	8	82	1,506	794	296	240	620	523	313	92	39	11	4,524
1966	18	93	101	143	121	236	416	260	35	0	0	2	1,425
1967	20	92	301	430	283	548	452	886	747	241	33	20	4,053
1968	26	52	87	150	443	291	279	235	81	5	14	4	1,667
1969	30	116	153	1,102	514	370	682	934	464	112	20	27	4,524
1970	47	65	365	1,334	350	339	219	356	194	39	14	14	3,336
1971	28	196	371	302	222	399	424	549	418	106	25	17	3,057
1972	37	74	158	137	198	456	334	368	161	20	8	15	1,966
1973	43	114	249	606	410	370	417	625	199	30	13	29	3,105
1974	45	430	437	756	236	733	626	621	336	148	33	28	4,429
1975	38	49	70	107	261	440	326	733	500	102	30	20	2,676
1976	87	94	78	62	73	124	124	134	5	0	5	12	798
1977	24	9	1	19	24	36	64	86	42	0	0	0	305
1978	1	14	178	561	305	565	543	581	366	83	5	27	3,229
1979	12	28	49	201	230	364	375	634	160	30	3	8	2,094
1980	49	83	98	1,217	730	415	403	482	287	122	14	24	3,924
1981	23	33	64	97	142	258	285	212	33	0	0	0	1,147
1982	34	536	839	523	908	708	1,132	815	377	127	24	59	6,082
1983	152	288	579	486	710	1,182	626	979	949	377	92	71	6,491
1984	63	717	969	400	301	385	324	469	226	40	10	17	3,921
1985	47	192	124	83	148	212	423	269	67	0	0	23	1,588
1986	14	76	157	350	1,827	1,053	442	411	229	43	20	31	4,653
MEAN	34	98	204	315	347	403	465	520	291	75	19	17	2,788

PLATE 13

HISTORICAL MONTHLY INFLOWS TO FOLSOM LAKE

Values in 1000's of Acre Feet

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1955	N/A	N/A	N/A	N/A	N/A	164.1	244.3	483.2	218.4	41.4	26.3	26.9	N/A
1956	35.8	48.7	1,261.3	977.1	340.5	334.6	419.8	770.8	420.3	114.5	29.2	28.3	4,781.0
1957	53.4	61.8	70.8	77.5	300.4	455.2	317.5	566.6	293.2	57.4	22.0	21.4	2,296.9
1958	45.3	60.8	113.5	172.5	597.9	579.3	826.5	1,042.3	532.3	129.8	40.5	29.2	4,206.1
1959	34.3	46.2	37.2	160.3	214.1	196.8	277.7	199.1	73.9	19.4	11.4	21.6	1,292.0
1960	26.6	23.6	28.5	73.0	361.3	441.7	356.6	276.3	118.6	26.8	14.8	13.1	1,761.1
1961	23.4	54.2	70.8	45.3	128.5	157.6	237.0	267.4	120.1	34.5	24.8	17.1	1,180.7
1962	19.2	33.1	73.9	69.6	423.3	251.3	542.3	398.4	237.7	58.1	36.7	27.8	2,171.4
1963	324.7	70.8	182.6	244.1	682.8	216.9	613.7	660.4	278.8	64.4	23.5	24.3	3,386.8
1964	104.4	244.3	146.0	218.0	131.0	124.9	255.9	325.6	180.1	75.8	64.9	43.3	1,914.2
1965	29.3	99.2	1,328.4	787.5	324.0	241.3	559.2	480.7	271.5	138.2	89.7	73.0	4,422.1
1966	80.7	107.1	152.3	169.8	133.7	198.8	267.3	174.7	79.4	52.9	54.1	45.9	1,516.5
1967	52.6	92.9	293.8	435.3	293.5	517.7	477.9	712.4	582.4	282.7	146.3	99.8	3,987.4
1968	93.0	124.9	152.1	175.8	349.6	231.4	198.2	172.6	116.8	72.8	86.1	76.0	1,844.5
1969	94.7	137.2	185.0	993.2	591.2	457.2	608.8	653.9	386.0	170.7	146.9	124.3	4,549.3
1970	108.4	141.3	326.3	1,128.2	391.8	335.5	204.9	233.6	191.4	103.9	123.9	90.7	3,379.9
1971	101.9	209.8	427.6	333.0	240.7	334.1	301.9	354.3	313.6	169.7	143.7	111.1	3,041.5
1972	104.9	96.3	191.2	201.5	225.9	302.8	241.8	227.5	140.4	99.4	136.4	99.8	2,067.9
1973	103.4	139.9	252.6	595.4	453.0	407.9	306.5	374.9	172.8	92.5	93.7	100.9	3,093.4
1974	90.8	350.2	448.0	683.5	284.6	699.3	592.0	494.7	329.0	177.3	132.2	126.6	4,408.3
1975	112.4	120.0	115.8	158.4	270.1	422.5	340.8	505.7	348.3	138.5	119.7	133.4	2,785.6
1976	125.2	93.5	115.9	100.0	134.4	153.8	83.3	89.1	42.4	63.4	65.7	75.4	1,142.2
1977	58.0	26.0	27.3	29.1	21.4	32.7	34.9	43.1	25.4	11.4	24.1	24.1	357.6
1978	20.7	18.9	129.5	499.5	304.5	496.6	472.9	459.3	256.8	120.3	103.2	81.2	2,963.5
1979	50.1	87.6	82.9	229.1	265.3	335.1	298.3	428.6	154.3	117.9	114.4	113.3	2,276.7
1980	88.8	100.1	144.8	986.9	711.5	474.9	403.1	406.7	237.0	179.8	109.1	129.2	3,971.9
1981	83.6	102.4	144.4	130.6	137.5	234.6	188.7	130.5	64.3	66.8	61.2	67.2	1,411.8
1982	62.5	384.0	727.1	598.1	850.9	715.7	1,086.8	769.4	400.2	215.1	163.6	140.2	6,113.4
1983	165.5	318.5	602.1	491.1	743.4	1,196.5	681.0	822.1	773.9	405.7	187.4	154.2	6,541.2
1984	119.8	629.1	934.2	463.7	358.9	399.8	332.7	337.6	208.5	118.7	129.7	126.5	4,159.2
1985	82.9	190.8	168.6	108.6	174.8	203.3	275.5	170.7	94.1	104.8	105.7	116.4	1,796.2
1986	54.1	85.7	174.9	290.9	1,621.3	966.2	395.7	365.7	249.5	121.9	121.3	126.1	4,573.3
MEAN	82.3	138.7	293.9	375.1	389.1	383.8	388.9	418.7	247.1	114.0	86.0	77.8	2,995.4



LEVEES MAINTAINED BY:

(1) Reclamation District No. 1000

(2) American River Flood Control District

(3) California Exposition (Cal Expo)

(4) State of California Maintenance Area No. 10

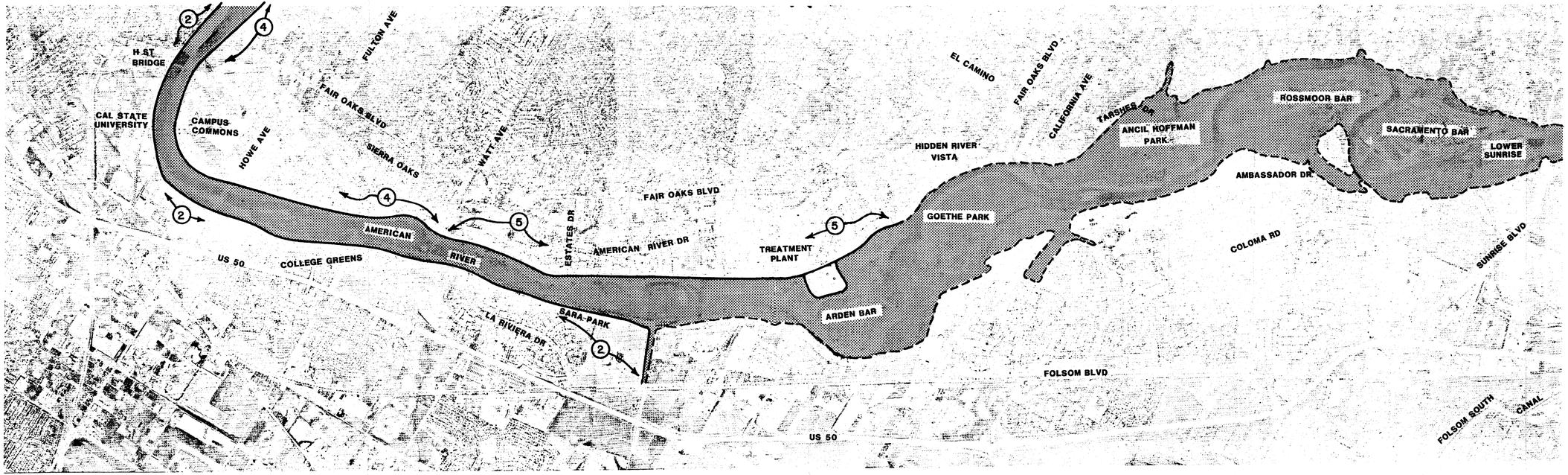
PROJECT LEVEE

AREA INUNDATED BY 115,000 cfs RELEASE FROM FOLSOM DAM.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

AMERICAN RIVER
LEVEE SYSTEM

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



LEVEES MAINTAINED BY:

(2) American River Flood Control District

(4) State of California Maintenance Area No. 10

(5) State of California Maintenance Area No. 11

PROJECT LEVEE

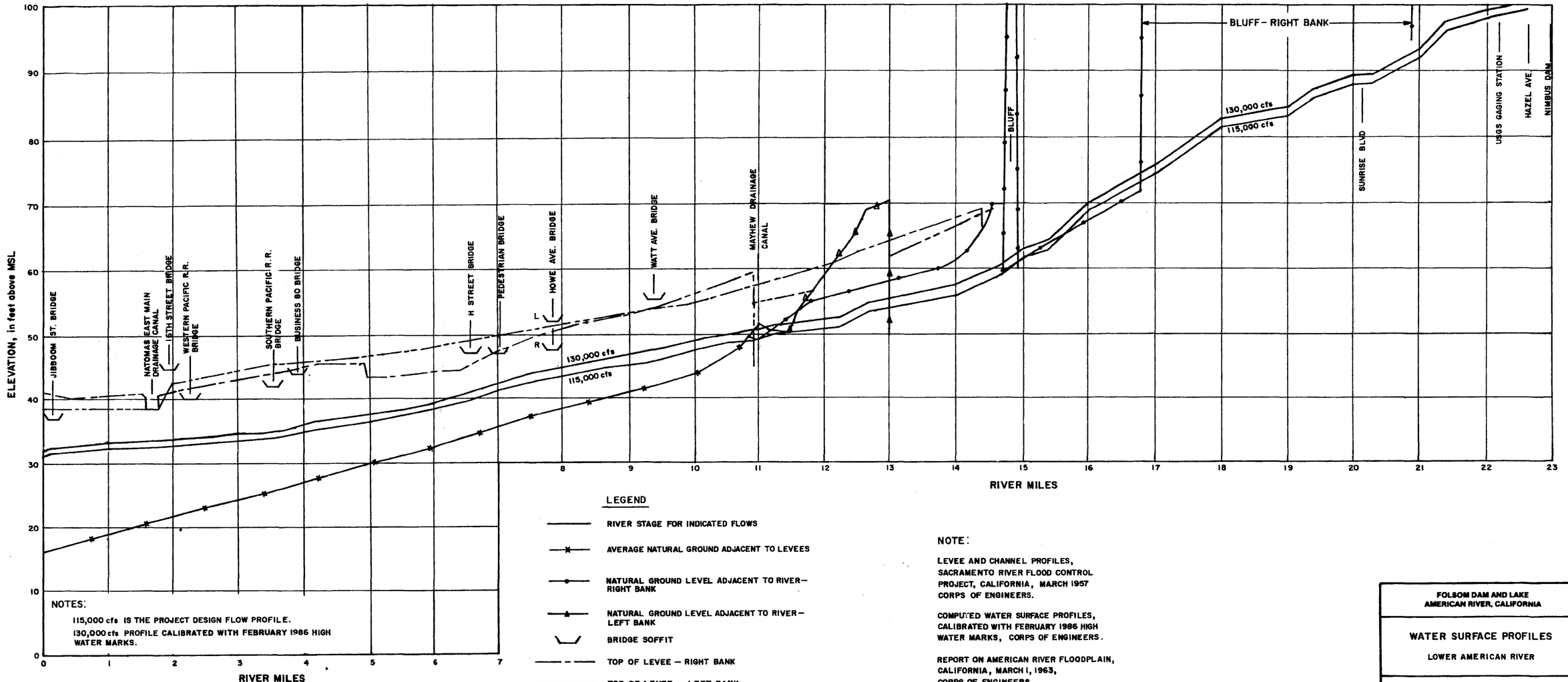
INUNDATION AREA BOUNDARY

AREA INUNDATED BY 115,000 cfs RELEASE FROM FOLSOM DAM.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

AMERICAN RIVER
LEVEE SYSTEM

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



NOTES:

115,000 cfs IS THE PROJECT DESIGN FLOW PROFILE.

130,000 cfs PROFILE CALIBRATED WITH FEBRUARY 1986 HIGH WATER MARKS.

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

NOTE:

LEVEE AND CHANNEL PROFILES, SACRAMENTO RIVER FLOOD CONTROL PROJECT, CALIFORNIA, MARCH 1957 CORPS OF ENGINEERS.

COMPUTED WATER SURFACE PROFILES, CALIBRATED WITH FEBRUARY 1986 HIGH WATER MARKS, CORPS OF ENGINEERS.

REPORT ON AMERICAN RIVER FLOODPLAIN, CALIFORNIA, MARCH 1, 1963, CORPS OF ENGINEERS.

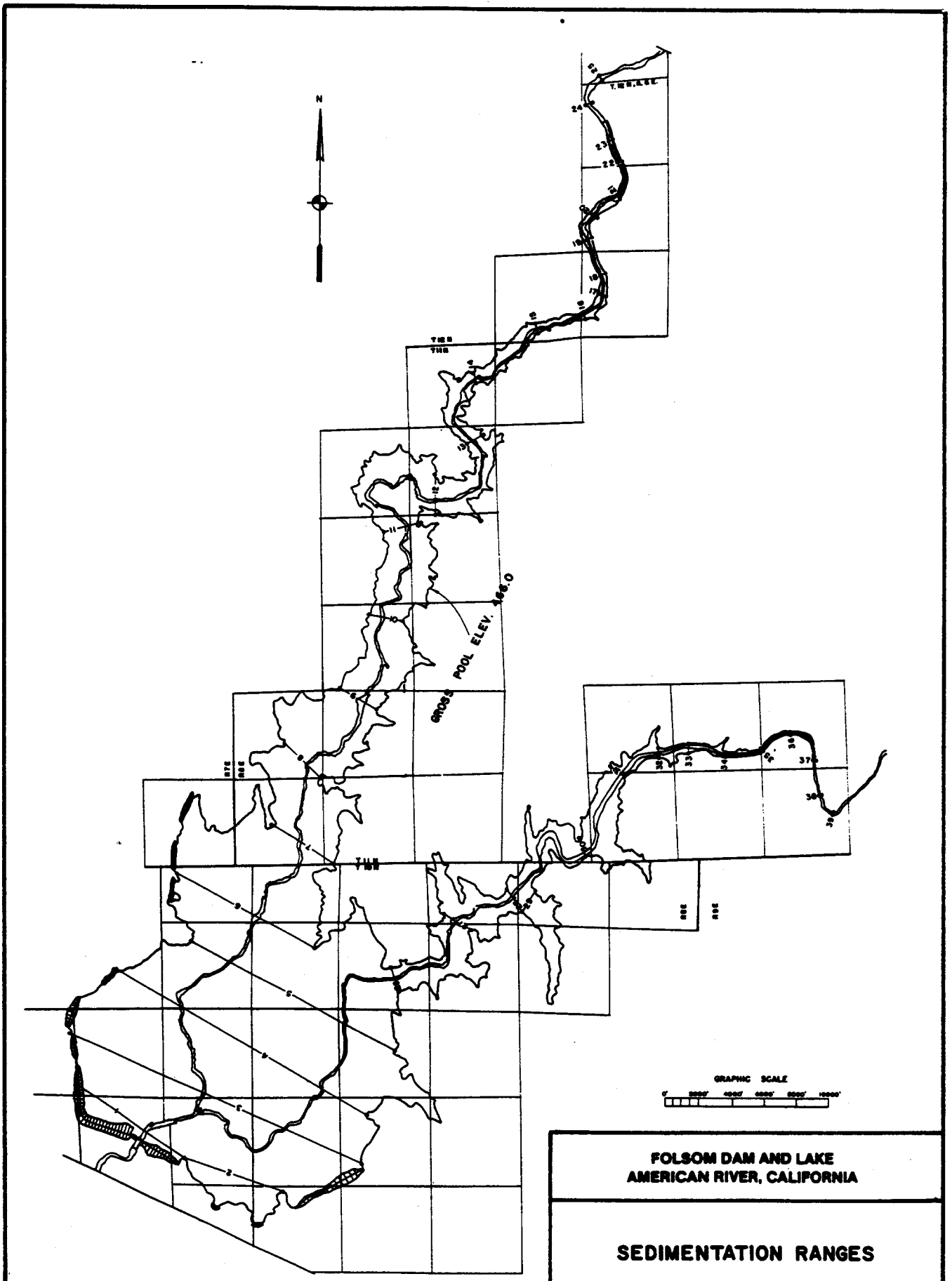
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

WATER SURFACE PROFILES

LOWER AMERICAN RIVER

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 16

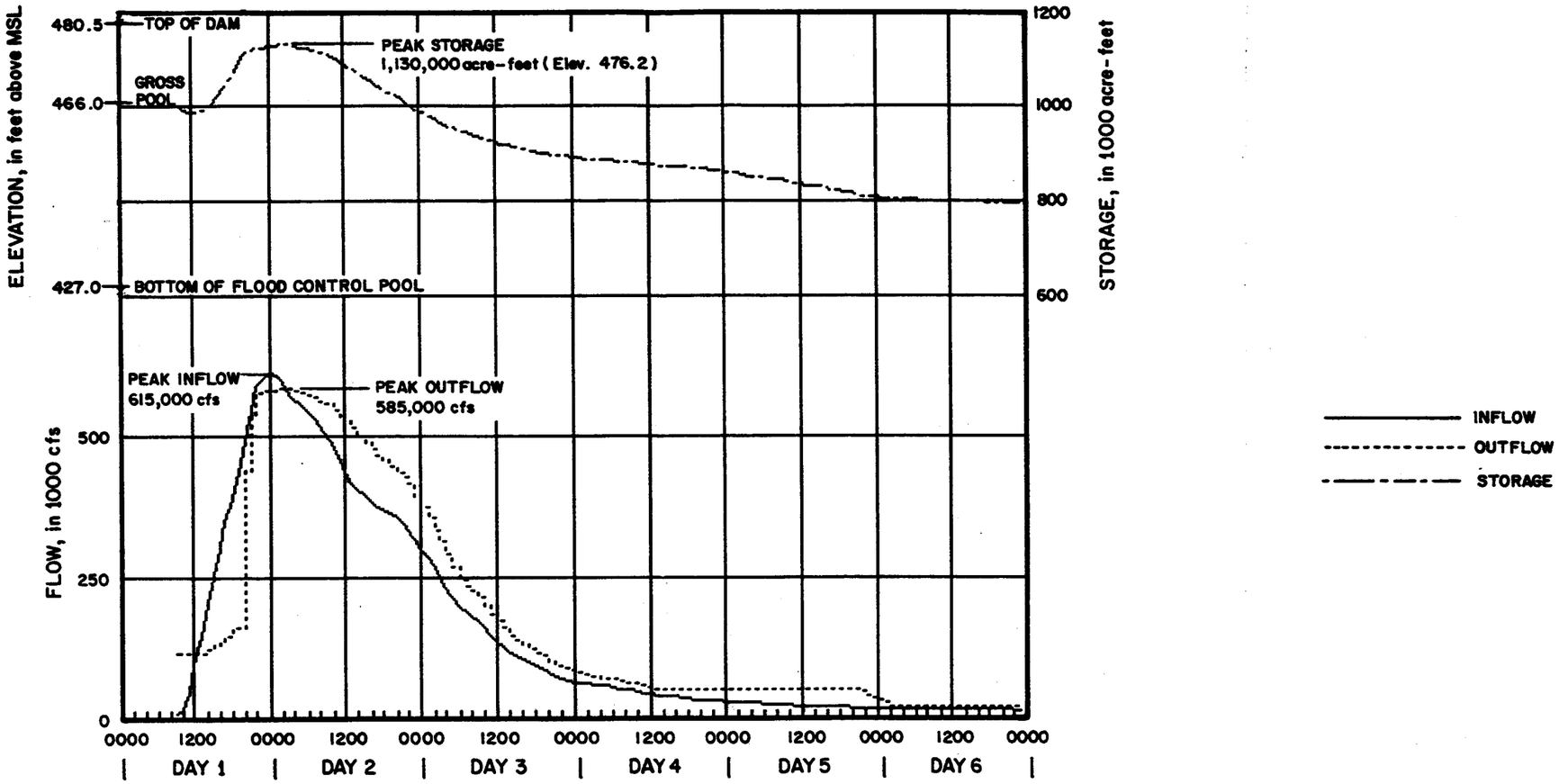


FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

SEDIMENTATION RANGES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 17



NOTES:

GROSS POOL, 1,010,000 acre-feet
BOTTOM OF FLOOD CONTROL RESERVATION, 610,000 acre-feet

INITIAL RELEASE 115,000 cfs

THE FLOOD WAS ROUTED IN ACCORDANCE WITH CRITERIA SHOWN ON EMERGENCY SPILLWAY RELEASE DIAGRAM, CHART A-9.

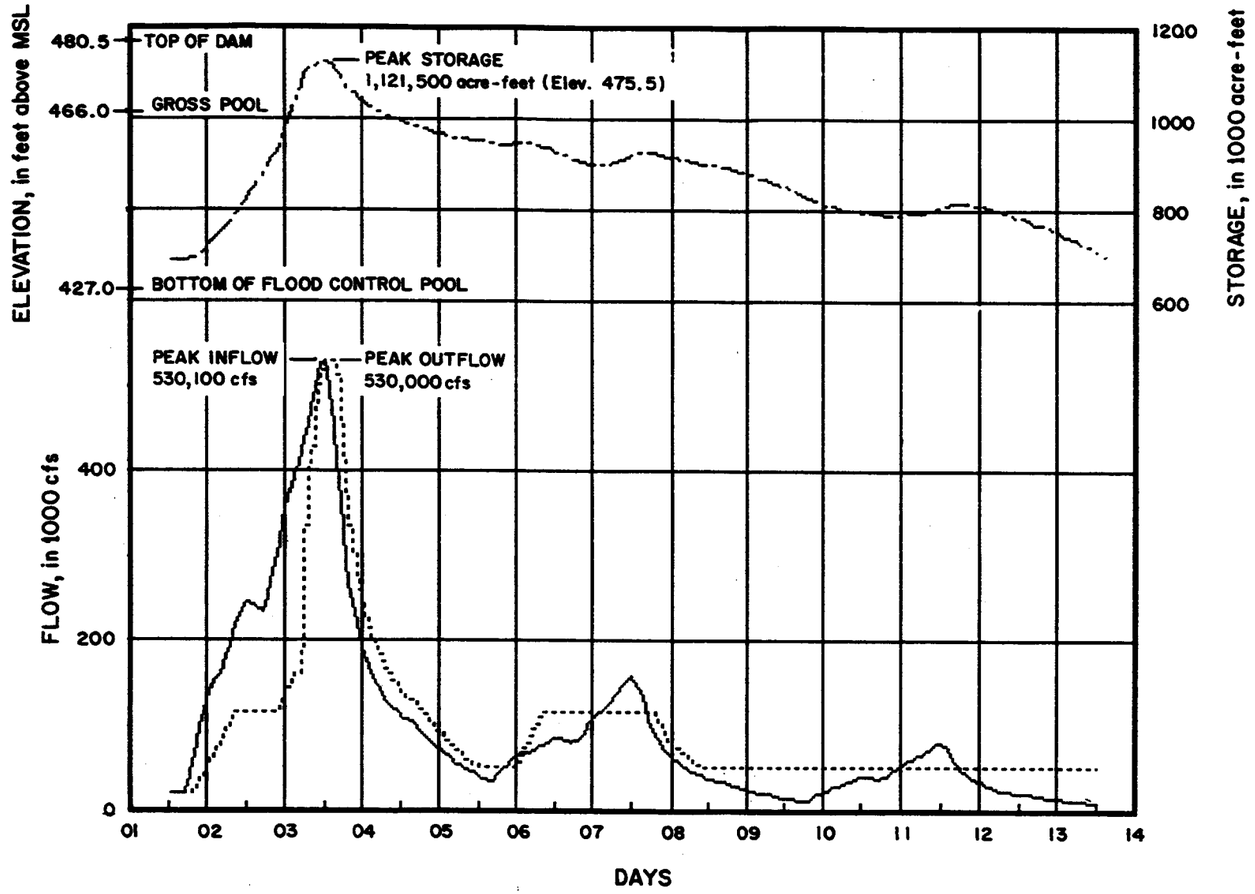
ALL SPILLWAY GATES WERE UTILIZED.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

SPILLWAY DESIGN FLOOD

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 18



NOTES:

THIS FLOOD ASSUMES:

a. INITIAL RELEASE OF 20,000 cfs.

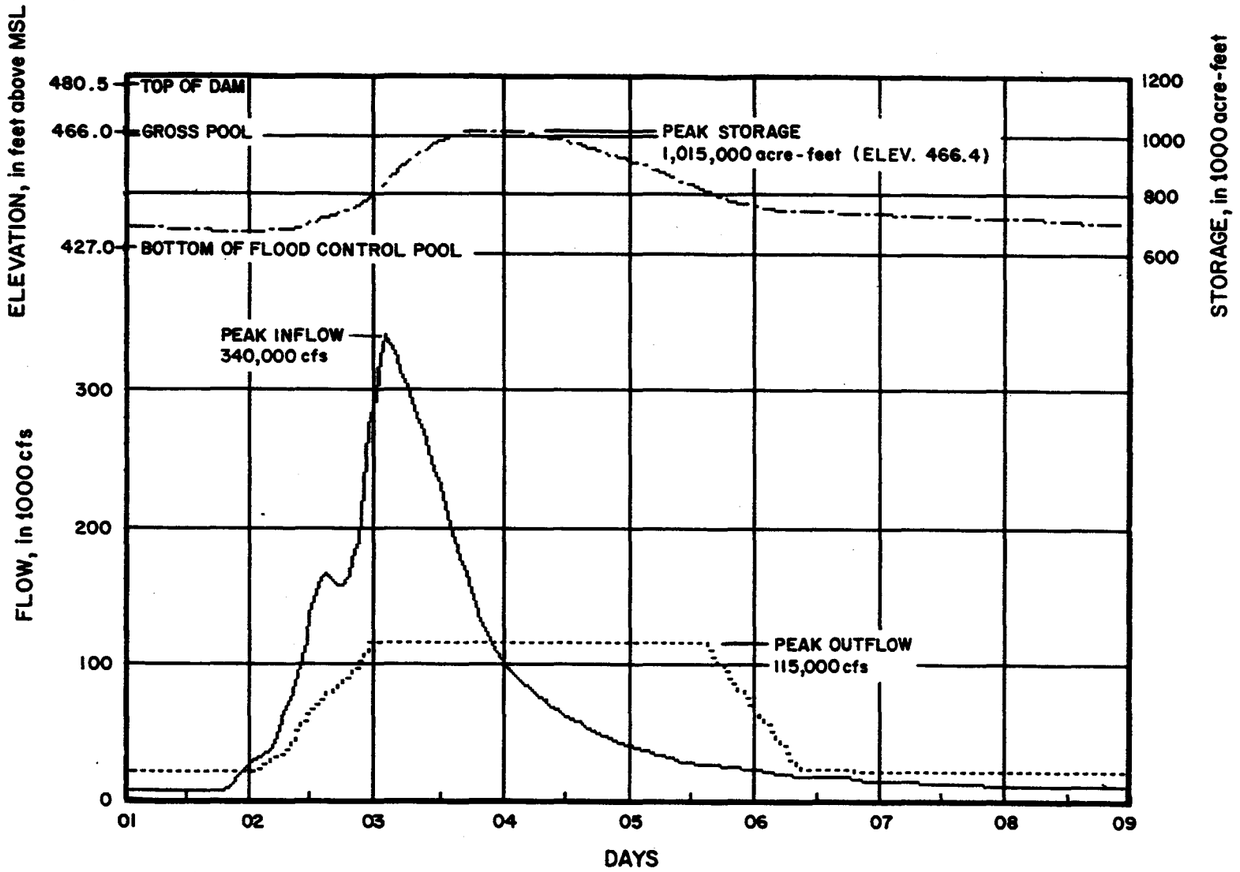
b. STARTING STORAGE OF 690,000 acre-feet TO REFLECT A CONTINGENCY OF 80,000 acre-feet.

c. THIS FLOOD WAS ROUTED IN ACCORDANCE WITH CRITERIA SHOWN ON EMERGENCY SPILLWAY RELEASE DIAGRAM, CHART A-9. ALL EIGHT SPILLWAY GATES WERE UTILIZED.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

STANDARD PROJECT FLOOD

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



NOTES:

THIS FLOOD ASSUMES:

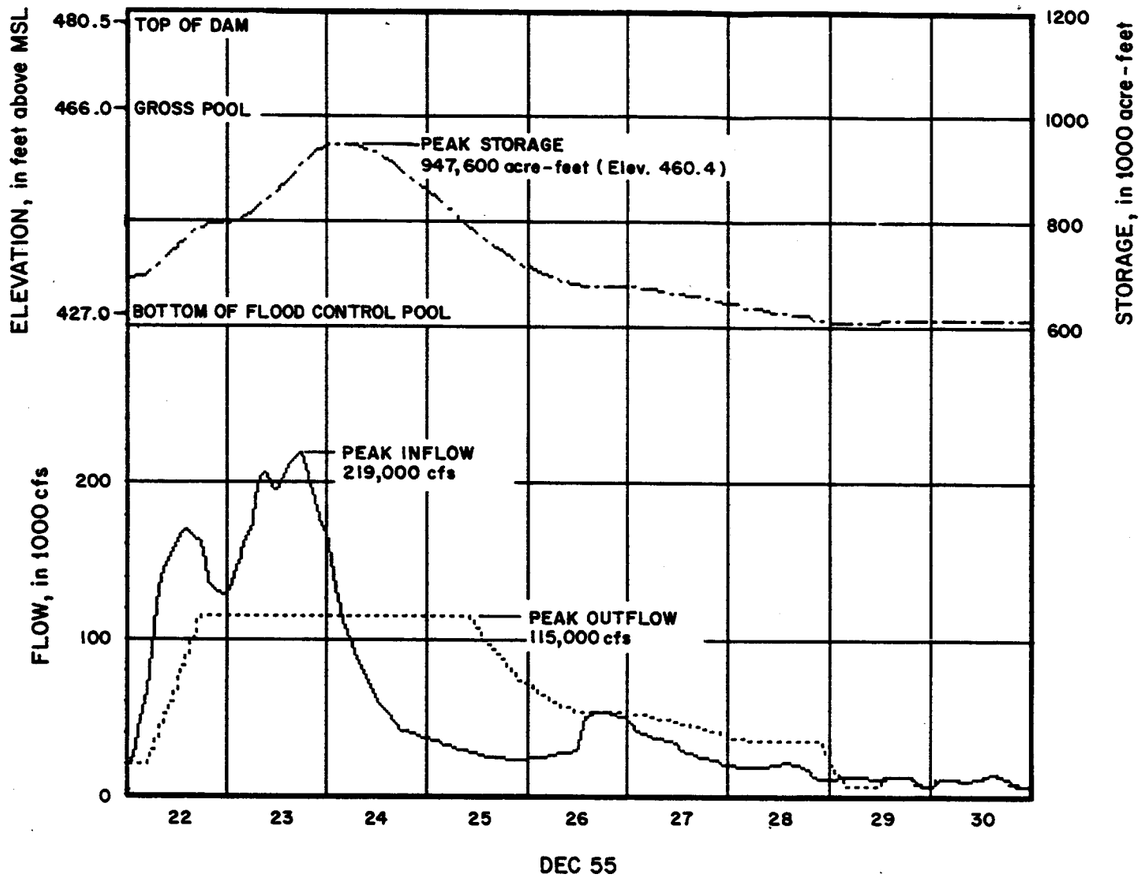
a. Initial release of 20,000 cfs.

b. Inflow hydrograph to Folsom reduced by 47,000 acre-feet to reflect effective upstream storage.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

RESERVOIR DESIGN FLOOD

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



NOTES:

THIS FLOOD ASSUMES:

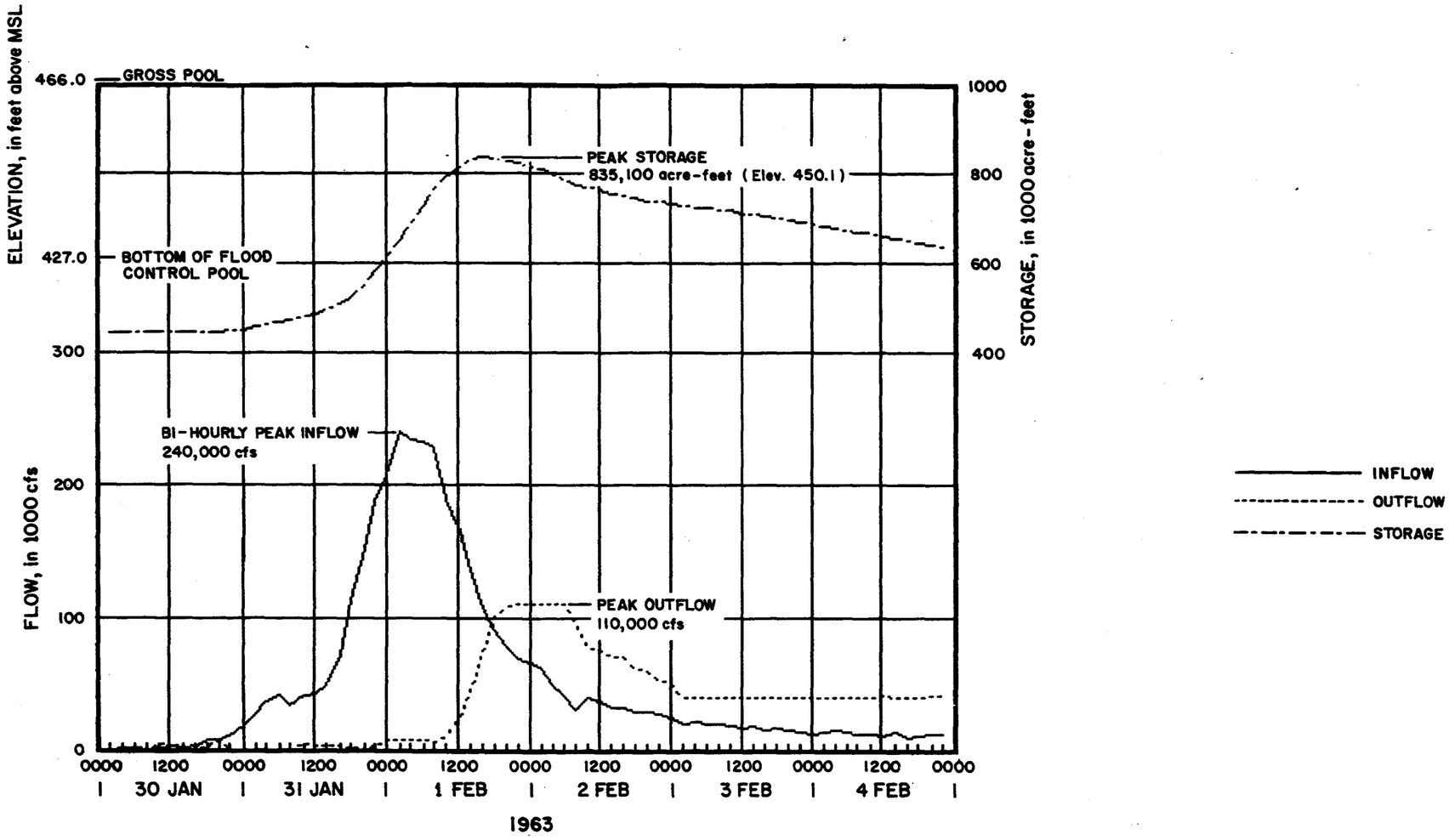
a. INITIAL RELEASE OF 20,000 cfs:

b. STARTING STORAGE OF 690,000 acre-feet TO REFLECT A CONTINGENCY OF 80,000 acre-feet.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HYPOTHETICAL OPERATION
1955 FLOOD

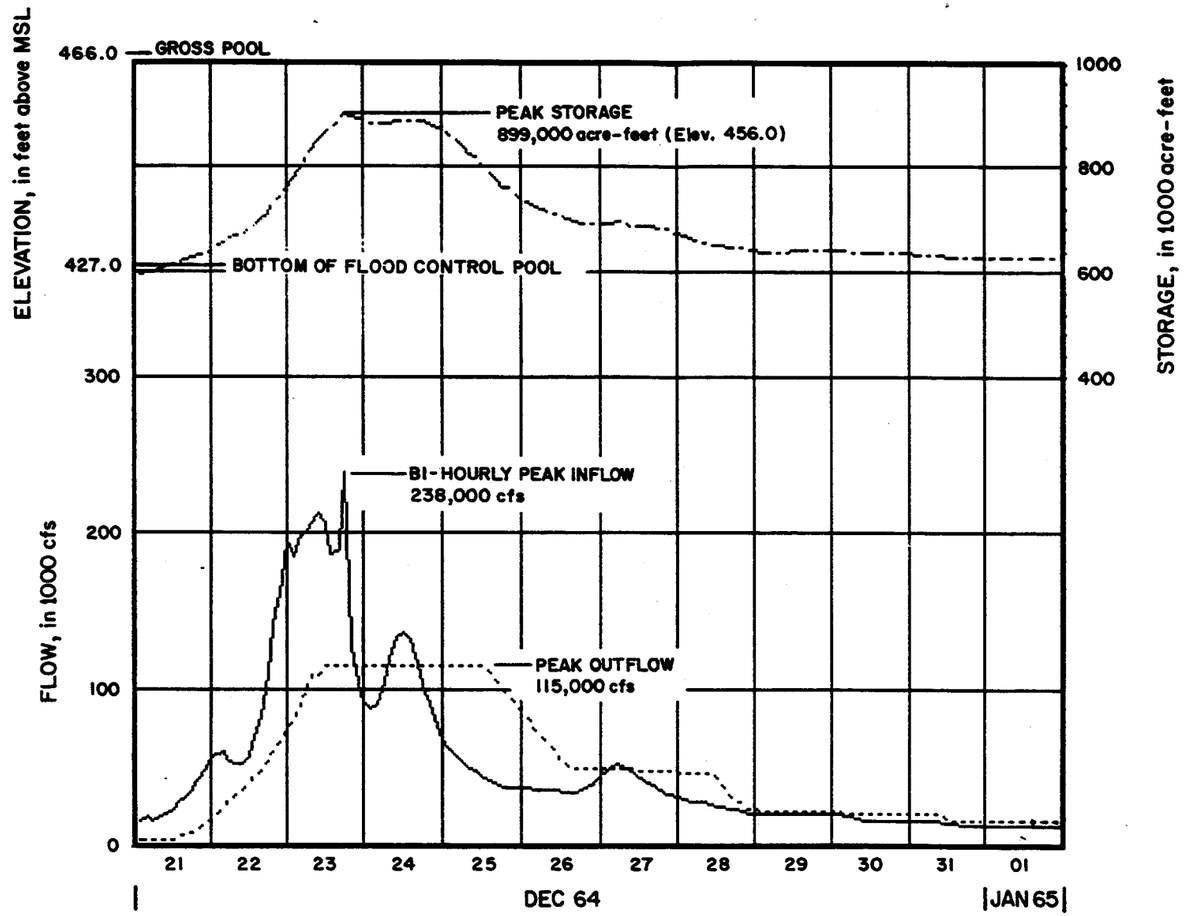
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
1963 FLOOD

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

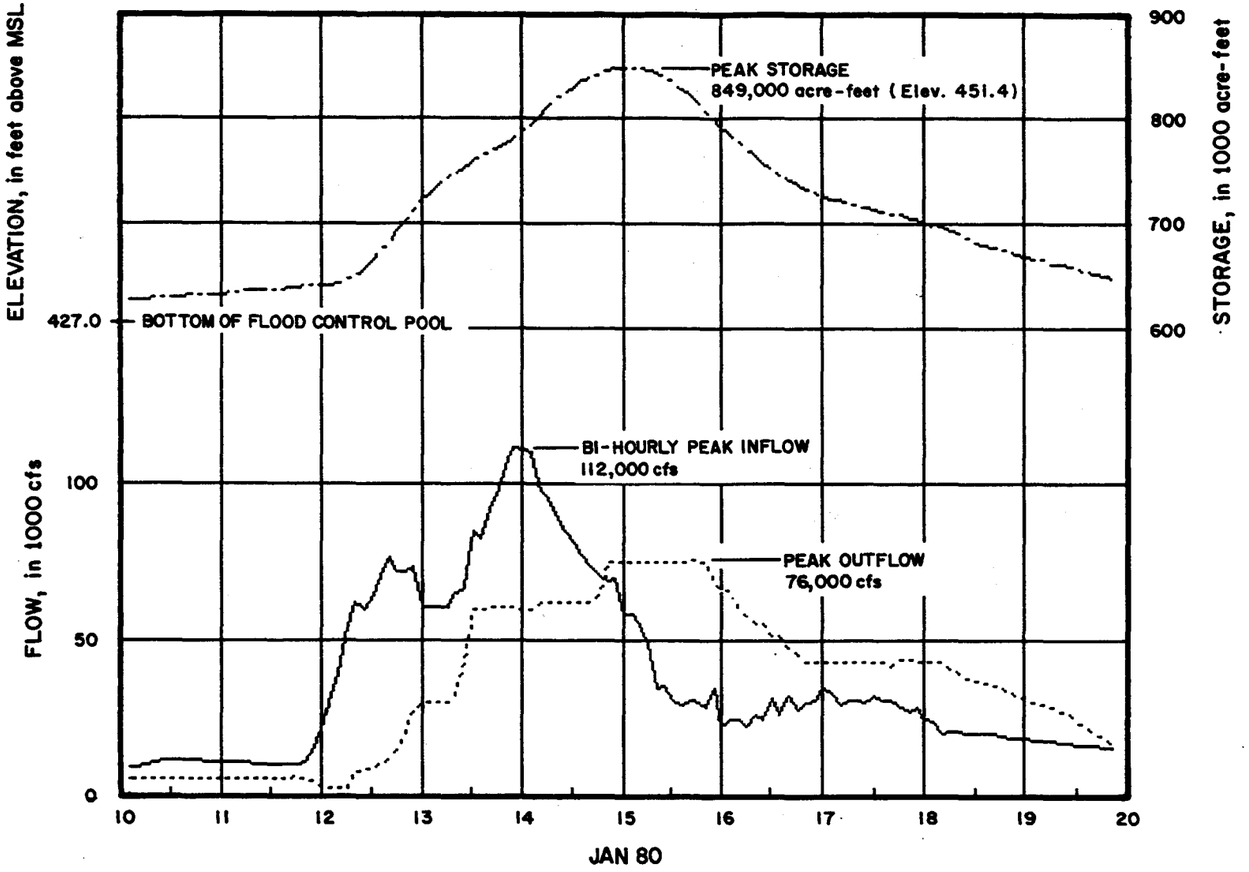


NOTE: PEAK INFLOW RESULTED FROM THE FAILURE OF THE PARTIALLY COMPLETED HELL HOLE DAM.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
1964 FLOOD

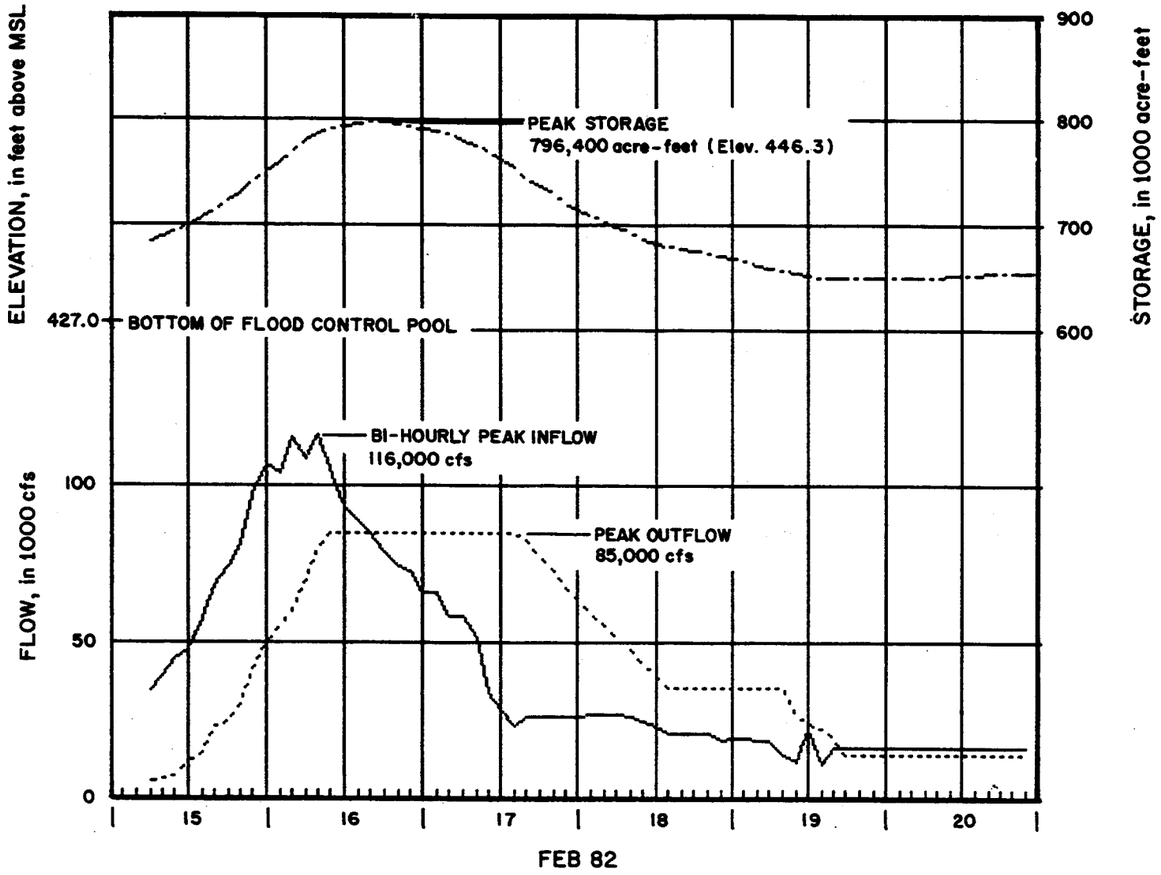
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
1980 FLOOD

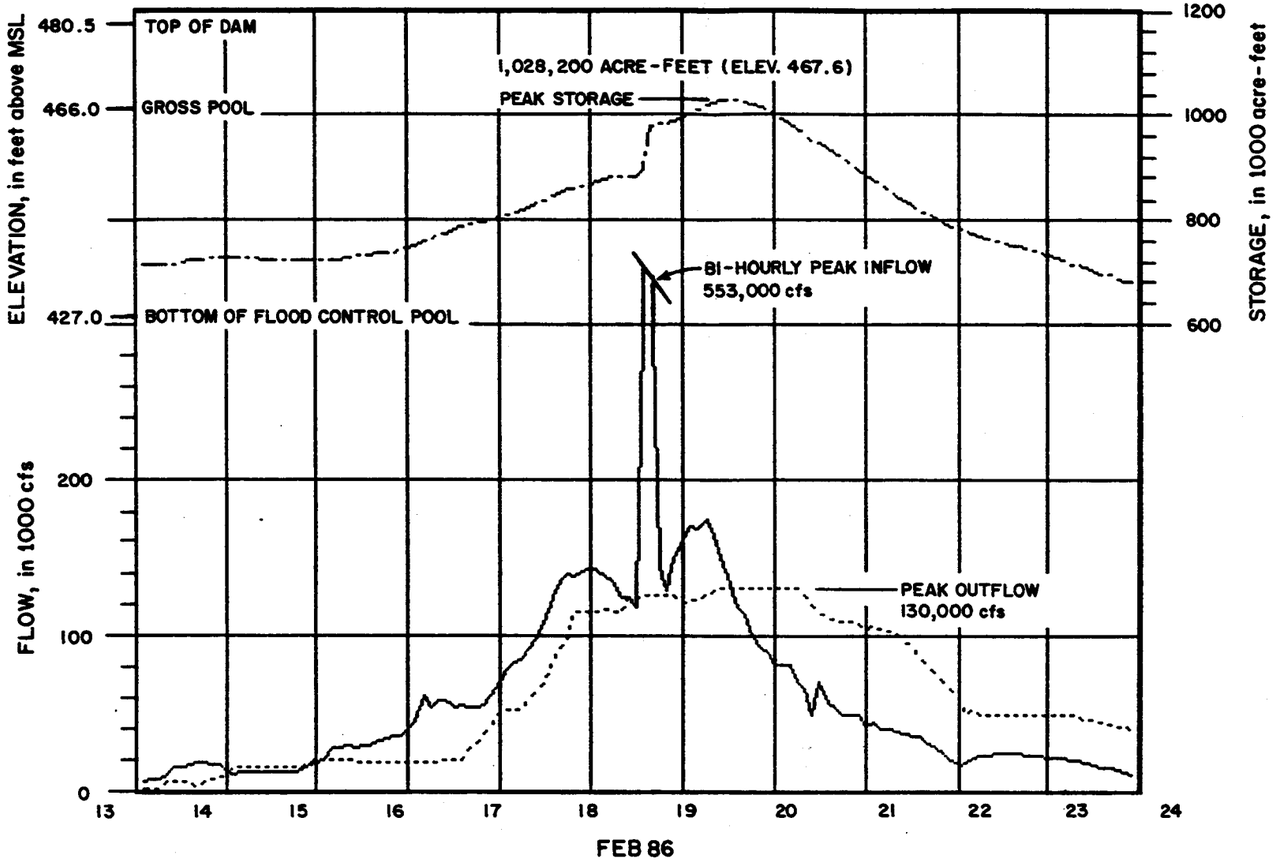
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
1982 FLOOD

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



NOTE: PEAK INFLOW RESULTED FROM THE FAILURE OF AUBURN COFFER DAM.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
1986 FLOOD

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

ANNUAL MAXIMUM SNOWMELT FLOWS
AMERICAN RIVER AT FAIR OAKS
UNREGULATED CONDITION

(FLOWS IN CFS)

WATER YEAR	1-DAY		3-DAY		7-DAY		15-DAY		30-DAY		60-DAY		90-DAY		120-DAY	
	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW
1905	17 May	9,080	16 May	8,627	15 May	7,917	14 May	6,855	1 May	6,221	1 May	4,645	1 May	3,341	1 May	2,578
1906	28 May	26,600	27 May	23,000	5 May	19,343	10 Jun	18,046	26 May	17,890	27 Apr	15,852	1 Apr	14,482	1 Apr	12,530
1907	15 Apr	21,000	13 Apr	20,066	13 Apr	18,214	11 Apr	17,373	1 Apr	15,643	1 Apr	13,911	1 Apr	13,007	1 Apr	11,211
1908	14 Apr	7,030	12 Apr	6.610	11 Apr	5,961	11 Apr	5,566	11 Apr	5,121	11 Apr	4,626	15 Mar	4,222	11 Mar	3,684
1909	4 May	13,000	9 May	12,400	4 May	11,971	28 Apr	11,423	18 Apr	10,690	16 Apr	9,644	2 Apr	8,433	2 Apr	6,917
1910	21 Apr	12,400	20 Apr	12,100	21 Apr	11,928	15 Apr	11,388	2 Apr	10,503	29 Mar	9,367	29 Mar	7,241	29 Mar	5,573
1911	6 Jun	23,800	11 Jun	24,400	10 Jun	23,443	5 Jun	22,906	22 May	20,270	23 Apr	17,201	15 Apr	13,975	15 Apr	10,839
1912	2 Jun	11,300	2 Jun	10,433	30 May	9,424	25 May	8,206	9 May	7,835	24 Apr	6,102	28 Mar	4,903	10 Mar	4,106
1913	27 Apr	10,900	26 Apr	9,360	23 Apr	8,041	6 May	8,158	26 Apr	7,538	3 Apr	6,677	22 Mar	5,432	3 Mar	4,445
1914	20 Apr	16,000	14 Apr	14,233	14 Apr	13,628	4 May	12,613	3 May	11,858	5 Apr	10,740	6 Mar	9,796	1 Mar	9,039
1915	18 May	20,600	18 May	18,433	18 May	14,971	18 May	14,387	18 May	12,425	18 May	8,027	18 May	5,595	18 May	4,264
1916	6 May	17,000	4 May	15,900	2 May	13,957	24 Apr	13,280	8 Apr	12,490	28 Mar	11,079	28 Mar	9,788	28 Mar	7,965
1917	14 May	15,500	13 May	14,367	9 May	13,628	4 May	12,167	6 May	10,588	1 May	9,721	1 May	7,086	1 May	5,413
1918	23 Apr	9,600	22 Apr	9,000	1 May	8,400	22 Apr	8,300	16 Apr	7,080	16 Apr	5,130	16 Apr	3,687	16 Apr	2,801
1919	1 May	16,200	1 May	15,667	29 Apr	14,543	23 Apr	12,669	18 Apr	11,265	30 Mar	9,736	23 Mar	7,535	23 Mar	5,767
1920	19 May	11,400	18 May	10,800	16 May	9,997	8 May	8,309	27 Apr	7,411	16 Apr	6,447	16 Apr	4,753	16 Apr	3,619
1921	14 May	13,800	13 May	12,633	11 May	10,763	13 May	9,282	29 Apr	8,934	18 Apr	8,300	21 Mar	7,924	21 Mar	6,566
1922	18 May	23,200	18 May	22,167	15 May	20,814	14 May	18,260	7 May	17,297	23 Apr	14,884	4 Apr	11,965	4 Apr	9,327
1923	10 May	14,900	8 May	13,833	6 May	12,357	5 May	11,877	28 Apr	10,141	10 Apr	9,032	10 Apr	7,342	10 Apr	5,761
1924	9 Apr	2,930	9 Apr	2,780	8 Apr	2,760	8 Apr	2,393	8 Apr	2,246	25 Mar	1,798	1 Mar	1,471	1 Mar	1,161
1925	5 May	15,500	4 May	15,033	2 May	13,486	25 Apr	11,752	26 Apr	10,220	20 Apr	8,405	20 Apr	6,375	20 Apr	4,899
1926	14 Apr	8,960	13 Apr	8,273	12 Apr	7,674	12 Apr	6,603	12 Apr	5,903	12 Apr	4,005	12 Apr	2,830	12 Apr	2,173
1927	28 Apr	17,600	25 Apr	16,433	24 Apr	14,914	23 Apr	12,927	21 Apr	12,107	20 Apr	9,883	10 Apr	8,125	10 Apr	6,333
1928	1 May	11,800	30 Apr	10,733	27 Apr	9,310	28 Apr	9,037	16 Apr	7,744	16 Apr	5,412	16 Apr	3,853	16 Apr	2,964
1929	4 May	7,200	3 May	6,833	3 May	6,657	3 May	6,613	26 Apr	6,082	29 Mar	4,701	23 Mar	4,098	17 Mar	3,425
1930	14 Apr	7,580	22 Apr	7,580	19 Apr	6,954	13 Apr	6,351	27 Mar	6,003	25 Mar	5,286	12 Mar	4,759	12 Mar	3,977
1931	29 Apr	3,880	28 Apr	3,760	27 Apr	3,543	22 Apr	3,149	8 Apr	2,842	20 Mar	2,550	20 Mar	2,000	20 Mar	1,599
1932	12 May	14,800	11 May	14,200	11 May	13,814	8 May	12,471	1 May	10,554	16 Apr	8,762	28 Mar	7,984	24 Mar	6,718
1933	30 May	12,700	29 May	12,067	27 May	10,803	26 May	9,153	19 May	7,876	22 Apr	6,073	28 Mar	5,205	4 Mar	4,447
1934	24 Apr	3,700	7 Apr	3,340	8 Apr	3,289	7 Apr	3,121	7 Apr	2,905	7 Apr	2,063	7 Apr	1,575	7 Apr	1,227
1935	23 May	12,700	22 May	12,633	22 May	12,143	9 May	10,796	7 May	10,674	1 May	8,306	1 May	5,900	1 May	4,495
1936	18 Apr	14,400	16 Apr	14,267	16 Apr	13,643	12 Apr	12,733	15 Apr	11,313	10 Apr	9,846	8 Apr	8,162	8 Apr	6,388
1937	15 May	15,900	13 May	15,367	12 May	13,771	3 May	12,961	19 Apr	11,173	1 Apr	9,759	1 Apr	7,771	1 Apr	6,062
1938	15 May	27,200	14 May	26,400	12 May	23,114	13 May	19,420	10 May	17,790	12 Apr	15,256	8 Apr	12,422	8 Apr	9,706
1939	3 Apr	7,380	3 Apr	7,187	3 Apr	7,014	1 Apr	6,180	21 Mar	5,754	14 Mar	4,617	13 Mar	3,742	13 Mar	2,924
1940	12 May	11,300	11 May	10,933	10 May	10,044	6 Apr	9,547	6 Apr	8,849	6 Apr	8,200	6 Apr	6,363	6 Apr	4,932
1941	13 May	18,000	12 May	16,767	8 May	14,785	4 May	13,626	29 Apr	11,696	9 Apr	9,260	9 Apr	7,383	9 Apr	5,772
1942	26 May	22,800	24 May	18,400	21 May	16,914	15 May	13,784	18 May	12,532	13 Apr	11,286	9 Apr	9,980	9 Apr	7,869
1943	2 May	13,200	2 May	11,367	30 Apr	10,441	30 Apr	8,754	30 Apr	7,297	30 Apr	5,953	30 Apr	4,435	30 Apr	3,422
1944	8 May	10,900	7 May	10,533	5 May	9,863	2 May	8,980	1 May	7,573	12 Apr	5,917	11 Mar	5,087	9 Mar	4,356
1945	4 May	13,900	3 May	13,433	2 May	13,271	28 Apr	12,500	19 Apr	11,098	17 Apr	8,318	1 Apr	6,867	1 Apr	5,434
1946	26 Apr	13,300	25 Apr	12,633	24 Apr	12,057	24 Apr	11,880	16 Apr	10,822	7 Apr	8,636	5 Apr	6,690	5 Apr	5,182
1947	3 May	7,900	3 May	7,583	2 May	6,913	26 Apr	5,527	10 Apr	5,282	16 Mar	4,847	16 Mar	4,081	16 Mar	3,216
1948	27 May	14,800	25 May	13,867	13 May	11,830	13 May	11,199	6 May	10,561	11 May	7,770	11 May	5,415	11 May	4,130
1949	15 May	14,500	23 Apr	13,633	22 Apr	12,443	15 Apr	11,344	17 Apr	10,483	6 Apr	8,629	11 Mar	7,343	10 Mar	5,941
1950	22 Apr	14,600	21 Apr	13,867	20 Apr	12,714	15 May	11,560	9 May	10,046	5 Apr	9,931	26 Mar	8,544	26 Mar	6,871
1951	11 May	10,800	10 May	9,740	10 Apr	9,215	6 Apr	8,296	29 Apr	7,571	30 Mar	7,359	12 Mar	6,734	12 Mar	5,503
1952	28 May	21,700	27 May	20,400	23 May	19,800	18 May	19,360	8 May	18,376	13 Apr	16,845	27 Mar	14,699	21 Mar	12,446
1953	7 Jun	13,200	18 Jun	11,967	15 Jun	10,340	7 Jun	9,610	29 May	8,492	27 Apr	9,067	27 Apr	7,202	27 Apr	5,539
1954	18 Apr	10,800	17 Apr	10,453	17 Apr	10,123	15 Apr	9,753	10 Apr	8,658	11 Apr	6,417	11 Apr	4,702	11 Apr	3,611
1955	9 May	10,528	21 May	10,120	7 May	9,850	9 May	8,584	5 May	7,786	16 Apr	6,400	20 Mar	5,320	1 Mar	4,512
1956	23 May	17,396	22 May	16,161	20 May	14,779	17 May	12,964	9 May	11,370	9 May	8,368	9 May	6,019	9 May	4,626
1957	2 Jun	9,995	26 May	9,615	27 May	9,343	24 May	8,781	24 May	6,423	24 May	3,812	24 May	2,635	24 May	2,014
1958	23 May	22,827	22 May	21,374	18 May	20,727	10 May	18,459	3 May	17,154	11 Apr	14,382	11 Apr	11,717	11 Mar	12,336
1959	6 Apr	6,260	5 Apr	6,105	2 Apr	5,540	31 Mar	5,025	2 Apr	4,631	18 Mar	4,036	1 Mar	3,675	1 Mar	3,056
1960	7 Apr	9,551	6 Apr	9,038	5 Apr	8,539	27 Mar	7,978	20 Mar	7,106	18 Mar	6,040	17 Mar	5,153	17 Mar	3,984
1961	4 Apr	6,914	3 Apr	6,455	2 Apr	5,417	10 May	4,926	28 Apr	4,425	30 Mar	4,155	30 Mar	3,414	30 Mar	2,543
1962	15 Apr	13,018	14 Apr	12,273	13 Apr	11,540	6 Apr	10,265	11 Apr	9,814	27 Mar	7,908	23 Mar	6,731	12 Mar	5,530
1963	20 May	16,430	19 May	15,249	18 May	14,510	16 May	13,051	1 May	12,493	20 Apr	9,595	20 Apr	6,987	20 Apr	5,305
1964	13 May	9,205	13 May	8,967	13 May	8,886	11 May	7,987	28 Apr	6,583	12 Apr	5,720	22 Mar	4,960	1 Mar	4,164
1965	30 Apr	16,190	29 Apr	15,629	25 Apr	14,514	23 Apr	12,192	23 Apr	10,476	23 Apr	8,390	23 Apr	6,381	23 Apr	4,989
1966	2 Apr	8,658	1 Apr	8,414	2 Apr	8,169	30 Mar	7,963	30 Mar	7,110	14 Mar	6,094	1 Mar	5,073	1 Mar	3,984
1967	23 May	24,551	22 May	24,011	20 May	22,572	16 May	19,698	16 May	15,751	13 May	13,225	13 May	9,375	13 May	7,124
1968	1 Apr	6,669	1 Apr	6,349	30 Mar	5,745	1 Apr	5,479	21 Mar	4,872	25 May	4,437	21 Mar	3,744	21 Mar	2,884
1969	12 May	21,952	11 May	20,532	9 May	19,147	7 May	17,318	7 May	15,543	12 Apr	13,456	25 Mar	11,964	11 Mar	9,911
1970	19 May	8,690	18 May	7,943	16 May	7,318	16 May	6,710	4 May	5,961	8 Apr	4,868	14 Mar	4,784	14 Mar	4,086
1971	12 May	11,931	15 May	11,615	11 May	11,454	12 May	10,058	30 Apr	9,002	30 Apr	8,073	1 Apr	7,748	1 Apr	6,282
1972	16 May	7,761	4 May	7,618	1 May	7,040	3 May	6,752	26 Apr	6,039	26 Apr	4,791	26 Apr	3,356	26 Apr	2,550
1973	14 May	14,817	14 May	14,544	14 May	14,314	11 May	12,265	26 Apr	10,690	7 Apr	8,899	26 Mar	7,159	26 Mar	5,553
1974	10 May	14,229	8 May	13,916	7 May	12,962	2 May	11,729	3 May	10,160	7 Apr	9,364	7 Apr	7,707	7 Apr	6,343
1975	19 May	16,929	18 May	16,254	14 May	15,749	14 May	14,191	11 May	13,863	28 Apr	10,438	28 Apr	7,670	28 Apr	5,872
1976	4 May	3,786	2 May	3,506	4 May	3,225	1 May	3,085	19 Apr	2,817	19 Mar	2,278	7 Mar	1,949	7 Mar	1,482
1977	10 Jun	2,358	27 May	2,090	22 May	1,841	14 May	1,679	6 May	1,507	7 Apr	1,343	14 Mar	1,152	1 Mar	961
1978	15 May	12,782	14 May	12,399	10 May	11,549	3 May	10,456	2 May	9,435	1 May	7,912	1 May	5,763	1 May	4,359
1979	6 May	13,306	17 May	13,029	16 May	12,626	14 May	11,472	1 May	10,455	1 May	6,652	1 May	4,606	1 May	3,465
1980	5 May	11,552	5 May	11,193	2 May	10,764	26 Apr	10,059	14 Apr	8,813	5 Apr	7,457	5 Apr	6,561	16 Mar	5,881
1981	25 Apr	8,432	24 Apr	7,795	23 Apr	6,559	19 Apr	6,173	6 Apr	5,153	29 Mar	4,230	29 Mar	3,153	29 Mar	2,306
1982	4 May	17,268	3 May	16,987	2 May	16,392	24 Apr	15,657	19 Apr	14,255	19 Apr	11,743	19 Apr	9,197	19 Apr	7,088
1983	30 May	26,398	28 May	26,061	25 May	24,714	21 May	21,704	20 May	19,857	28 Apr	16,399	1 Apr	14,189	1 Apr	12,273
1984	14 May	10,722	13 May	10,307	10 May	9,352	11 May	8,354	9 May	7,672	8 May	5,245	8 May	3,638	8 May	2,774
1985	15 Apr	10,783	15 Apr	10,369	11 Apr	9,493	4 Apr	9,027	4 Apr	7,258	1 Apr	5,784	1 Apr	4,256	1 Apr	3,190
1986	1 Apr	11,845	31 Mar	11,716	28 Mar	11,051	20 Mar	10,617	20 Mar	9,012	20 Mar	7,701	20 Mar	7,125	20 Mar	5,718

COMPUTED STATISTICS

YEARS RECORD	82	82	82	82	82	82	82	82
LOG MEAN	4.081	4.057	4.024	3.984	3.937	3.855	3.762	3.664
LOG STD.DEV.	0.211	0.212	0.212	0.211	0.211	0.218	0.226	0.235
SKEW	-0.999	-1.059	-1.060	-1.090	-0.992	-0.842	-0.673	-0.533

ADOPTED STATISTICS

LOG MEAN	4.089	4.066	4.033	3.993	3.946	3.864	3.771	3.673
LOG STD.DEV.	0.192	0.193	0.196	0.198	0.201	0.207	0.213	0.219
SKEW	-0.800	-0.800	-0.800	-0.800	-0.700	-0.600	-0.500	-0.400

PLATE 20

ANNUAL MAXIMUM RAIN FLOODS
AMERICAN RIVER AT FAIR OAKS
UNREGULATED CONDITIONS

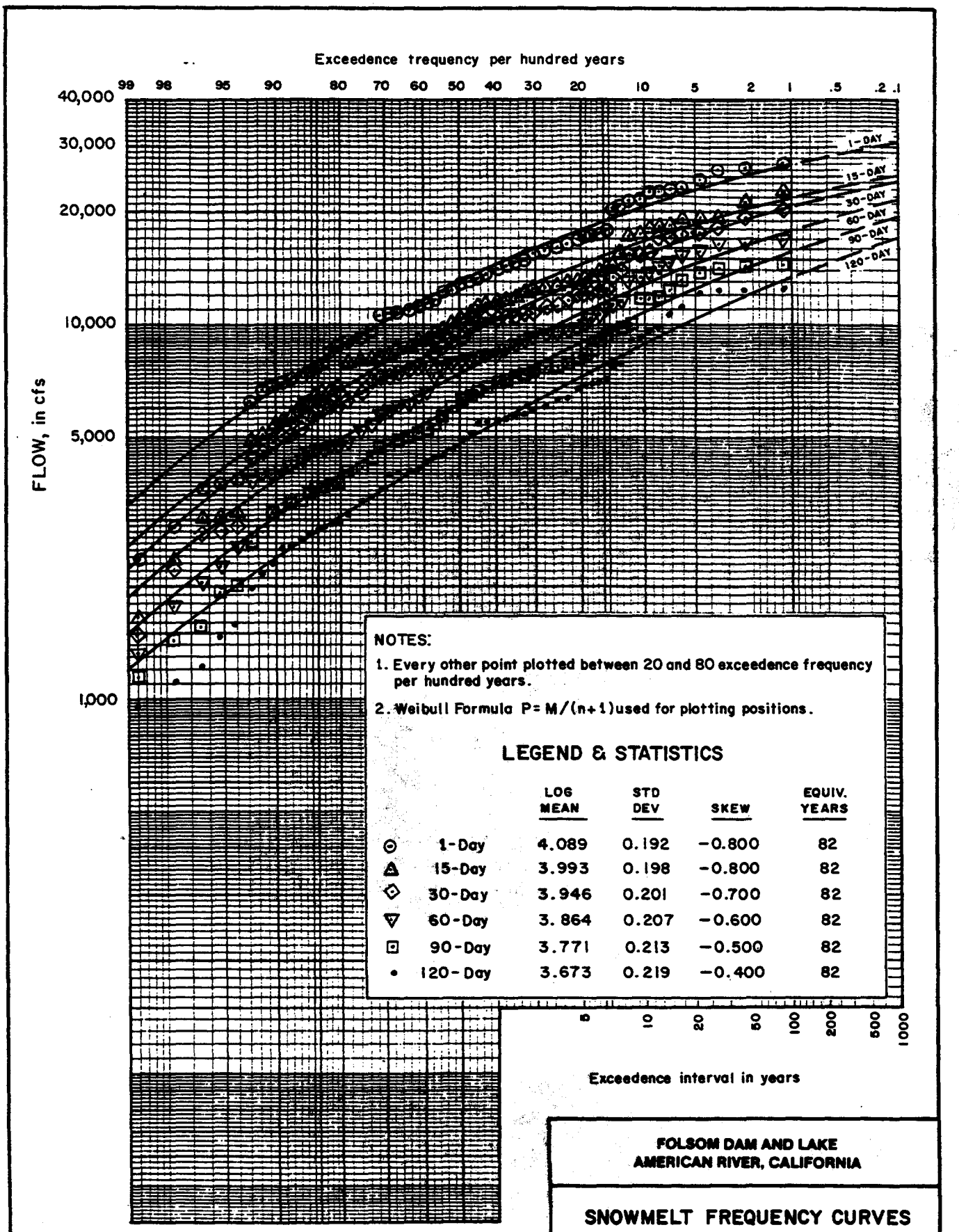
(FLOWS IN CFS)

WATER YEAR	PEAK		1-DAY		3-DAY		5-DAY		7-DAY		10-DAY		15-DAY		30-DAY	
	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW	DATE	FLOW
1905	19 MAR	24,200	19 MAR	21,200	19 MAR	13,700	19 MAR	11,300	19 MAR	10,300	19 MAR	9,660	17 MAR	8,550	4 MAR	6,430
1906	18 JAN	59,700	19 JAN	44,500	17 JAN	36,700	16 JAN	29,000	14 JAN	23,900	23 MAR	21,100	22 MAR	18,600	7 MAR	15,400
1907	19 MAR	156,000	19 MAR	105,000	19 MAR	87,800	18 MAR	78,500	17 MAR	65,900	17 MAR	55,000	17 MAR	41,800	1 MAR	25,100
1908	27 DEC	10,300	23 JAN	6,570	22 JAN	6,180	21 JAN	5,740	21 JAN	4,500	20 JAN	4,180	21 JAN	3,670	27 DEC	2,960
1909	14 JAN	119,000	14 JAN	98,000	14 JAN	87,200	14 JAN	70,300	14 JAN	59,100	14 JAN	53,800	12 JAN	41,500	14 JAN	28,900
1910			2 DEC	47,000	1 DEC	23,700	30 DEC	20,200	30 DEC	18,200	2 DEC	15,900	21 NOV	13,600	21 NOV	11,000
1911	31 JAN	81,300	31 JAN	69,100	30 JAN	57,300	29 JAN	43,300	29 JAN	36,100	24 JAN	30,900	24 JAN	25,500	11 JAN	19,100
1912			7 MAR	4,490	6 MAR	3,260	6 MAR	2,940	6 MAR	2,650	6 MAR	2,520	6 MAR	2,320	20 FEB	1,630
1913			7 NOV	8,210	6 NOV	6,600	6 NOV	4,940	6 NOV	4,020	5 NOV	3,170	15 JAN	2,470	15 JAN	1,870
1914	1 JAN	74,100	1 JAN	57,700	24 JAN	41,900	22 JAN	37,600	22 JAN	33,600	22 JAN	26,600	14 JAN	22,400	31 DEC	18,300
1915	12 MAY	39,900	2 FEB	23,100	1 FEB	17,800	1 FEB	13,500	1 FEB	11,100	1 FEB	12,000	31 JAN	9,940	1 FEB	8,970
1916	3 JAN	40,700	20 MAR	33,200	20 MAR	25,630	19 MAR	21,600	18 MAR	19,000	14 MAR	16,900	4 FEB	11,400	7 FEB	10,900
1917	25 FEB	42,300	25 FEB	37,600	24 FEB	27,000	21 FEB	24,400	21 FEB	22,200	20 FEB	18,200	19 FEB	13,800	20 FEB	8,950
1918			12 MAR	11,300	11 MAR	7,570	11 MAR	6,260	11 MAR	5,560	11 MAR	5,990	11 MAR	5,870	11 MAR	4,990
1919	11 FEB	67,500	11 FEB	45,000	10 FEB	26,100	10 FEB	18,900	10 FEB	14,900	9 FEB	11,700	9 FEB	9,030	9 FEB	7,430
1920	16 APR	15,100	16 APR	18,800	15 APR	12,800	15 APR	10,700	15 APR	9,490	14 APR	8,390	10 APR	7,340	22 MAR	5,720
1921	18 JAN	39,200	18 JAN	32,800	18 JAN	22,400	18 JAN	17,100	18 JAN	14,100	18 JAN	11,700	18 JAN	10,900	5 MAR	8,880
1922	20 FEB	31,600	20 FEB	22,200	18 FEB	17,500	18 FEB	14,200	18 FEB	11,700	18 FEB	10,600	18 FEB	8,890	9 FEB	7,220
1923	13 DEC	39,000	13 DEC	29,800	12 DEC	23,400	11 DEC	19,400	11 DEC	16,000	11 DEC	12,500	31 MAR	10,600	15 MAR	6,930
1924	8 FEB	14,000	8 FEB	10,600	7 FEB	7,360	7 FEB	5,560	7 FEB	4,490	7 FEB	3,660	7 FEB	2,910	6 FEB	2,000
1925	6 FEB	99,500	6 FEB	68,200	5 FEB	40,200	5 FEB	30,100	5 FEB	24,300	5 FEB	20,600	5 FEB	15,900	5 FEB	10,900
1926	6 APR	27,400	6 APR	22,700	6 APR	18,500	5 APR	16,400	5 APR	14,300	3 APR	11,300	29 MAR	8,440	14 MAR	5,950
1927	21 FEB	67,700	21 FEB	48,200	21 FEB	38,700	18 FEB	32,160	18 FEB	29,300	16 FEB	25,100	15 FEB	20,500	15 FEB	14,000
1928	25 MAR	163,000	25 MAR	119,000	25 MAR	98,200	24 MAR	73,300	24 MAR	58,700	24 MAR	45,100	23 MAR	34,000	23 MAR	21,300
1929			4 FEB	14,800	4 FEB	7,900	4 FEB	5,600	3 FEB	4,470	3 FEB	3,510	2 FEB	2,680	2 FEB	1,780
1930	5 MAR	24,400	5 MAR	18,800	4 MAR	13,700	4 MAR	10,900	4 MAR	9,030	4 MAR	7,480	4 MAR	6,160	18 FEB	4,580
1931	18 MAR	9,900	19 MAR	7,920	19 MAR	5,390	18 MAR	4,700	18 MAR	4,240	18 MAR	3,660	12 MAR	3,120	2 MAR	2,180
1932	7 FEB	21,100	7 FEB	18,900	7 FEB	16,300	6 FEB	14,300	6 FEB	12,400	6 FEB	10,200	31 JAN	8,230	31 JAN	5,740
1933			17 MAR	4,960	17 MAR	3,740	17 MAR	3,240	13 MAR	3,160	13 MAR	2,960	17 MAR	2,890	2 MAR	2,370
1934	1 JAN	22,600	2 JAN	13,300	1 JAN	10,400	30 DEC	8,580	30 DEC	7,200	30 DEC	5,800	29 DEC	4,470	29 DEC	2,990
1935	8 APR	52,900	8 APR	49,300	8 APR	29,100	7 APR	22,200	4 APR	19,500	8 APR	18,400	8 APR	16,500	3 APR	13,800
1936	22 FEB	58,300	22 FEB	46,400	22 FEB	34,400	21 FEB	27,700	21 FEB	23,500	14 FEB	22,300	12 FEB	21,700	12 FEB	14,800
1937	21 MAR	33,000	14 FEB	22,500	5 FEB	17,700	21 MAR	13,200	20 MAR	11,600	20 MAR	10,100	12 MAR	8,950	12 MAR	7,920
1938	11 DEC	114,000	11 DEC	81,100	10 DEC	47,500	10 DEC	32,800	10 DEC	25,000	10 DEC	18,600	1 FEB	13,500	1 FEB	10,400
1939	9 MAR	10,900	9 MAR	8,500	9 MAR	5,650	9 MAR	4,380	9 MAR	3,890	6 MAR	3,270	1 MAR	2,540	14 FEB	2,000
1940	30 MAR	89,200	30 MAR	69,600	30 MAR	53,500	27 MAR	44,100	27 MAR	38,600	26 MAR	31,300	26 MAR	24,400	26 MAR	16,900
1941	27 DEC	38,800	11 FEB	26,900	11 FEB	21,300	10 FEB	17,700	10 FEB	15,200	10 FEB	13,200	10 FEB	11,900	10 FEB	10,900
1942	27 JAN	83,200	27 JAN	54,600	26 JAN	40,300	25 JAN	34,000	25 JAN	28,000	25 JAN	23,000	25 JAN	23,400	24 JAN	15,500
1943	22 JAN	152,000	22 JAN	73,800	21 JAN	53,000	21 JAN	40,800	21 JAN	33,100	6 MAR	28,400	6 MAR	22,900	6 MAR	16,000
1944	4 MAR	20,100	4 MAR	12,400	4 MAR	9,230	29 FEB	7,940	29 FEB	7,850	29 FEB	6,590	29 FEB	5,760	29 FEB	4,380
1945	2 FEB	94,400	2 FEB	70,900	2 FEB	40,700	1 FEB	29,300	1 FEB	23,700	1 FEB	19,100	1 FEB	15,000	1 FEB	9,740
1946	22 DEC	42,200	22 DEC	32,400	28 DEC	25,500	22 DEC	23,200	22 DEC	22,100	22 DEC	22,300	22 DEC	18,000	21 DEC	11,600
1947	13 FEB	27,900	13 FEB	20,100	12 FEB	12,400	12 FEB	9,410	12 FEB	7,650	10 MAR	6,610	10 MAR	5,870	10 MAR	5,300
1948	17 APR	21,000	17 APR	17,600	17 APR	15,200	17 APR	13,700	17 APR	13,300	17 APR	12,100	16 APR	11,300	17 APR	10,500
1949	3 MAR	37,500	3 MAR	25,500	3 MAR	15,600	3 MAR	11,300	2 MAR	9,110	3 MAR	8,120	3 MAR	7,420	2 MAR	6,030
1950	23 JAN	34,400	6 FEB	22,800	22 JAN	20,100	4 FEB	15,400	18 JAN	13,900	17 JAN	12,300	17 JAN	9,810	17 JAN	8,950
1951	21 NOV	180,000	21 NOV	132,000	19 NOV	108,000	18 NOV	80,900	18 NOV	61,800	18 NOV	45,200	18 NOV	31,700	18 NOV	30,600
1952	2 FEB	37,200	2 FEB	30,500	2 FEB	20,800	12 JAN	19,800	12 JAN	16,600	25 JAN	14,600	12 JAN	12,700	12 JAN	12,000
1953	28 APR	48,400	28 APR	27,600	27 APR	20,800	26 APR	17,300	24 APR	15,600	23 APR	14,000	23 APR	12,400	22 APR	10,400
1954	9 MAR	42,600	10 MAR	36,500	9 MAR	26,100	9 MAR	19,900	9 MAR	16,100	9 MAR	13,200	9 MAR	10,700	9 MAR	8,920
1955	2 JAN	10,800	2 JAN	8,710	1 JAN	6,780	1 JAN	5,190	4 DEC	4,440	3 DEC	4,120	3 DEC	3,280	31 DEC	2,690
1956	23 DEC	219,000	23 DEC	189,000	24 DEC	127,000	22 DEC	89,800	21 DEC	71,000	19 DEC	56,200	19 DEC	40,600	19 DEC	28,200
1957	25 FEB	42,000	25 FEB	31,100	24 FEB	21,000	24 FEB	17,100	23 FEB	14,300	25 FEB	14,400	24 FEB	13,400	22 FEB	9,650
1958	3 APR	54,000	3 APR	42,300	1 APR	33,600	30 MAR	27,900	30 MAR	25,300	30 MAR	21,500	21 MAR	19,000	16 MAR	14,900
1959	17 FEB	20,000	17 FEB	15,400	17 FEB	12,300	16 FEB	10,400	16 FEB	8,850	16 FEB	7,110	16 FEB	5,880	16 FEB	4,590
1960	8 FEB	75,000	8 FEB	63,000	8 FEB	34,800	8 FEB	23,800	8 FEB	18,200	7 FEB	13,700	2 FEB	10,100	8 FEB	7,150
1961	11 FEB	8,000	11 FEB	5,950	10 FEB	5,760	10 FEB	4,680	10 FEB	4,060	10 FEB	3,440	1 FEB	2,970	31 JAN	2,300
1962	10 FEB	40,000	10 FEB	35,200	14 FEB	20,700	10 FEB	19,100	10 FEB	19,700	9 FEB	16,800	9 FEB	12,700	9 FEB	8,750
1963	1 FEB	240,000	1 FEB	153,000	31 JAN	93,900	31 JAN	64,000	31 JAN	49,100	31 JAN	36,700	31 JAN	26,700	30 JAN	15,500
1964	15 NOV	24,000	21 JAN	13,400	20 JAN	9,560	20 JAN	7,650	19 JAN	6,450	15 NOV	5,650	19 JAN	4,550	18 JAN	3,400
1965	23 DEC	260,000	23 DEC	183,000	22 DEC	140,000	22 DEC	106,000	21 DEC	87,700	21 DEC	68,300	21 DEC	50,500	20 DEC	33,100
1966	29 DEC	6,500	29 DEC	5,720	29 DEC	5,430	29 DEC	4,490	28 DEC	3,830	29 DEC	4,090	28 DEC	3,630	25 DEC	2,700
1967	16 MAR	46,000	17 MAR	36,200	16 MAR	29,800	16 MAR	23,800	16 MAR	20,100	16 MAR	17,100	16 MAR	13,700	16 MAR	10,900
1968	20 FEB	30,000	21 FEB	24,700	20 FEB	22,300	20 FEB	20,600	20 FEB	17,900	18 FEB	15,200	18 FEB	12,400	17 FEB	8,710
1969	21 JAN	120,000	21 JAN	83,500	20 JAN	71,900	19 JAN	54,400	20 JAN	49,500	19 JAN	42,800	19 JAN	32,400	19 JAN	21,000
1970	22 JAN	122,000	22 JAN	88,300	21 JAN	68,800	21 JAN	54,500	17 JAN	49,600	16 JAN	46,100	14 JAN	38,600	10 JAN	23,500
1971	26 MAR	48,000	26 MAR	34,100	26 MAR	25,300	26 MAR	19,800	26 MAR	16,900	25 MAR	14,200	25 MAR	12,300	24 MAR	9,910
1972	4 MAR	12,000	4 MAR	10,000	4 MAR	9,590	3 MAR	8,920	4 MAR	8,820	3 MAR	8,860	4 MAR	8,470	25 FEB	7,820
1973	12 JAN	69,000	12 JAN	49,300	12 JAN	31,200	12 JAN	27,100	12 JAN	25,700	11 JAN	21,900	9 JAN	16,800	12 JAN	11,100
1974	17 JAN	55,000	17 JAN	40,600	17 JAN	35,500	16 JAN	31,400	15 JAN	28,110	15 JAN	23,300	13 JAN	18,100	27 DEC	14,700
1975	25 MAR	46,000	25 MAR	30,000	25 MAR	20,800	25 MAR	15,900	22 MAR	13,500	22 MAR	11,400	21 MAR	9,620	7 MAR	7,600
1976	27 OCT	15,000	27 OCT	10,400	26 OCT	5,970	26 OCT	4,410	26 OCT	3,660	26 OCT	2,870	27 OCT	2,450	26 OCT	2,150
1977	22 FEB	2,500	22 FEB	1,720	22 FEB	1,550	21 FEB	1,130	19 FEB	950	22 FEB	910	18 FEB	750	20 FEB	650
1978	17 JAN	40,000	17 JAN	31,200	15 JAN	25,800	14 JAN	21,800	14 JAN	18,800	10 JAN	15,500	5 JAN	14,000	28 DEC	10,200
1979	12 JAN	33,000	12 JAN	18,300	11 JAN	15,600	11 JAN	12,100	11 JAN	9,670	14 FEB	7,480	15 FEB	6,880	16 FEB	6,480
1980	14 JAN	175,000	14 JAN	125,000	13 JAN	97,800	12 JAN	78,200	12 JAN	63,800	12 JAN	48,600	10 JAN	35,400	31 DEC	20,400
1981	26 MAR	20,000	26 MAR	15,500	25 MAR	11,200	24 MAR	8,830	22 MAR	7,780	19 MAR	7,440	14 MAR	5,700	27 FEB	3,970
1982	16 FEB	152,000	16 FEB	113,000	15 FEB	78,900	15 FEB	56,700	15 FEB	45,300	14 FEB	36,100	14 FEB	27,400	14 FEB	19,700
1983	13 MAR	93,000	13 MAR	68,800	13 MAR	48,600	12 MAR	36,500	12 MAR	31,100	10 MAR	26,100	1 MAR	24,300	26 FEB	19,800
1984	26 DEC	88,000	26 DEC	65,200	25 DEC	54,000	25 DEC	42,400	25 DEC	37,000	24 DEC	30,700	24 DEC	23,900	10 DEC	17,200
1985	8 FEB	17,000	8 FEB	13,500	8 FEB	8,440	8 FEB	6,360	8 FEB	5,310	8 FEB	4,300	8 FEB	3,550	8 FEB	3,070
1986	18 FEB	255,000	18 FEB	204,000	17 FEB	162,000	16 FEB	125,000	15 FEB	98,400	14 FEB	75,500	14 FEB	55,900	14 FEB	39,700

RAIN FLOOD

	1-Day	3-Day	5-Day	7-Day	10-Day	15-Day	30-Day
COMPUTED STATISTICS							
YEARS RECORD	82	82	82	82	82	82	82
LOG MEAN	4.478	4.346	4.250	4.182	4.129	4.114	3.910
LOG STD.DEV.	0.417	0.412	0.405	0.399	0.387	0.376	0.361
SKEW	-0.262	-0.139	-0.219	-0.273	-0.310	-0.416	-0.545
ADOPTED STATISTICS							
EQ. YEARS	82	82	82	82	82	82	82
LOG MEAN	4.493	4.360	4.265	4.197	4.129	4.045	3.924
LOG STD.DEV.	0.404	0.390	0.380	0.373	0.366	0.358	0.345
SKEW	0.000	0.000	0.000	-0.100	-0.100	-0.200	-0.400

PLATE 21



Period of record: 1905 – 1986

Drainage Area: 1,888 square miles

Curves based on Expected Probability

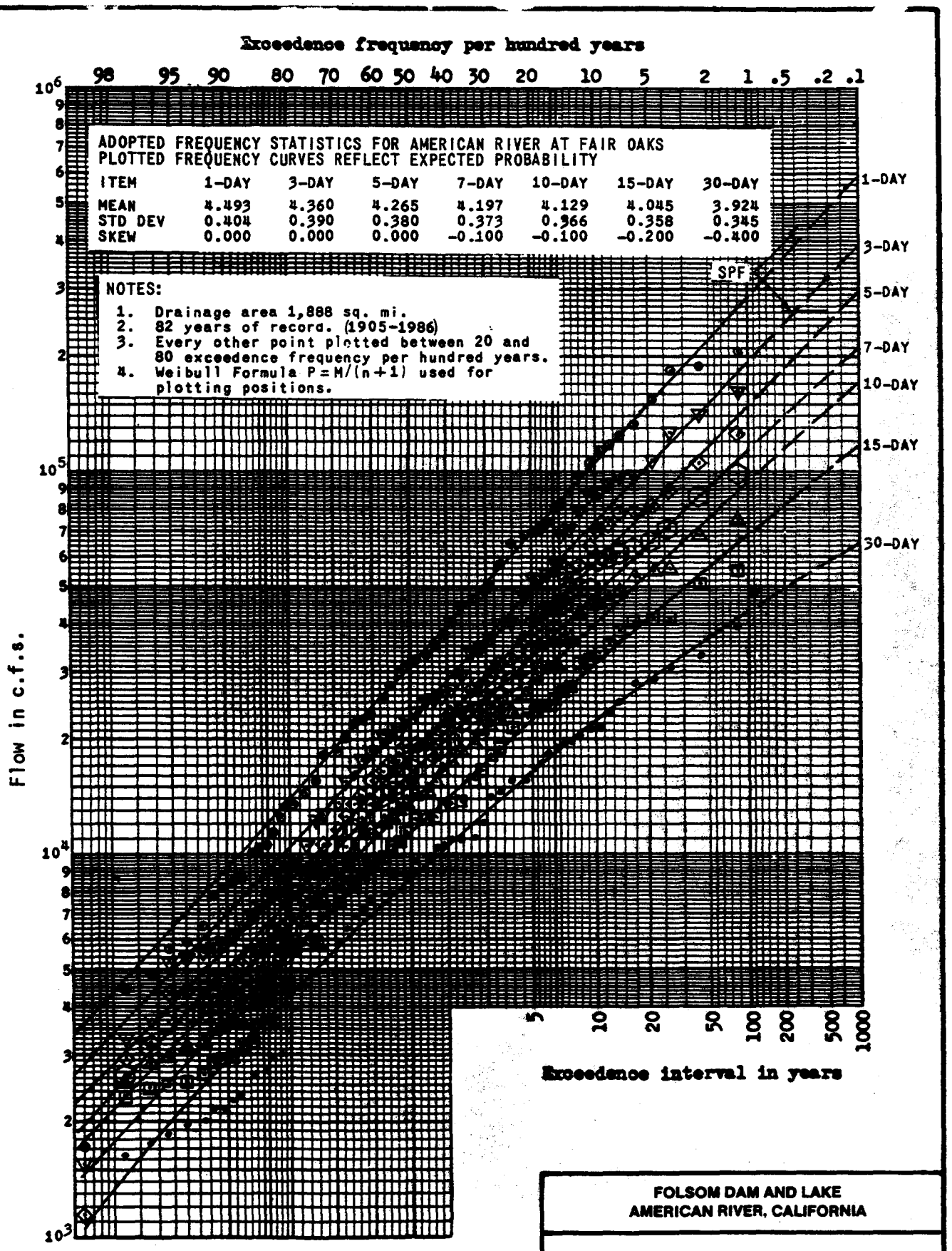
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

SNOWMELT FREQUENCY CURVES (UNREGULATED CONDITIONS)

AMERICAN RIVER AT FAIR OAKS

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 22



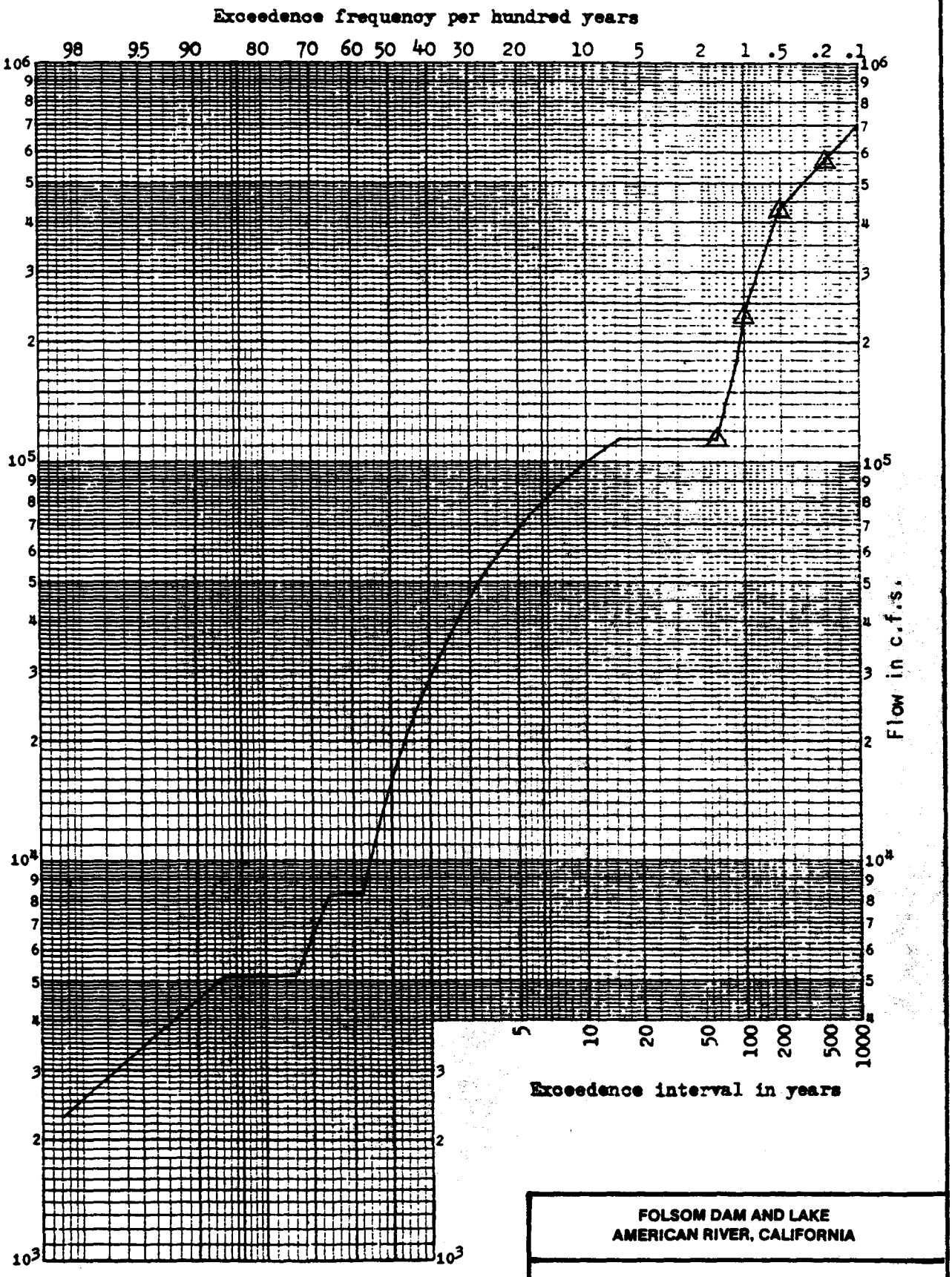
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

RAIN FLOOD FREQUENCY CURVES

UNREGULATED CONDITIONS
AMERICAN RIVER AT FAIR OAKS

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 23



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.

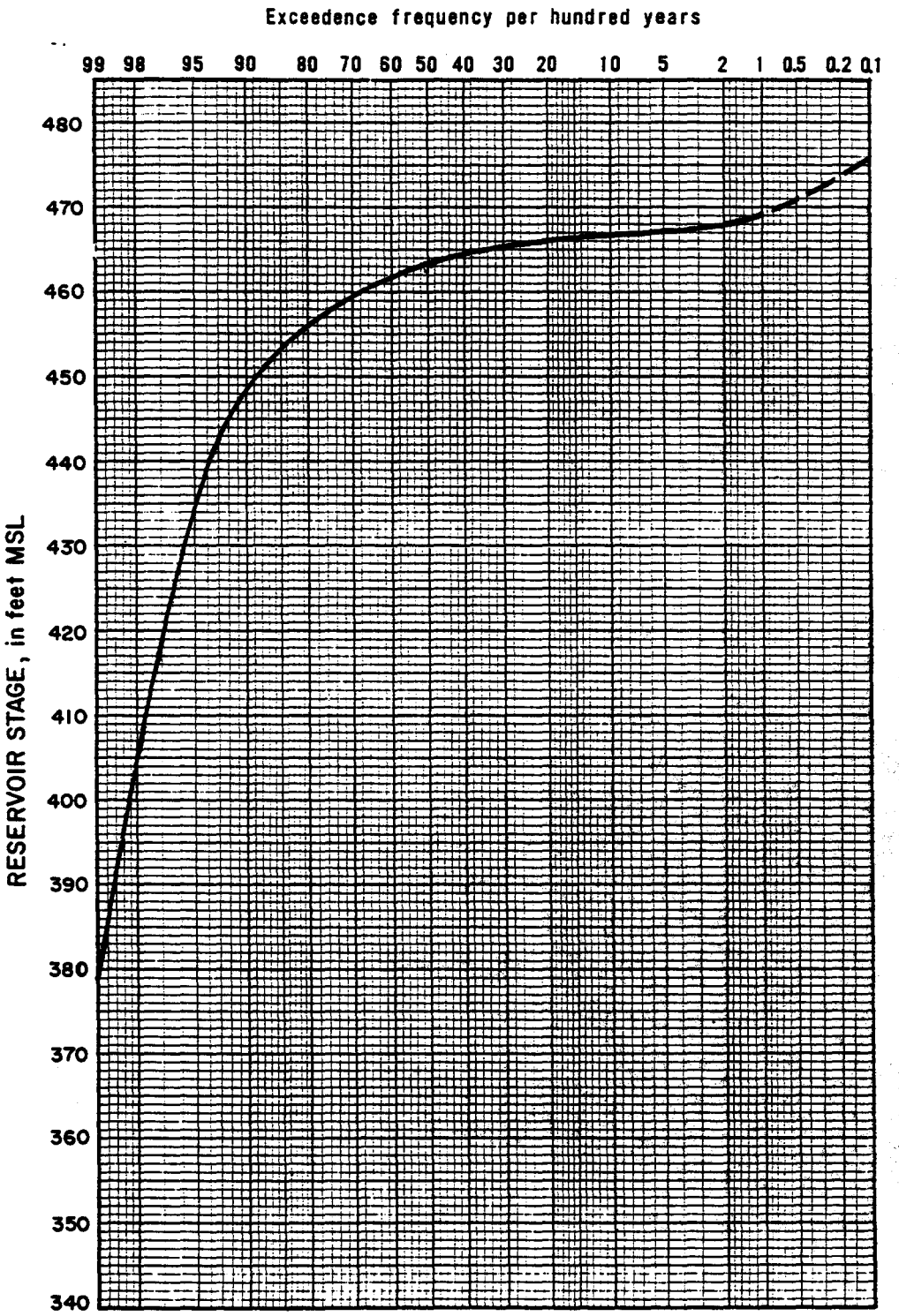
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

PEAK FLOW FREQUENCY CURVE

REGULATED CONDITIONS
AMERICAN RIVER AT FAIR OAKS

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 24



Period of Record: 1956—1986

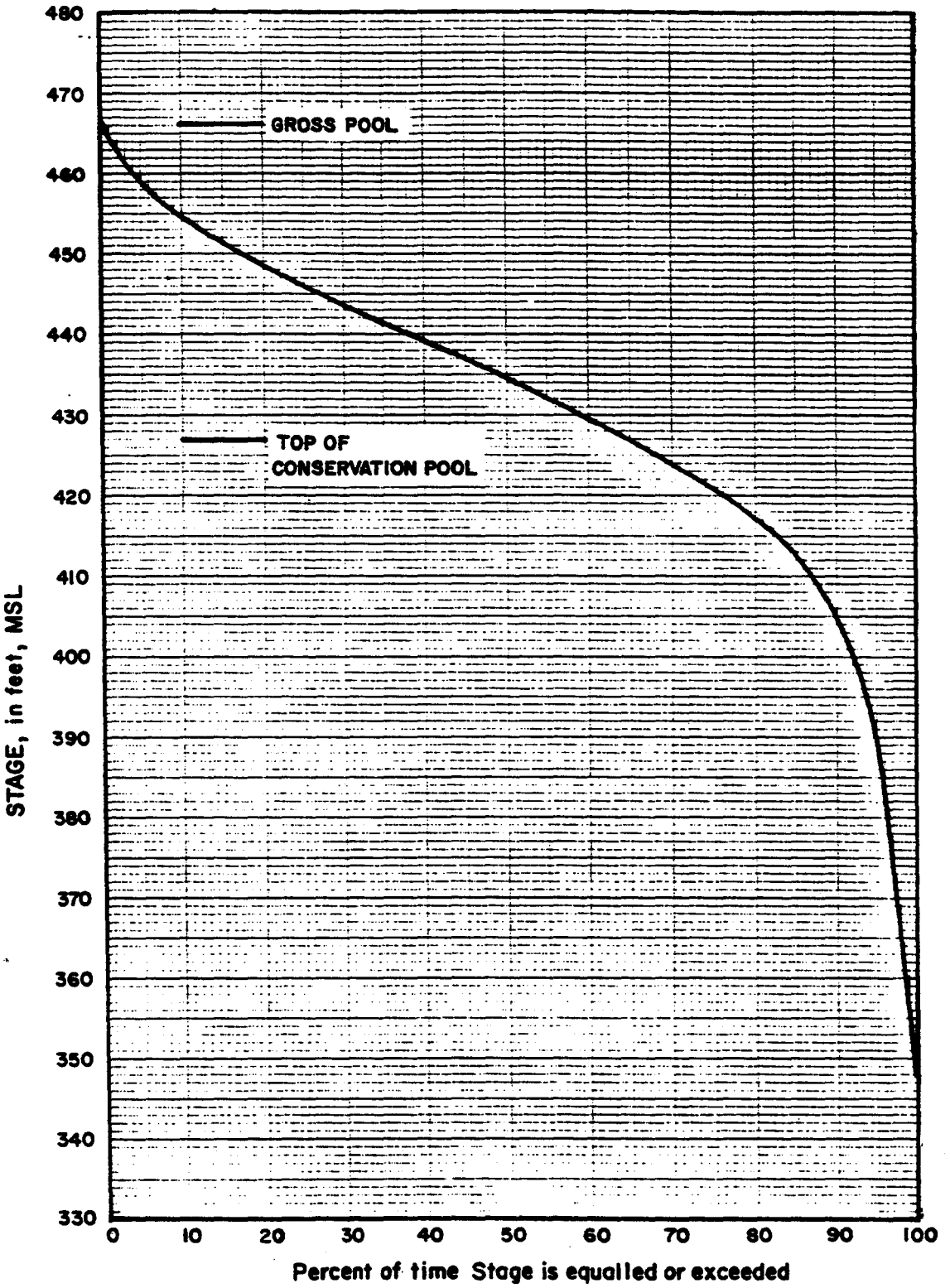
CURVE BASED ON HISTORICAL OPERATION

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

FOLSOM LAKE
STAGE FREQUENCY CURVE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 25

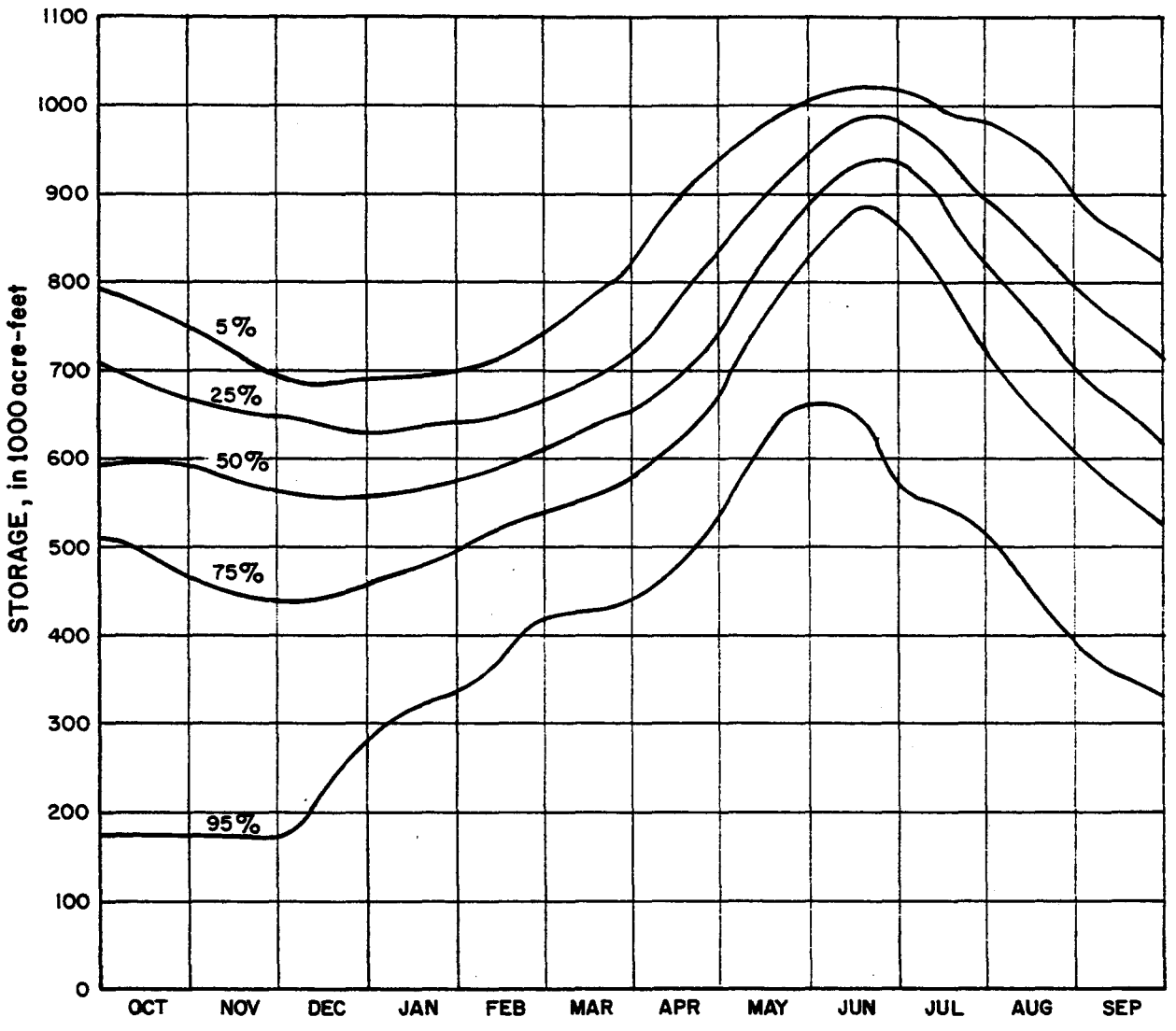


Period of record: 1956 to 1968

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

STAGE DURATION CURVE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



NOTE:

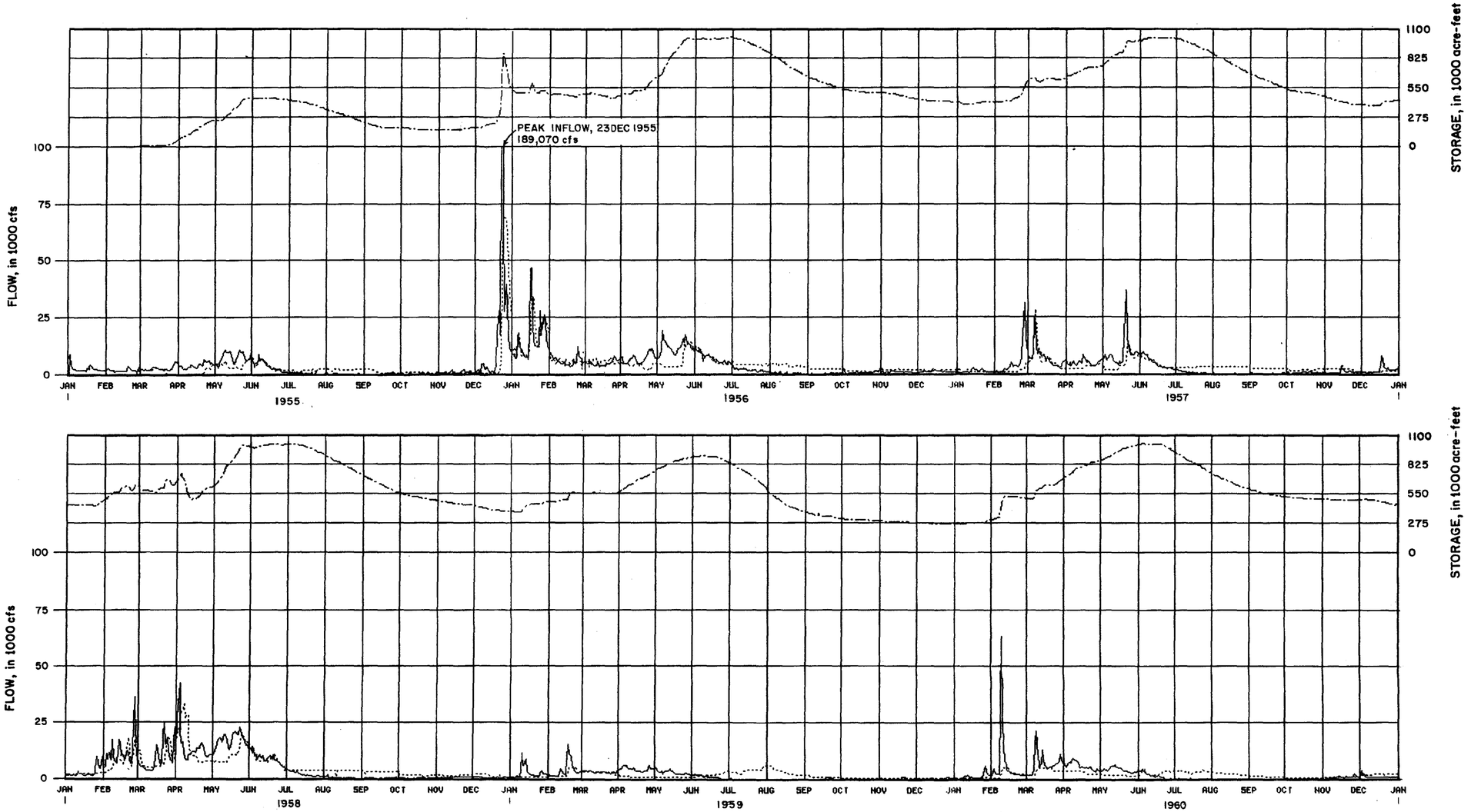
Indicated value is percentage of years that the storage is exceeded on a given date, based on daily storage records for the water years 1956 – 1986.

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

SEASONAL VARIATION OF STORAGE FREQUENCY

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

PLATE 27



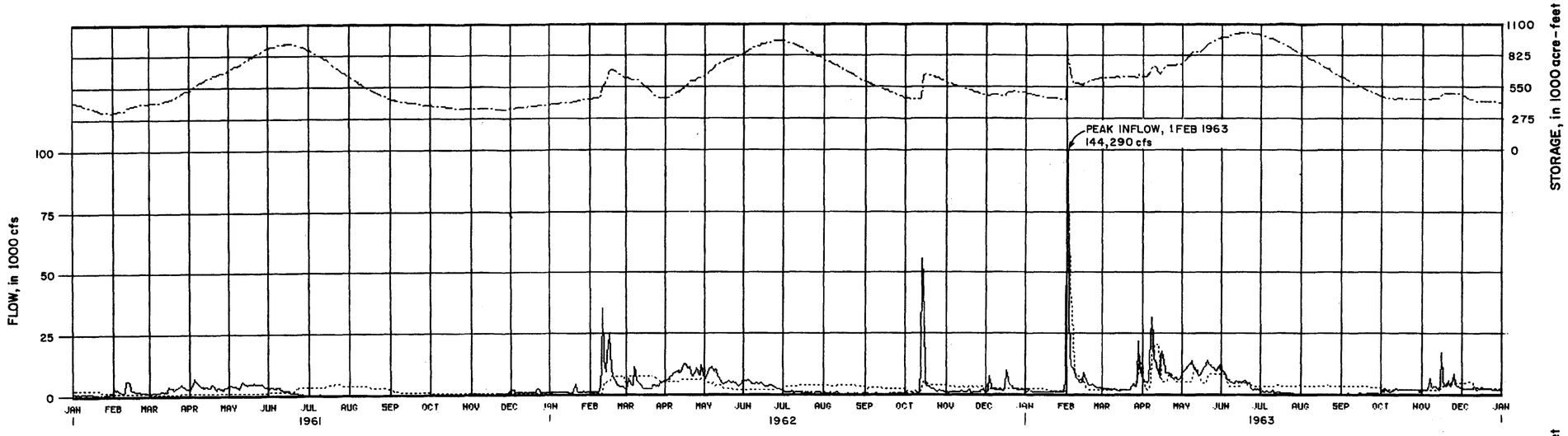
LEGEND

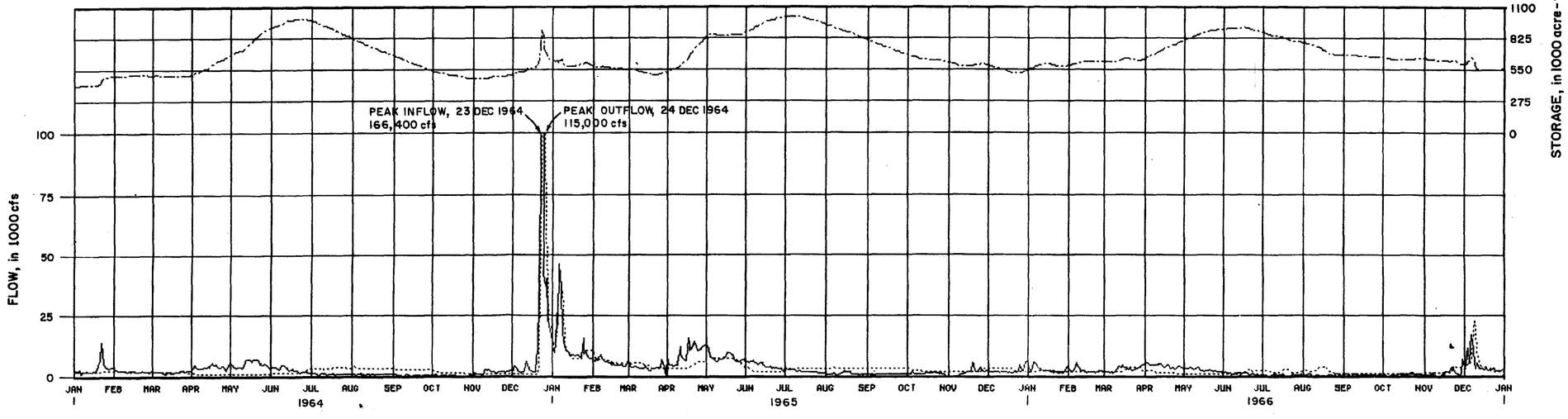
- INFLOW
- OUTFLOW
- STORAGE

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
FOLSOM LAKE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT





LEGEND

INFLOW

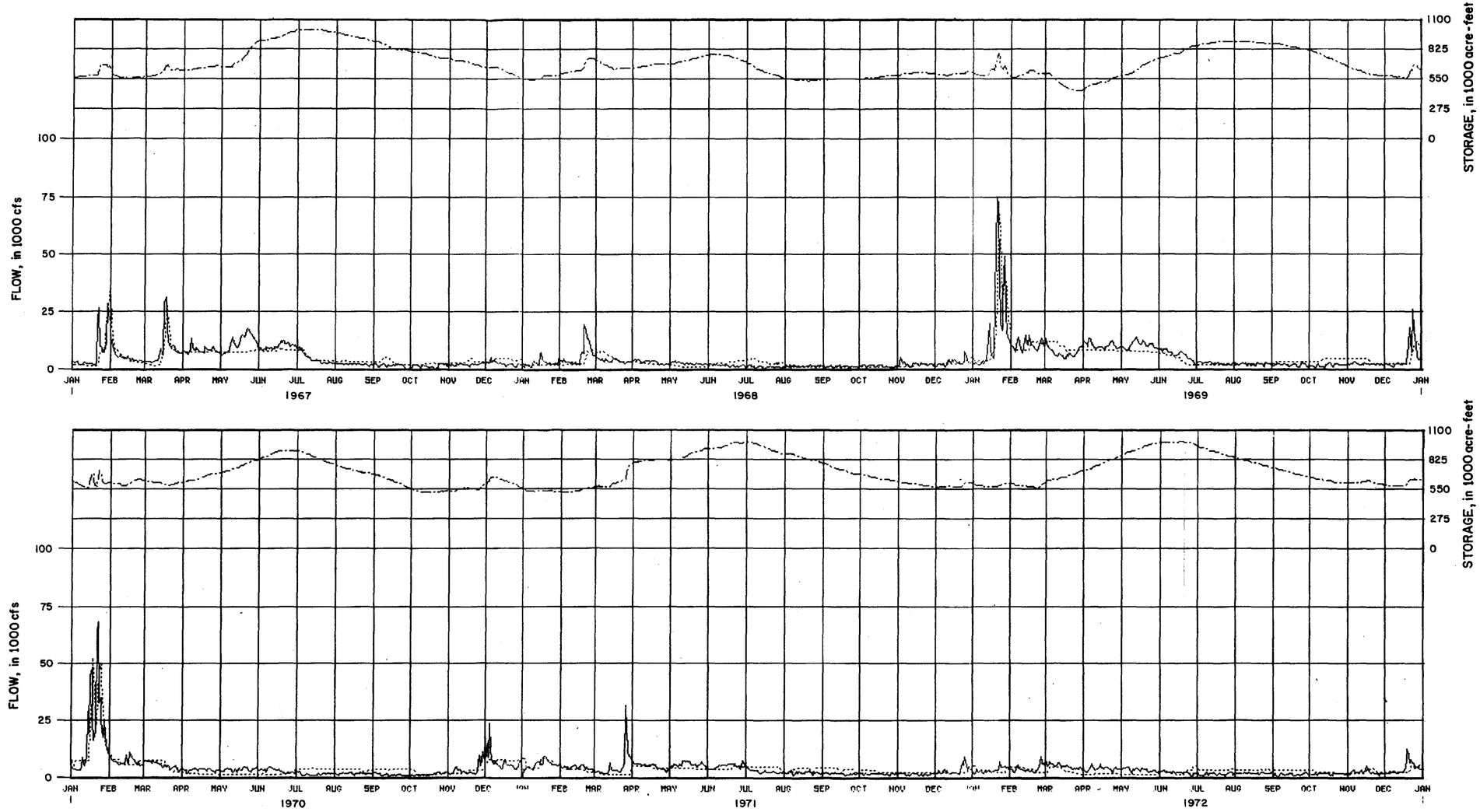
OUTFLOW

STORAGE

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
FOLSOM LAKE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



LEGEND

INFLOW

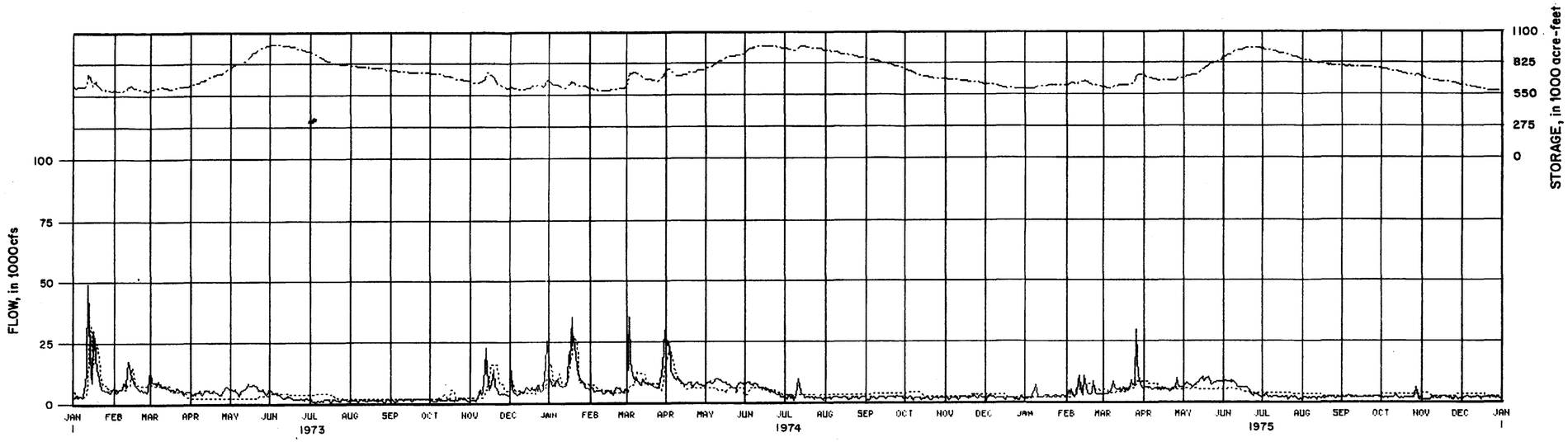
OUTFLOW

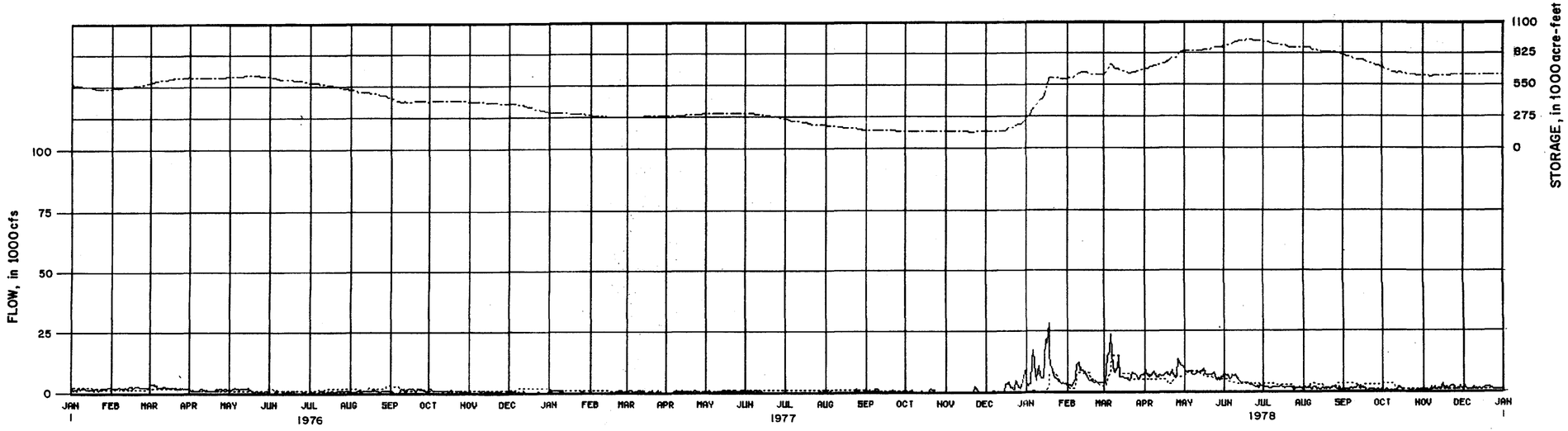
STORAGE

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
FOLSOM LAKE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT





LEGEND

INFLOW

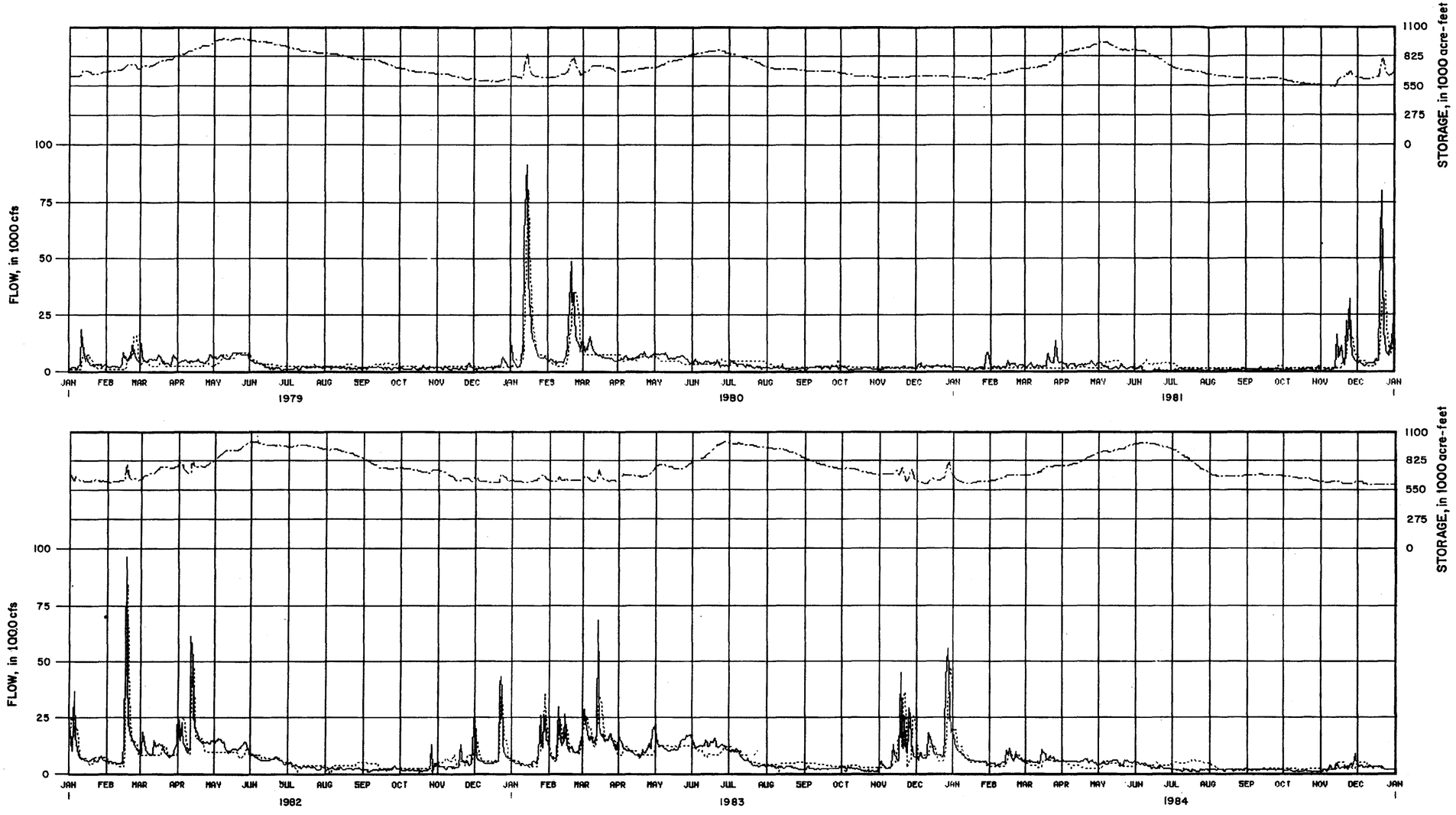
OUTFLOW

STORAGE

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
FOLSOM LAKE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



LEGEND

INFLOW

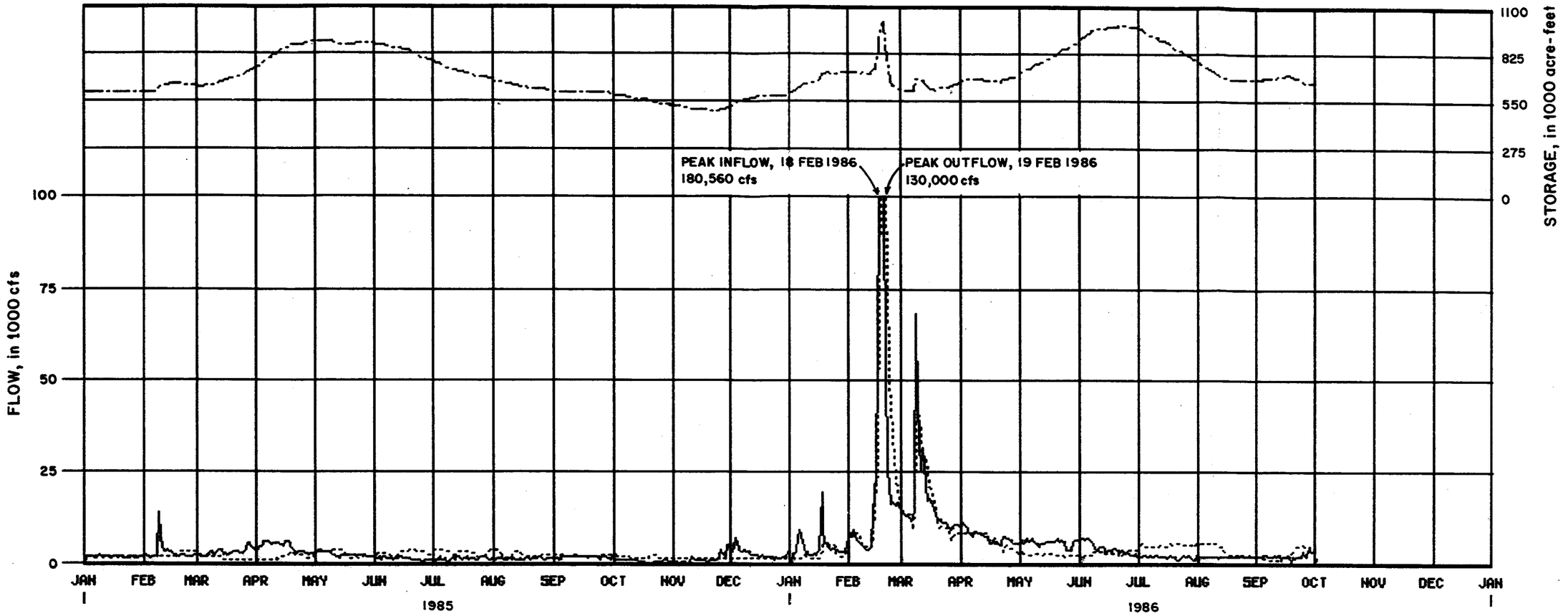
OUTFLOW

STORAGE

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
FOLSOM LAKE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT



LEGEND

——— INFLOW

- - - - - - - OUTFLOW

— · — · — STORAGE

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

HISTORICAL OPERATION
FOLSOM LAKE

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

WATER CONTROL MANUAL

DECEMBER 1987

EXHIBIT A

STANDING INSTRUCTIONS TO DAMTENDERS
FOR
FOLSOM DAM AND LAKE

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

EXHIBIT A

STANDING OPERATING INSTRUCTIONS TO DAMTENDERS FOR FOLSOM DAM AND LAKE AMERICAN RIVER, CALIFORNIA

CONTENTS

Personnel Concerned in Flood Control Operation of Folsom Dam and Lake

LIST OF CHARTS

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA
WATER CONTROL MANUAL
EXHIBIT A

STANDING INSTRUCTIONS TO DAMTENDERS FOR FOLSOM DAM AND LAKE

1. GENERAL

a. This exhibit to the "Folsom Dam and Lake, American River, California, Water Control Manual," is prepared in accordance with instructions contained in EM 1110-2-3600, paragraph 4-07, (Standing Instructions to Damtenders) and pertains to duties and responsibilities of the damtender in connection with the functional operation of Folsom Dam and Lake, and the reporting of required hydrologic data.

b. Operational instructions to the damtender are briefly outlined with specific emphasis on the damtender's duties and responsibilities during extreme flood emergencies when communication facilities between him and his operating office may have been disrupted. It is designed to be used independently as an emergency flood control guide, or as published, in conjunction with the water control manual. To facilitate independent use of this exhibit, charts required for the emergency flood control operation of Folsom Dam are included herein.

2. FLOOD CONTROL OPERATION REQUIREMENTS

a. Folsom Dam and Lake will be operated for flood control in accordance with rules and regulations prescribed by the Code of Federal Regulations Title 33, Part 208.11, and the Field Working Agreement for Central Valley Project Dams and Reservoirs, copies of which are contained in Exhibits B and C, respectively. In conjunction with these regulations are the Flood Control Diagram and the Emergency Spillway Release Diagram which together define the requirements for flood control operation of Folsom Dam and Lake. The flood control objectives for Folsom Dam and Lake are:

(1) To control flows in the American River, insofar as possible, to not more than 115,000 cfs below the dam.

(2) To permit use of the maximum practical amount of storage space for conservation, power and other purposes without impairment of the flood control functions.

b. Storage space in Folsom Lake shall be reserved on the basis of the Flood Control Diagram, Chart A-8, which indicates variable storage space requirements according to the current flood hazard as measured by the accumulation of seasonal precipitation over the basin. Whenever encroachment into the currently required flood control storage reservation occurs this water should be released in accordance with the schedule contained on the Flood Control Diagram, Chart A-8.

c. The currently required flood control storage reservation is determined from Chart A-8, which indicates the required flood control storage reservation at any time in the flood season from 1 October to 31 May. The diagram requires:

(1) Flood control space increases from zero on 1 October to a maximum of 400,000 acre-feet on 17 November and is required until 8 February.

(2) A variable flood control space reservation up to a maximum of 400,000 acre-feet from 8 February to 31 May is required. This space varies according to parameters based on the accumulation of seasonal precipitation. This variable space provides the required flood space while allowing the space not required to be filled for conservation purposes. Provision of this space, therefore, allows a more efficient operation of the project.

d. The flood control operation each day consists of determining the required storage space reservation and scheduling releases as to provide the required space reservation by the end of the day, whenever possible. This procedure requires a forecast of reservoir inflow for the next 24 hours.

3. LIMITATIONS OF STORAGE

Operational limitations on storage in Folsom Lake are specified in paragraph 2 of this exhibit. There are no legal limitations on storage as the taking line is above the maximum operating level.

4. LIMITATIONS ON RELEASES

Releases from Folsom Dam, insofar as possible, will be restricted so that the flow below the dam does not exceed the channel capacity of 115,000 cfs. However, local flooding in the Campus Commons and Discovery Park areas does begin when flows exceed 20,000 cfs. The rate of change of release will be restricted to values that will not endanger life and property in the flood plain area along the American River below the dam. In addition, the restricted rate of change of release will minimize bank sloughing and caving. As an operating guide, the rate of change of release from Folsom Dam should be limited insofar as practicable to:

a. Increasing releases up to 15,000 cfs each 2 hours.

b. Decreasing releases not to exceed 10,000 cfs each 2 hours.

5. EMERGENCY OPERATION OF GATED SPILLWAY

a. Whenever the reservoir level approaches gross pool level and the reservoir is rising rapidly because of flood inflow, the necessity for emergency releases should be determined. The Emergency Spillway Release Diagram, Chart A-9, indicates the minimum permissible releases that can be made without endangering the structure and without releasing quantities in excess of natural runoff. In order to assure the safety of the structure and minimize surcharge, the operating agency may, on the

basis of forecasts, make releases somewhat greater than those required by the diagram.

b. The diagram is derived in accordance with procedures outlined in EM 1110-2-3600 and is based on minimum remaining volume of inflow when only reservoir elevations and inflow are known. This minimum volume of remaining inflow was estimated on the basis that inflow peak was past and that recession of flow would be somewhat steeper than in most observed floods. The diagram is thus designed to defer emergency releases until it is virtually certain that those or larger releases will be necessary. Accordingly, when such releases are indicated by the diagram, it is essential that they be made immediately in order that it will not subsequently be necessary to make still larger releases. For this reason, the reservoir operators at the dam should be thoroughly familiar with the Emergency Spillway Release Diagram and should be empowered by standing instructions to initiate use of the diagram if required when communication with Central Valley Project operations in Sacramento is disrupted.

6. STANDING INSTRUCTIONS DURING FLOOD EMERGENCY

a. The functional operation of Folsom Dam and Lake is under the direction of the Regional Director, Mid-Pacific Region, U.S. Bureau of Reclamation. Instructions to U.S. Bureau of Reclamation personnel are the responsibility of the Regional Director. The following are suggested instructions for emergency operation of Folsom Dam and Lake. During flood periods close contact will be maintained between the damtender (or operating personnel) and the Regional Office.

b. If communication is broken between the operating personnel and the Regional Office during a flood emergency, the following procedure is recommended:

(1) Continue releases in accordance with the last instructions received from the Regional Office and make every attempt to re-establish communication.

(2) If communications cannot be re-established and larger releases are required by the Flood Control Diagram (Chart A-8), releases should be increased in accordance with the diagram.

(3) Whenever the reservoir level of Folsom Lake approaches gross pool elevation (466.0 feet) and the reservoir level is rising because of flood inflow, the necessity for emergency spillway releases from Folsom Dam should be determined. Chart A-9, Emergency Spillway Release Diagram, indicates the minimum release considered permissible to avoid endangering the structure.

7. OPERATIONAL RESPONSIBILITIES

Responsibilities for flood control operation of Folsom Dam and Lake are summarized in the following paragraphs. A list of personnel involved in operation of the reservoir for flood control are contained at the front of this manual.

a. The District Engineer, Sacramento District, Corps of Engineers, is responsible for:

(1) Approving and disapproving deviations from the prescribed flood control criteria on Charts A-8 and A-9.

(2) Advising the operating agencies of any departure from the flood control regulations.

(3) Preparing monthly operation and other special reports relative to operation of the reservoir required by the Office, Chief of Engineers.

(4) Preparing revisions to the flood control criteria found herein.

b. The Regional Director, Mid-Pacific Region, Bureau of Reclamation, is responsible for:

(1) Accomplishing the physical operation of the reservoir and associated facilities in accordance with the official regulations.

(2) Advising the District Engineer, Sacramento District, Corps of Engineers, of any deviation from prescribed requirements.

(3) Reporting to the District Engineer, Sacramento District, Corps of Engineers, any unusual condition in the reservoir or along downstream channels that might interfere with the planned flood control operation of the reservoir.

(4) Keeping downstream interests advised of all changes of flood control releases which might affect them.

(5) Reporting to the Reservoir Control Section, Sacramento District, Corps of Engineers, and to the Department of Water Resources of the State of California, data as outlined in paragraph 8a below and other data that may be required from time to time.

(6) Keeping informed of the rules and regulations contained in the reservoir regulation manual and bringing to the attention of the District Engineer, Sacramento District, Corps of Engineers, any feature of the manual that may require clarification or revision.

(7) Keeping the District Engineer, Sacramento District, Corps of Engineers, advised of any inaccuracies contained in the manual or that may develop as a consequence of changing conditions.

(8) Immediately after the end of each month, transmitting to the Reservoir Control Section, Sacramento District, Corps of Engineers, data specified in paragraph 8b below.

8. OPERATION REPORTS

a. The reservoir operator or operating agency shall provide to the Reservoir Control Section, Sacramento District, Corps of Engineers, and to the Department of Water Resources, State of California, each workday

between 7:00 and 9:00 a.m. and at other times upon request, data as described on Chart A-7, Operational Data Requirements.

Data obtained on non-workdays will be furnished on the following workday.

b. Immediately after the end of each month, the operating agency shall provide to the Reservoir Control Section, Sacramento District, Corps of Engineers, a summary of the following operation data:

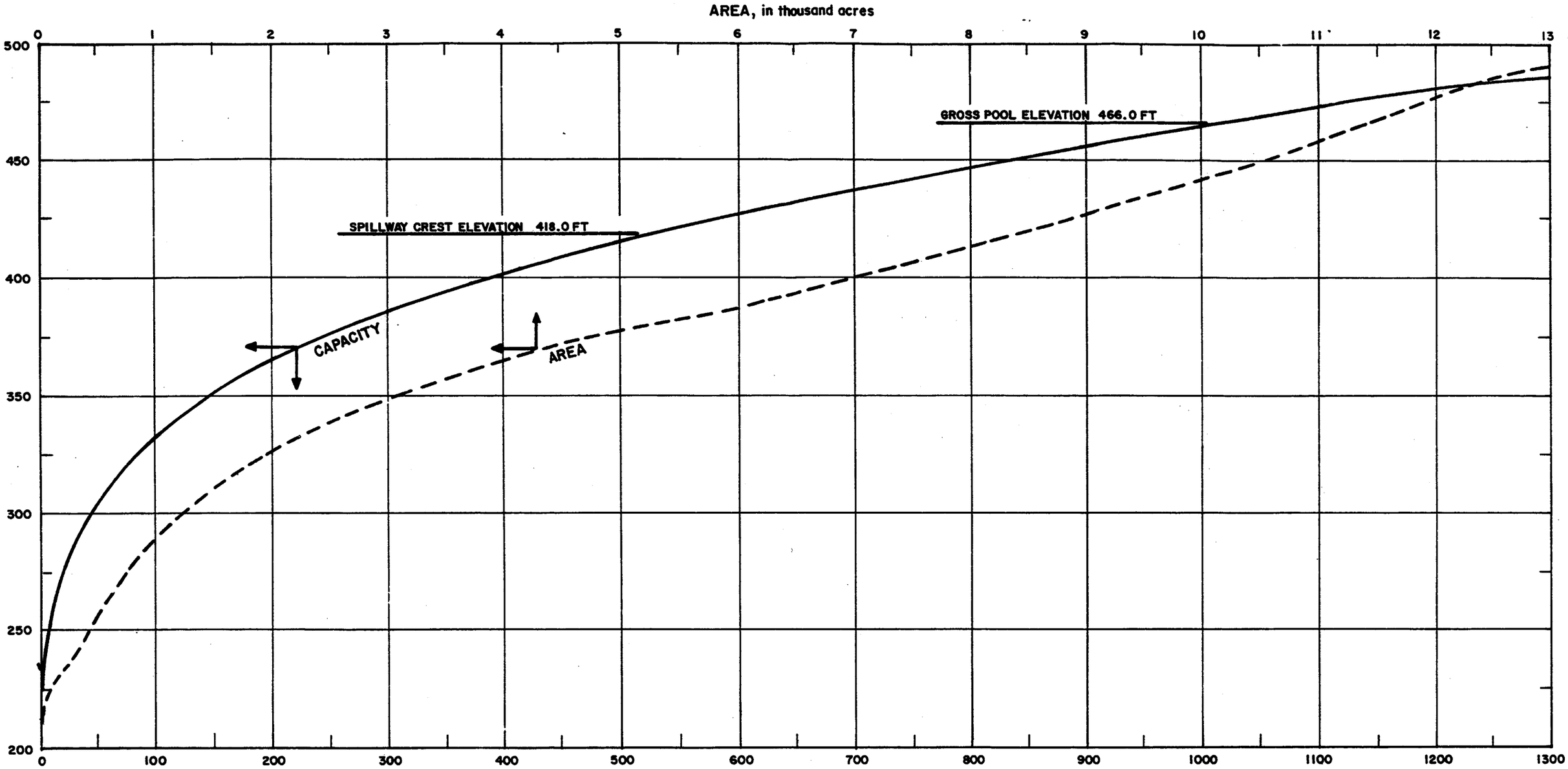
(1) Daily inflow, outflow, elevation and storage at Folsom Lake.

(2) Daily requirement of flood control space at Folsom Lake.

(3) Precipitation at Folsom Dam.

9. MODIFICATION OF REGULATIONS

The official regulations are subject to temporary modifications during flood emergencies by the District Engineer, Sacramento District, Corps of Engineers. The flood control criteria will be revised by the Corps of Engineers, as necessary, to reflect changed conditions that come to bear upon flood control operation of the reservoir. Permanent revisions of the flood control criteria are subject to prior approval of the Chief of Engineers or his duly authorized representative.



FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

AREA AND CAPACITY CURVES

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

FOLSOM DAM AND LAKE, AMERICAN RIVER, CALIFORNA

CAPACITY TABLE
FOLSOM LAKE

Elev. Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Difference
					ACRE-FEET						
321	78,296	78,479	78,662	78,845	79,028	79,212	79,395	79,578	79,761	79,944	1,831
322	80,127	80,313	80,499	80,685	80,871	81,058	81,244	81,430	81,616	81,802	1,861
323	81,988	82,177	82,367	82,556	82,746	82,935	83,124	83,314	83,503	83,693	1,894
324	83,882	84,075	84,268	84,460	84,653	84,846	85,039	85,232	85,424	85,617	1,928
325	85,810	86,006	86,202	86,399	86,595	86,791	86,987	87,183	87,380	87,576	1,962
326	87,772	87,972	88,172	88,372	88,572	88,772	88,972	89,172	89,372	89,572	2,000
327	89,772	89,976	90,179	90,383	90,587	90,790	90,994	91,198	91,402	91,605	2,037
328	91,809	92,016	92,224	92,432	92,639	92,846	93,054	93,262	93,469	93,676	2,075
329	93,884	94,096	94,307	94,519	94,730	94,942	95,154	95,365	95,577	95,788	2,116
330	96,000	96,216	96,431	96,646	96,862	97,078	97,293	97,508	97,724	97,940	2,155
331	98,155	98,375	98,594	98,814	99,034	99,254	99,473	99,693	99,913	100,132	2,197
332	100,352	100,576	100,800	101,024	101,248	101,472	101,696	101,920	102,144	102,368	2,240
333	102,592	102,820	103,048	103,277	103,505	013,733	103,961	104,189	104,418	104,646	2,282
334	104,874	105,107	105,340	105,572	105,805	106,038	016,271	106,504	106,736	106,969	2,328
335	107,202	107,439	107,677	107,914	108,151	108,388	108,626	108,863	109,100	109,338	2,373
336	109,575	109,817	110,059	110,301	110,543	110,784	111,026	111,268	111,510	111,752	2,419
337	111,994	112,241	112,488	112,734	112,981	113,228	113,475	113,722	113,968	114,215	2,468
338	114,462	114,714	114,965	115,216	115,468	115,720	115,971	116,222	116,474	116,726	2,515
339	116,977	117,234	117,490	117,746	118,003	118,260	118,516	118,772	119,029	119,286	2,565
340	119,542	119,804	120,065	120,326	120,588	120,850	121,111	121,372	121,634	121,896	2,615
341	122,157	122,424	122,690	122,956	123,223	123,490	123,756	124,022	124,289	124,556	2,665
342	124,822	125,094	125,365	125,637	125,908	126,180	126,452	126,723	126,995	127,266	2,716
343	127,538	127,815	128,091	128,368	128,644	128,921	129,198	129,474	129,751	130,027	2,766
344	130,304	130,586	130,868	131,149	131,431	131,713	131,995	132,277	132,558	132,840	2,818
345	133,122	133,409	133,696	133,982	134,269	134,556	134,843	135,130	135,416	135,703	2,868
346	135,990	136,282	136,574	136,867	137,159	137,451	137,743	138,035	138,328	138,620	2,922
347	138,912	139,209	139,506	139,804	140,101	140,398	140,695	140,992	141,290	141,598	2,972
348	141,884	142,187	142,489	142,792	143,094	143,397	143,700	144,002	144,305	144,607	3,026
349	144,910	145,218	145,526	145,833	146,141	146,449	146,757	147,065	147,372	147,680	3,078
350	147,988	148,301	148,614	148,928	149,241	149,554	149,867	150,180	150,494	150,807	3,132
351	151,120	151,539	151,757	152,076	152,395	152,714	153,032	153,351	153,670	153,988	3,187
352	154,307	154,631	154,955	155,280	155,604	155,928	156,252	156,576	156,901	157,225	3,242
353	157,549	157,879	158,209	158,539	158,869	159,198	159,528	159,858	160,188	160,518	3,299
354	160,848	161,184	161,519	161,855	162,190	162,526	162,862	163,197	163,533	163,868	3,356
355	164,204	164,545	164,887	165,228	165,570	165,911	166,252	166,594	166,935	167,277	3,414
356	167,618	167,965	168,313	168,660	169,008	169,355	169,702	170,050	170,397	170,745	3,474
357	171,092	171,445	171,799	172,152	172,506	172,859	173,212	173,566	173,919	174,273	3,534
358	174,626	174,986	175,345	175,705	176,064	176,424	176,784	177,143	177,503	177,862	3,596
359	178,222	178,588	178,954	173,320	179,686	180,052	180,417	180,783	181,149	181,515	3,659
360	181,881	182,253	182,625	182,998	183,370	183,742	184,114	184,486	184,859	185,231	3,722
361	185,603	185,982	186,360	186,739	187,118	187,496	187,875	188,254	188,633	189,011	3,787
362	189,390	189,775	190,161	190,546	190,932	191,317	191,702	192,088	192,473	192,859	3,854
363	193,244	193,636	194,029	194,421	194,813	195,206	195,598	195,990	196,382	196,775	3,923
364	197,167	197,566	197,966	198,365	198,765	199,165	199,563	199,963	200,362	200,762	3,994
365	201,161	201,568	201,974	202,381	202,788	203,194	203,601	204,008	204,415	204,821	4,067
366	205,228	205,642	206,056	206,471	206,885	207,299	207,713	208,127	208,542	208,956	4,142
367	209,370	209,792	210,214	210,636	211,058	211,480	211,901	212,323	212,745	213,167	4,219
368	213,589	214,019	214,449	214,878	215,308	215,738	216,168	216,598	217,028	218,457	4,298
369	217,887	218,325	218,763	219,201	219,639	220,076	220,514	220,952	221,390	221,828	4,379
370	222,266	222,712	223,158	223,604	224,050	224,496	224,942	225,388	225,834	226,820	4,460
371	226,726	227,180	227,634	228,089	228,543	228,997	229,451	229,905	230,360	230,814	4,542
372	231,268	231,731	232,193	232,656	233,118	233,581	234,044	234,506	234,969	235,431	4,626
373	235,894	236,365	236,836	237,307	237,778	238,249	238,720	239,191	239,662	240,133	4,710
374	240,604	241,084	241,563	242,043	242,522	243,002	243,482	243,961	244,441	244,920	4,796
375	245,400	245,888	246,377	246,865	247,353	247,842	248,330	248,818	249,306	249,795	4,883

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CAPACITY TABLE FOLSOM LAKE

Elev. Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Difference
						ACRE-FEET					
376	250,283	250,780	251,277	251,744	252,271	252,768	253,265	253,762	254,259	254,756	4,970
377	255,253	255,759	256,265	256,770	257,276	257,782	258,288	258,794	259,299	259,805	5,058
378	260,311	260,826	261,340	261,855	262,370	262,884	263,399	263,914	264,429	264,943	5,147
379	265,458	265,982	266,505	267,028	267,552	268,076	268,599	269,122	269,646	270,170	5,235
380	270,693	271,225	271,758	272,290	272,823	273,355	273,887	274,420	274,952	275,485	5,324
381	276,017	276,558	277,099	277,641	278,182	278,723	279,264	279,805	280,347	280,888	5,412
382	281,429	281,979	282,529	283,079	283,629	284,178	284,728	285,278	285,828	286,378	5,499
383	286,928	287,487	288,045	288,604	289,163	289,722	290,280	290,839	291,398	291,956	5,587
384	292,515	293,082	293,650	294,217	294,784	295,352	295,919	296,486	297,053	297,621	5,673
385	298,188	298,764	299,340	299,916	300,492	301,068	301,643	302,219	392,795	393,371	5,759
386	303,947	304,532	305,116	305,700	306,285	306,870	307,454	308,038	308,623	309,208	5,845
387	309,792	310,385	310,978	311,571	312,164	312,756	313,349	313,942	314,535	315,128	5,929
388	315,721	316,322	316,924	317,525	318,127	318,728	319,329	319,931	320,532	321,134	6,014
389	321,735	322,345	322,955	323,564	324,174	324,784	325,394	326,004	326,613	327,223	6,098
390	327,833	328,451	329,069	329,687	330,305	330,924	331,542	332,160	332,778	333,396	6,181
391	334,014	334,640	335,267	335,894	336,520	337,146	337,773	338,400	339,026	339,652	6,267
392	340,279	340,914	341,548	342,183	342,818	343,452	344,087	344,722	345,357	345,991	6,347
393	346,626	347,269	347,912	348,555	349,198	349,840	350,483	351,126	351,769	352,412	6,429
394	353,055	353,706	354,357	355,008	355,659	356,310	356060	357,613	358,264	358,915	6,511
395	359,566	360,225	360,885	361,543	362,202	362,862	363,521	364,180	364,839	365,498	6,591
396	366,157	366,824	367,491	368,159	368,826	369,493	370,160	370,827	371,495	372,162	6,672
397	372,829	373,504	374,179	374,855	375,530	376,205	376,80	377,555	378,231	378,906	6,752
398	379,581	380,264	380,947	381,630	382,313	382,996	383,680	384,363	385,046	385,729	6,831
399	386,412	387,103	387,794	388,485	389,176	389,868	390,559	391,250	391,941	392,632	6,911
400	393,323	394,022	394,721	395,420	396,119	396,818	397,517	398,216	398,915	399,614	6,990
401	400,313	401,020	401,727	402,434	403,141	403,848	404,555	405,262	405,969	406,676	7,070
402	407,383	408,09	408,813	409,528	410,243	410,958	411,673	412,388	413,103	413,818	7,150
403	414,533	415,256	415,979	416,702	417,425	418,148	418,871	419,594	420,317	421,040	7,230
404	421,763	422,494	423,225	423,956	424,687	425,418	426,149	426,880	427,611	428,342	7,310
405	429,073	429,812	430,551	431,290	432,029	432,768	433,507	434,246	434,985	435,724	7,390
406	436,463	437,210	437,957	438,704	439,451	440,198	440,945	441,692	442,439	443,186	7,470
407	443,933	444,688	445,443	446,198	446,953	447,708	448,463	449,218	449,973	450,728	7,550
408	451,483	452,246	453,009	453,772	454,535	455,298	456,060	454,823	457,586	458,349	7,629
409	459,112	459,883	460,654	461,425	462,196	462,966	463,737	464,508	465,279	466,050	7,709
410	466,821	467,600	468,378	469,157	469,936	470,714	471,493	472,272	473,051	473,829	7,787
411	474,608	475,395	476,181	476,968	477,755	478,542	479,328	480,115	480,902	481,688	7,867
412	482,475	483,270	484,064	484,858	485,653	486,448	487,242	488,036	488,831	489,626	7,945
413	490,420	491,222	492,025	492,828	493,630	494,432	495,235	496,038	496,840	497,642	8,025
414	498,445	499,255	500,066	500,876	501,686	502,496	503,307	504,117	504,927	505,738	8,103
415	506,548	507,366	508,185	509,003	509,821	510,640	511,458	512,276	513,094	513,913	8,183
416	514,731	515,557	516,383	517,209	518,035	518,862	519,688	520,514	521,340	522,166	8,261
417	522,992	523,826	524,660	525,494	526,328	527,162	527,997	528,831	529,665	530,499	8,341
418	531,333	532,175	533,017	533,859	534,701	535,542	536,384	537,226	538,068	538,910	8,419
419	539,752	540,602	541,452	542,302	543,152	544,002	544,851	545,701	546,551	547,401	8,499
420	548,251	459,109	549,966	550,824	551,682	552,540	553,397	554,255	555,113	555,970	8,577
421	556,828	557,693	558,559	559,424	560,290	561,155	562,020	562,886	563,751	564,617	8,654
422	565,482	566,355	567,228	568,101	568,974	569,846	570,719	571,592	572,465	573,338	8,729
423	574,211	575,091	575,971	576,852	577,732	578,612	579,492	580,372	581,253	582,133	8,802
424	583,013	583,900	584,788	585,675	586,562	587,450	588,337	589,224	590,111	590,999	8,873
425	591,886	592,780	593,674	594,569	595,463	596,357	597,251	598,145	599,040	599,934	8,942
426	600,828	601,729	602,630	603,532	604,433	605,334	606,235	607,136	608,038	608,939	9,012
427	609,840	610,748	611,656	612,563	613,471	614,379	615,287	616,195	617,102	618,010	9,078
428	681,918	619,832	620,747	621,662	622,576	623,490	624,405	625,320	626,234	627,148	9,145
429	628,063	628,984	629,905	630,826	631,747	632,668	633,590	634,511	635,432	636,353	9,211
430	637,274	638,202	639,129	640,057	640,984	641,912	642,840	643,767	644,695	645,622	9,276

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CAPACITY TABLE FOLSOM LAKE

Elev. Feet	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Difference
					ACRE-FEET						
431	646,550	647,484	648,418	649,353	650,287	561,221	652,155	653,089	654,024	654,958	9,342
432	655,892	656,833	657,773	658,714	659,654	660,595	661,536	662,476	663,417	664,357	9,406
433	665,298	666,245	667,192	668,139	669,086	670,033	670,980	671,927	672,874	673,821	9,470
434	674,768	675,721	676,675	677,628	678,582	679,535	680,488	681,442	682,395	683,349	9,534
435	684,302	685,262	686,221	687,181	688,140	689,100	690,060	691,019	691,979	692,938	9,596
436	693,898	694,864	695,830	696,796	697,762	698,728	699,693	700,659	701,625	702,591	9,659
437	703,557	704,529	705,501	706,473	707,445	708,418	709,390	710,362	711,334	712,306	9,721
438	713,278	714,256	715,234	716,213	717,191	718,169	719,147	720,125	721,104	722,082	9,782
439	723,060	724,044	725,029	726,013	726,998	727,982	728,966	729,951	730,935	731,920	9,844
440	732,904	733,894	734,884	735,875	736,865	737,855	738,845	739,835	740,826	741,816	9,902
441	742,806	743,802	744,799	745,795	746,792	747,788	748,784	749,781	750,777	751,774	9,964
442	752,770	753,772	754,775	755,777	756,779	757,782	758,784	759,786	760,788	761,791	10,023
443	762,793	763,802	764,810	765,818	766,827	767,836	768,844	769,852	770,861	771,870	10,085
444	772,878	773,892	774,907	775,922	776,936	777,950	778,965	779,980	780,994	782,008	10,145
445	783,023	784,044	785,065	786,086	787,107	788,128	789,148	790,169	791,190	792,211	10,209
446	793,232	794,259	795,286	796,313	797,340	798,367	799,394	800,421	801,448	802,475	10,270
447	803,502	804,535	805,568	806,602	807,635	808,668	809,701	810,734	811,768	812,801	10,332
448	813,834	814,873	815,913	816,952	817,992	819,031	820,070	821,110	822,149	823,189	10,394
449	824,228	825,274	826,319	827,365	828,410	829,456	830,502	831,547	832,593	833,638	10,456
450	834,684	835,736	836,788	837,839	838,891	839,943	840,995	842,047	843,098	844,150	10,518
451	845,202	846,260	847,318	848,376	849,434	850,492	851,550	852,608	853,666	854,724	10,580
452	855,782	856,846	857,910	858,975	860,039	861,103	862,167	863,231	864,296	865,360	10,642
453	866,424	867,494	868,565	869,635	870,706	871,776	872,846	873,917	874,987	876,058	10,704
454	877,128	878,205	879,281	880,358	881,434	882,511	883,588	884,664	885,741	886,817	10,766
455	887,894	888,977	890,060	891,142	892,225	893,308	894,391	895,474	896,556	897,639	10,828
456	898,722	899,911	900,900	901,989	903,078	904,167	905,256	906,345	907,434	908,523	10,890
457	909,612	910,707	911,802	912,897	913,992	915,088	916,183	917,278	918,373	919,468	10,951
458	920,563	921,664	922,765	923,867	924,968	926,069	927,170	928,271	929,373	930,474	11,012
459	931,575	932,682	933,789	934,897	936,004	937,111	938,218	939,325	940,433	941,540	11,072
460	942,647	943,760	944,873	945,986	947,099	948,212	949,326	950,439	951,552	952,665	11,131
461	953,778	954,897	956,016	957,135	958,254	959,373	960,492	961,611	962,730	963,849	11,190
462	964,968	966,093	967,218	968,342	969,467	970,592	971,717	972,842	973,966	975,091	11,248
463	976,216	977,346	978,477	979,607	980,738	981,868	982,998	984,129	985,259	986,390	11,304
464	987,520	988,656	989,792	990,928	992,064	993,200	994,336	995,472	996,608	997,744	11,360
465	998,880	1,000,021	1,001,163	1,002,304	1,003,446	1,004,587	1,005,728	1,006,870	1,008,011	1,009,153	11,414
466	1,010,294	1,011,441	1,012,588	1,013,735	1,014,882	1,016,028	1,017,175	1,018,322	1,019,49	1,020,616	11,469
467	1,021,763	1,022,915	1,025,068	1,025,220	1,026,372	1,027,524	1,028,677	1,029,829	1,030,981	1,032,134	11,523
468	1,033,286	1,034,444	1,035,601	1,036,759	1,037,916	1,039,074	1,040232	1,041,389	1,042,547	1,043,704	11,576
469	1,044,862	1,046,025	1,047,188	1,048,351	1,049,514	1,050,677	1,051,840	1,053,003	1,054,166	1,055,329	11,630
470	1,056,492	1,057,660	1,058,828	1,059,997	1,061,165	1,062,333	1,063,501	1,064,669	1,065,838	1,067,006	11,682
471	1,068,174	1,069,347	1,070,521	1,071,694	1,072,868	1,074,041	1,075,214	1,076,388	1,077,561	1,078,735	11,734
472	1,079,908	1,081,087	1,082,265	1,083,444	1,084,622	1,085,801	1,086,980	1,088,158	1,089,337	1,090,515	11,786
473	1,091,694	1,092,878	1,094,062	1,095,245	1,096,429	1,097,613	1,098,797	1,099,981	1,101,164	1,102,348	11,838
474	1,103,532	1,104,721	1,105,910	1,107,098	1,108,287	1,109,476	1,110,665	1,111,854	1,113,042	1,114,231	11,888
475	1,115,420	1,116,614	1,117,808	1,119,002	1,120,196	1,121,390	1,122,584	1,123,778	1,124,972	1,126,166	11,940
476	1,127,360	1,128,559	1,129,758	1,130,957	1,132,156	1,133,550	1,134,554	1,135,753	1,136,952	1,138,151	11,990
477	1,139,350	1,140,554	1,141,758	1,142,962	1,144,166	1,145,370	1,146,575	1,147,779	1,148,983	1,150,187	12,041
478	1,151,391	1,152,600	1,153,809	1,155,018	1,156,227	1,157,436	1,158,646	1,159,855	1,161,064	1,162,273	12,091
479	1,163,482	1,164,696	1,165,910	1,167,124	1,168,338	1,169,552	1,170,767	1,171,981	1,173,195	1,174,409	12,141
480	1,175,623	1,176,842	1,178,061	1,179,280	1,180,499	1,181,718	1,182,938	1,184,157	1,185,376	1,186,595	12,191

NOTES:
1. Areas below elevation 400 ft based on USGS River Survey "American River above Folsom" surveyed in 1935-36, contour interval 20 ft. Areas above elevation 420 ft based on USC of E survey dated March 1946, file No. AM-1-21-97, contour interval 20 ft. Datum is mean sea level.
2. Minimum power pool elevation: 327.0 ft.
3. Gross pool elevation: 466.0 ft.
4.
5. Basic computations by Corps of Engineers and interpolations by Bureau of Reclamation.

4 Nov 55 File: AM-1-26-723

Chart A-3 is not available in this version of the Folsom water control manual. For additional information, contact the U.S. Army Corps of Engineers Sacramento District Office of Counsel at (916) 557-5290.

Chart A-4 is not available in this version of the Folsom water control manual. For additional information, contact the U.S. Army Corps of Engineers Sacramento District Office of Counsel at (916) 557-5290.

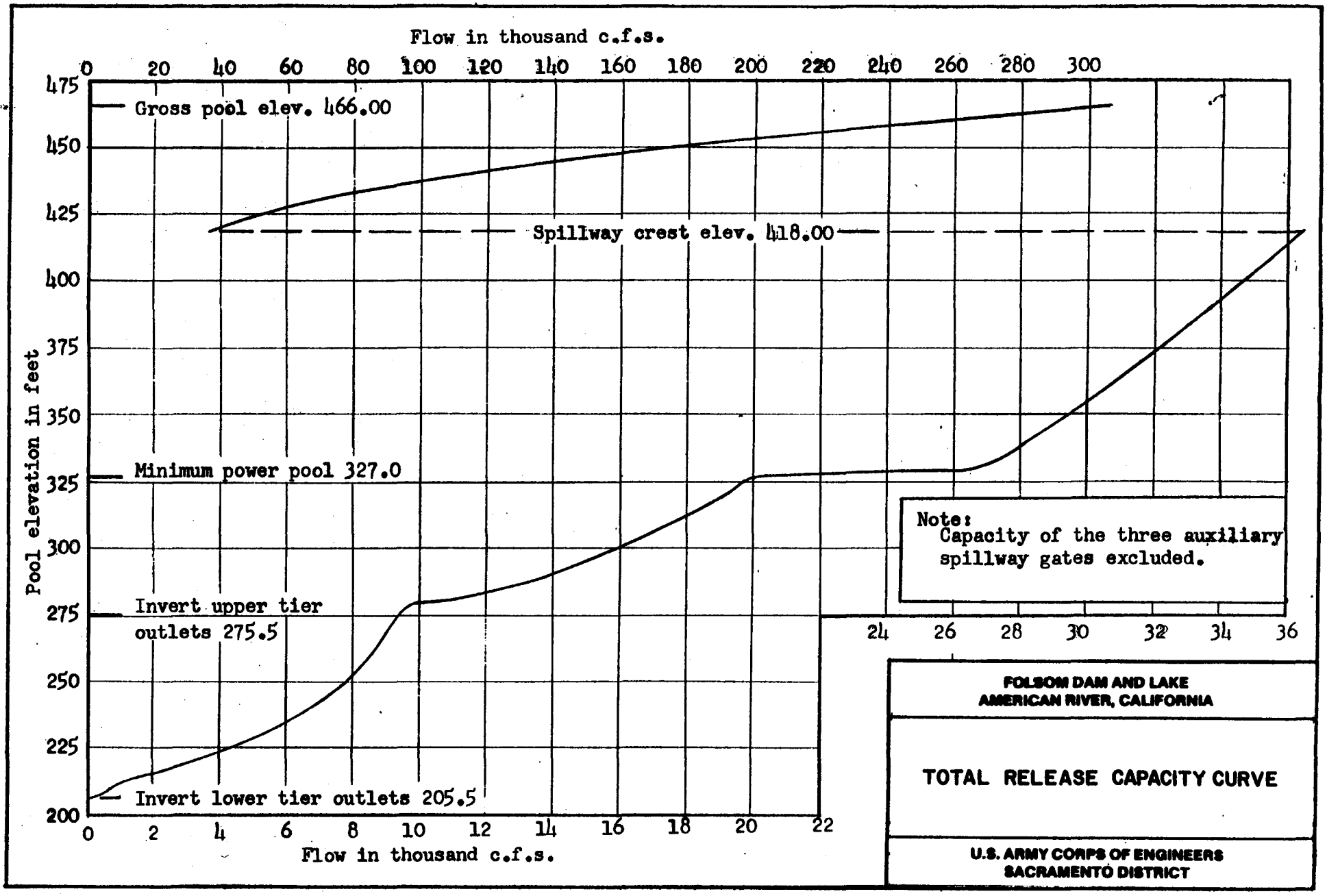
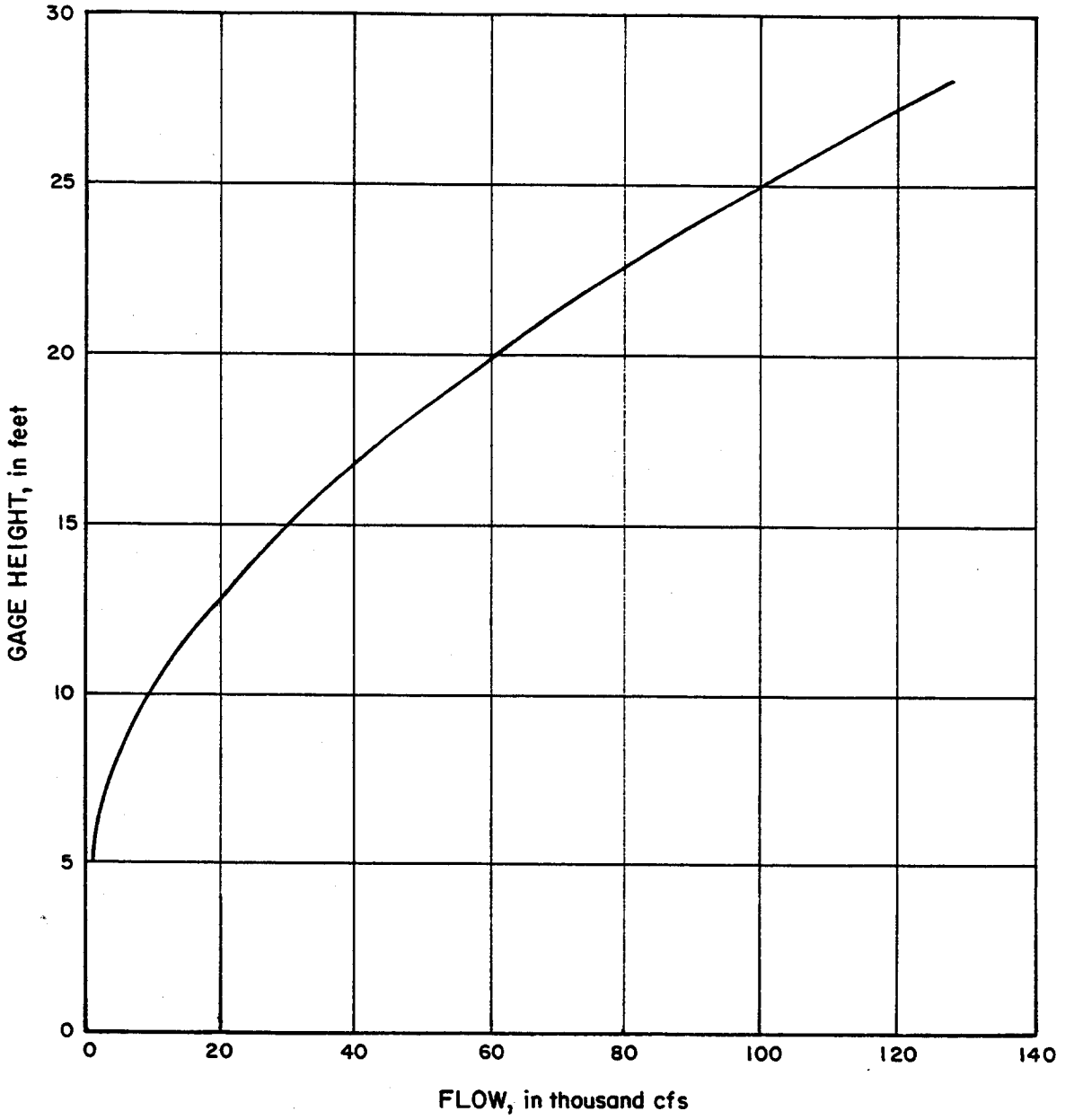

Flow in thousand c.f.s.
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300
475
450
425
400
375
350
325
300
275
250
225
200
Pool elevation in feet
Gross pool elev. 466.00
Spillway crest elev. 418.00
Minimum power pool 327.0
Invert upper tier outlets 275.5
Invert lower tier outlets 205.5
0 2 4 6 8 10 12 14 16 18 20 22
24 26 28 30 32 34 36
Flow in thousand c.f.s.
Note:
Capacity of the three auxiliary spillway gates excluded.
FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA
TOTAL RELEASE CAPACITY CURVE
U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

CHART A-5



NOTE: DATUM OF GAGE IS 71.53 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

DISCHARGE RATING CURVE

AMERICAN RIVER AT FAIR OAKS, CA
USGS STATION NO. 11446500

U.S. ARMY CORPS OF ENGINEERS
SACRAMENTO DISTRICT

CHART A-6

O P E R A T I O N A L D A T A R E Q U I R E M E N T S
FOLSOM DAM & LAKE, AMERICAN RIVER, CALIFORNIA

COE RES CON STATUS	PROJECT STATUS CRITERION	PROJECT BASIN CONDITION	COE RES CON DATA REQUIREMENT *
I	Daily Inflow Less Than 8,000 sfd	No Flood Threat	Daily Data on non-work days shall be furnished on first work day following by 0900 hrs
II	Daily Inflow Equal to OR Greater Than 8,000 sfd & Less Than 20,000 sfd	Forecast Storms W/Potential Reservoir F.C. Space Encroachment	Daily Data furnished same day by 0900 hrs
III	Daily Inflow Equal to OR Greater Than 8,000 sfd & Less Than 20,000 sfd OR F.C. Space Encroachment of 25% or Greater	Forecast Storms W/Reservoir F.C. Space Encroachment	Daily Data same as for II plus Short Period Data @ 0600, 1200, 1800 & 2400 hrs
IV	Inflow Equal to OR Greater Than 20,000 cfs & OR F.C. Space Encroachment of 25% or Greater	Storm In Progress W/Reservoir F.C. Space Encroachment, F.C. Releases Are Being Made From Reservoir	Daily Data same as for II plus Short Period Data each 2 hrs @ 0200, 0400, 0600 etc
V	Declared Emergency	Severe Flood Threat, Flood Flows Occurring, Emergency Declared By District Engineer	Daily Data same as for II plus Short Period Data each 2 hrs @ 0200, 0400, 0600 etc

* OPERATION DATA:

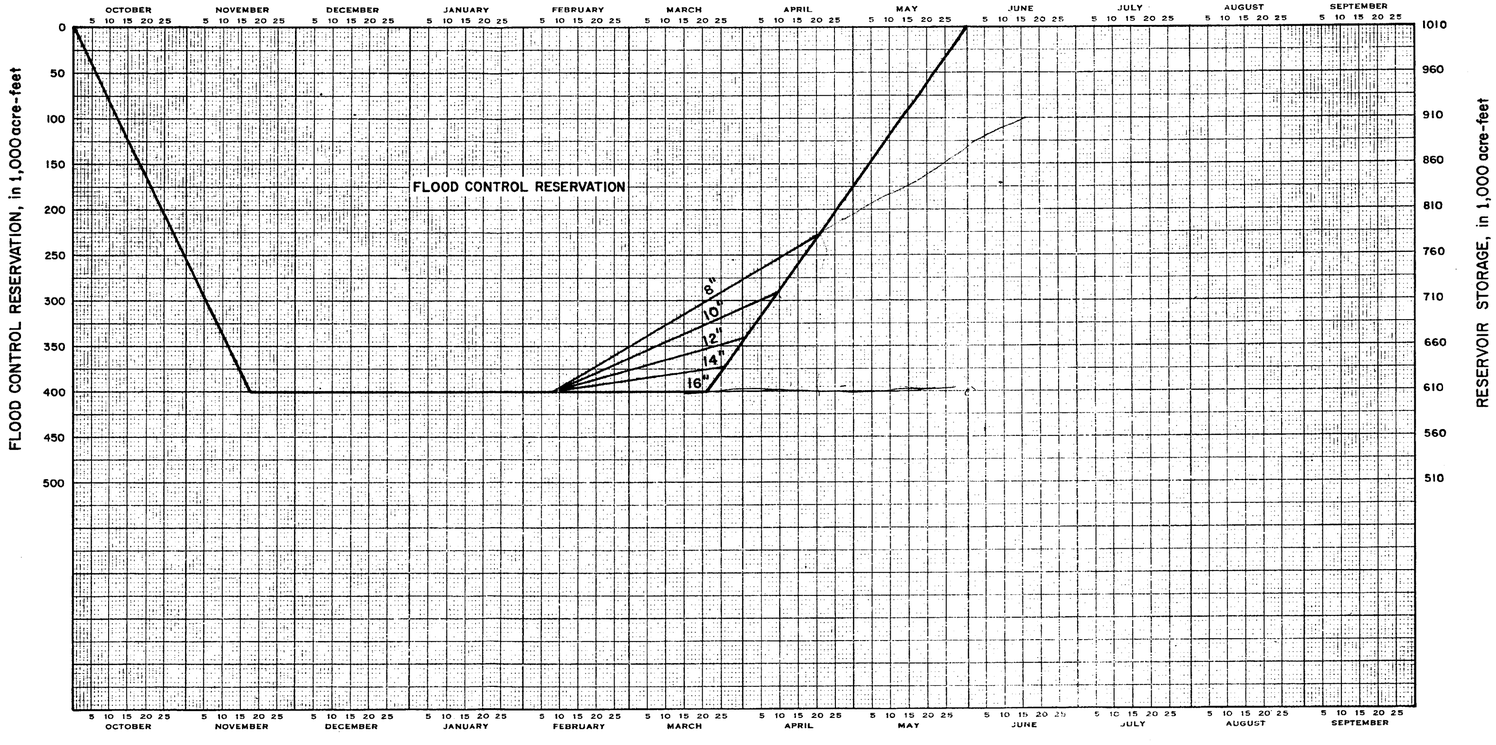
Daily Data:

[1] Elevation : Storage : Outflow : Inflow.
[2] Forecasted inflow and anticipated outflow changes.
[3] Precipitation at the dam and at reporting stations in or adjacent to the drainage basin.
[4] The amount of Flood Control space required.

Short Period Data: (For Rainflood Conditions only)

Data same as above and other data as requested.

REV. 13-NOV-87



NOTES

1. The objective of the Flood Control Diagram is to provide an increased degree of protection to the Lower American River during the development of a revised flood control operational plan for the American River Basin.

2. Flood Control Reservation is the flood control space required under present authorization. When water is stored in this space, reservoir releases must be in accordance with requirements of this diagram.

USE OF DIAGRAM

1. Rain flood parameters define the flood control space reservation on any given day and are computed daily from the weighted accumulation of seasonal basin mean precipitation by adding the current day's precipitation in inches to 97% of the parameter computed the preceding day.

2. Except when larger releases are required by the accompanying Emergency Spillway Release Diagram, water stored within the Flood Control Reservation, defined hereon, shall be released as rapidly as possible subject to the following schedule:

   a. Required Flood Control Release $\frac{1/}{}$ Maximum inflow up to 115,000 cfs but not less than 20,000 cfs when inflows are increasing.

   b. Releases will not be increased more than 15,000 cfs or decreased more than 10,000 cfs during any 2 hour period.

1/ Maximum inflow is the greatest inflow since storage entered into Flood Control Reservation.

FOLSOM DAM AND LAKE
American River, California

FLOOD CONTROL DIAGRAM

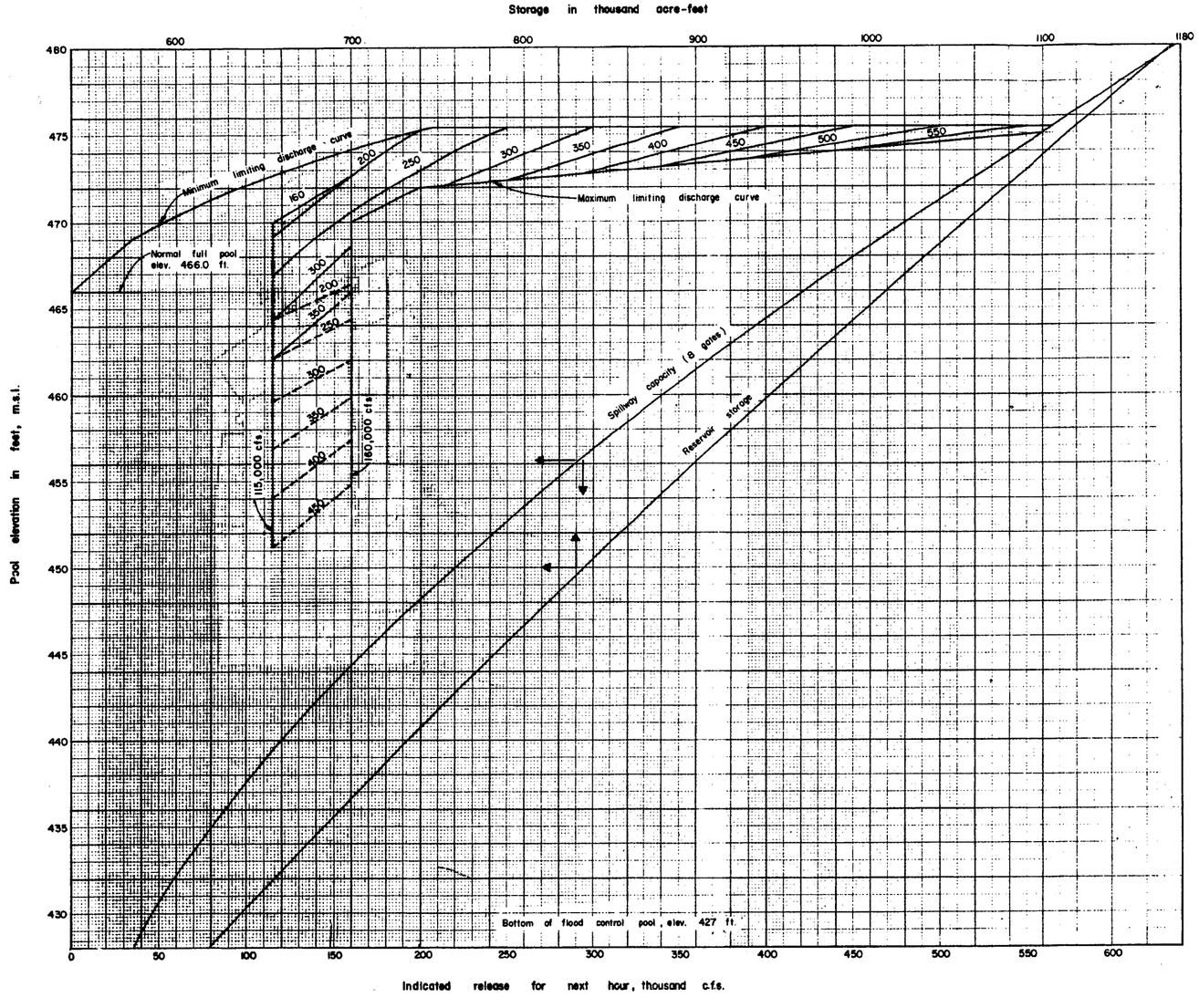
Prepared Pursuant to Flood Control Regulations for Folsom Dam and Lake in accordance with the Code of Federal Regulations Title 33 Part 208.11

APPROVED _____
Brigadier General, USA, Division Engineer
South Pacific Division

APPROVED _____
Regional Director Mid Pacific Region
U.S.B.R.

Effective Date 7 November 1986 File No. AM-1-26-584

CHART A-1



EMERGENCY SPILLWAY RELEASE DIAGRAM

OPERATING INSTRUCTIONS

1. The following procedure should be initiated whenever water is stored above elevation 448 feet m.s.l. and flood control releases are required by the Flood Control Diagram.
   a. Compute preceding hours inflow in thousand c.f.s. This is the parameter value used to enter diagram.
   b. When the stage has not exceeded normal full pool (elev. 466 feet m.s.l.) determine if the inflow is increasing faster than 5,000 c.f.s. per hour. If the inflow is increasing faster than 5,000 c.f.s. per hour enter diagram from existing pool elevation. Find dashed line parameter value and read indicated release.
   c. When the stage is above normal full pool (elev. 466 feet m.s.l.) or the inflow is not increasing faster than 5,000 c.f.s. per hour enter diagram from existing pool elevation. Find solid line parameter value and read indicated release.
   d. Whenever the indicated release is greater than 115,000 c.f.s., such release will be accomplished in accordance with the release schedule shown below. Use flood control diagram to determine release of 115,000 c.f.s. or less
2. Once releases based on this emergency spillway release diagram are initiated, gate changes shall be made in accordance with the criteria found herein, until the stage drops below elevation 448 feet m.s.l.

SCHEDULE FOR EMERGENCY SPILLWAY RELEASES

POOL ELEVATION	CONDITION	INDICATED RELEASE	ACTION
Less than elev. 448		0 to 115,000 c.f.s.	Follow F.C. Diagram
Elev. 448-470 rising pool	Downstream levees intact	115,000 to 160,000 c.f.s.	Increase outflows to indicated release at a rate of 15,000 c.f.s. per 2 hrs. Notify local authorities that evacuation of areas adjacent to downstream levees should be initiated. Do not reduce outflow while pool is rising.
Greater than elev. 470 rising pool	Downstream levees intact	Greater than 160,000 c.f.s.	Increase outflow to indicated release but not greater than 160,000 c.f.s. until 6 hrs. has elapsed since flows greater than 115,000 were initiated.
Greater than elev. 448 falling pool	Downstream levees intact	The lesser of 125% of inflow or maximum release during flood.	Make indicated release but do not reduce outflows below 115,000 c.f.s. until the reservoir pool has dropped below elev. 448.
Greater than elev. 448 falling pool	Downstream levees inoperative	The lesser of 125% of inflow or maximum release during flood.	Make indicated release but do not reduce outflows below 50,000 c.f.s. until the reservoir pool has dropped below elev. 448.

EXAMPLE OF DIAGRAM UTILIZATION

TIME	POOL ELEV	MEAN INFLOW LAST HOUR	INDICATED RELEASE	OUTFLOW NEXT HOUR
0800	458.0	320,000	F.C. Diagram	115,000 c.f.s.
0900	459.7	340,000	150,000	130,000
1000	461.4	350,000	160,000	130,000
1100	463.1	356,000	160,000	145,000
1200	464.4	351,000	142,000	145,000
1300	466.0	340,000	154,000	154,000
1400	467.2	325,000	158,000	158,000
1500	468.3	295,000	153,000	158,000
1600	469.1	260,000	144,000	158,000

FOLSOM DAM AND LAKE
American River, California

EMERGENCY SPILLWAY RELEASE DIAGRAM

Prepared Pursuant to Flood Control Regulations for Folsom Dam and Lake in accordance with the Code of Federal Regulations Title 33 Part 208.11

APPROVED _____
Brigadier General, USA, Division Engineer
South Pacific Division

_____
Regional Director Mid Pacific Region
U.S.B.R.

Effective Date 7 November 1986

File No. AM-1-26-584

CHART A-9

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

WATER CONTROL MANUAL

DECEMBER 1987

EXHIBIT B

CODE OF FEDERAL REGULATIONS TITLE 33
PART 208.11

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

absence of any indication that further public comment would shed any new light on the matter, OSHA concludes that no change in the standard is warranted. Accordingly, the ground-fault protection standard at 29 CFR 1910.309(c) and 29 CFR 1926.400(h), as promulgated on December 21, 1976, is hereby reaffirmed.

(Secs. 6(b) and 8(c), Pub. L. 91-596, 84 Stat. 1593, 1599 (29 U.S.C. 655, 657); sec. 107, Pub. L. 91-54, 83 Stat. 96 (40 U.S.C. 333); Secretary of Labor's Order No. 8-76 (41 FR 25059); 29 CFR Part 1911.)

Signed at Washington, D.C., this 3d day of October 1978.

EULA BINGHAM,
Assistant Secretary of Labor.

[FR Doc. 78-28687 Filed 10-12-78; 8:45 am]

[3710-92-M]

Title 33—Navigation and Navigable Waters

CHAPTER II—CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY

[ER 1110-2-241]

PART 208—FLOOD CONTROL REGULATIONS

Use of Storage Allocated for Flood Control and Navigation Purposes

AGENCY: U.S. Army Corps of Engineers, DOD.

ACTION: Final rule.

SUMMARY: This revision of 33 CFR 208.11 regulations prescribes the policy and procedure for regulating reservoir projects capable of regulation for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation. The revised regulations are applicable to dam and reservoir projects licensed, maintained, and operated under provisions of the Federal Power Act (41 Stat. 1063 (16 U.S.C. 791(A))), Pub. L. 83-436, and other similar authorizing legislation; as well as to reservoir projects constructed wholly or in part with Federal funds as directed by section 7 of the Flood Control Act of 1944. These regulations are intended to establish an understanding between project owners, operating agencies and the Corps of Engineers with regard to certain activities and responsibilities concerning water control management throughout the Nation in the interest of flood control and navigation. Interested persons were given until November 2, 1977 (42 FR 57141) to submit comments. No written comments were received.

DATES: This regulation is effective on October 15, 1978.

ADDRESSES: HQDA (DAEN-CWE-HY) Washington, D.C. 20314.

FOR FURTHER INFORMATION CONTACT:

Mr. Edgar P. Story, Engineering Division, Civil Works Directorate, Office of the Chief of Engineers, Washington, D.C. 20314 202-693-7330.

SUPPLEMENTARY INFORMATION: This final regulation is essentially the same as the proposed rule (42 FR 53637), however, certain reordering has been done of the reference material presented in § 208.11(b). Specifically, excerpts from sections 4(e), 10(a), and 10(c) of the Federal Power Act have been added for improved clarity. Also Federal Power Commission order No. 540 issued October 31, 1975, and published November 7, 1975 (40 FR 51998), amending § 2.9 of the Commission's general policy and interpretations which prescribed standardized conditions (Forms) for inclusion in preliminary permits and licenses issued under part I of the Federal Power Act has been cited and appropriately excerpted. Reference to and citation from article 33 of Federal Power Commission license No. 2009 have been deleted in lieu thereof.

In addition to the proposed action, certain project names and pertinent data are added to and deleted from the list of projects shown in § 208.11(e), list of projects (42 FR 53637). The following projects are added to the list of projects:

(a) U.S. Army Corps of Engineers, Missouri River Division area: Webster Dam and Lake.

(b) U.S. Army Corps of Engineers, New England Division area:

(i) Bear Swamp Pumped Storage Project.

(ii) Turners Falls Reservoir.

(c) U.S. Army Corps of Engineers, North Pacific Division area:

(i) American Falls Dam and Reservoir.

(ii) Anderson Ranch Dam and Reservoir.

(iii) Arrowrock Dam and Reservoir.

(iv) Brownlee Dam and Reservoir.

(v) Grand Coulee Dam and Franklin D. Roosevelt Lake.

(vi) Hells Canyon Dam and Reservoir.

(vii) Kerr Dam and Flathead Lake.

(viii) Mayfield Dam and Reservoir.

(ix) Mossyrock Dam and Davisson Lake.

(x) Oxbow Dam and Reservoir.

(xi) Priest Rapids Dam and Reservoir.

(xii) Ririe Dam and Reservoir.

(xiii) Rocky Reach Dam and Lake Entiat.

(xiv) Ross Dam and Reservoir.

(xv) Upper Baker Dam and Baker Lake.

(xvi) Wanapum Dam and Reservoir.

(xvii) Wells Dam and Lake Pateros.

(d) U.S. Army Corps of Engineers, South Atlantic Division area: Lewis M. Smith Dam and Reservoir.

(e) U.S. Army Corps of Engineers, South Pacific Division area:

(i) Indian Valley Dam and Reservoir.

(ii) Lemon Dam and Reservoir.

(iii) Navajo Dam and Reservoir.

(iv) Paoina Dam and Reservoir.

(v) Vallecito Dam and Reservoir.

The following projects are deleted from the list of projects:

(a) U.S. Army Corps of Engineers, South Altantic Division area: H. Neely Henry Dam and Reservoir.

(b) U.S. Army Corps of Engineers, South Pacific Division area:

(i) Causey Dam and Reservoir.

(ii) Devil Creek Dam and Reservoir.

NOTE.—The Chief of Engineers has determined that this rule does not contain a major proposal requiring preparation of an inflation impact statement under Executive Order 11821 and OMB Circular A-107 (Statutory Authority Pub. L. 90-483).

Dated: October 10, 1978.

CHARLES I. MCGINNIS,
Major General, USA,
Director of Civil Works.

Section 208.11 is revised to read as follows:

§ 208.11 Regulations for use of storage allocated for flood control or navigation and/or project operation at reservoirs subject to prescription of rules and regulations by the Secretary of the Army in the interest of flood control and navigation.

(a) *Purpose.* This regulation prescribes the responsibilities and general procedures for regulating reservoir projects capable of regulation for flood control or navigation and the use of storage allocated for such purposes and provided on the basis of flood control and navigation, except projects owned and operated by the Corps of Engineers; the International Boundary and Water Commission, United States and Mexico; and those under the jurisdiction of the International Joint Commission, United States, and Canada, and the Columbia River Treaty. The intent of this regulation is to establish an understanding between project owners, operating agencies, and the Corps of Engineers.

(b) *Responsibilities.* The basic responsibilities of the Corps of Engineers regarding project operation are set out in the cited authority and described in the following paragraphs:

(1) Section 7 of the Flood Control Act of 1944 (58 Stat. 890, 33 U.S.C. 709) directs the Secretary of the Army to prescribe regulations for flood control and navigation in the following manner:

Hereafter, it shall be the duty of the Secretary of War to prescribe regulations for the use of storage allocated for flood control or navigation at all reservoirs constructed wholly or in part with Federal funds provided on the basis of such purposes, and the operation of any such project shall be in accordance with such regulations: *Provided*, That this section shall not apply to the Tennessee Valley Authority, except that in case of danger from floods on the lower Ohio and Mississippi Rivers the Tennessee Valley Authority is directed to regulate the release of water from the Tennessee River into the Ohio River in accordance with such instructions as may be issued by the War Department.

(2) Federal Energy Regulatory Commission (formerly Federal Power Commission (FPC)) licenses.

(i) Responsibilities of the Secretary of the Army and/or the Chief of Engineers in Federal Energy Regulatory Commission (FERC) licensing actions are set out in the Federal Power Act. Pertinent sections of that Act are cited herein. The Commission may also stipulate, as part of license conditions, that the licensee enter into an agreement with the Department of the Army providing for operation of the project during flood times, in accordance with rules and regulations prescribed by the Secretary of the Army.

(A) Section 4(e) of the Federal Power Act requires approval by the Chief of Engineers and the Secretary of the Army of plans of dams or other structures affecting the navigable capacity of any navigable waters of the United States, prior to issuance of a license by the Commission as follows:

The Commission is hereby authorized and empowered to issue licenses to citizens * * * for the purpose of constructing, operating, and maintaining dams, water conduits, reservoirs, powerhouses, transmission lines, or other project works necessary or convenient for the development and improvement of navigation and for the development, transmission, and utilization of power across, along, from or in any of the streams or other bodies of water over which Congress has jurisdiction * * * *Provided further*, That no license affecting the navigable capacity of any navigable waters of the United States shall be issued until the plans of the dam or other structures affecting navigation have been approved by the Chief of Engineers and the Secretary of the Army.

(B) Sections 10(a) and 10(c) of the Federal Power Act specify conditions of project licenses including the following:

(1) Section 10(a). That the project adopted * * * shall be such as in the judgment of the Commission will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for the use of benefit of interstate or foreign commerce, for the improvement and utilization of waterpower development, and for other beneficial public use * * *.

(2) Section 10(c). That the licensee shall * * * so maintain and operate said works as not to impair navigation, and shall conform .. to such rules and regulations as the Commission may from time to time prescribe for the protection of life, health, and property.* * *

(C) Section 18 of the Federal Power Act directs the operation of any navigation facilities built under the provision of that act, be controlled by rules and regulations prescribed by the Secretary of the Army as follows:

The operation of any navigation facilities which may be constructed as part of or in connection with any dam or diversion structure built under the provisions of this Act, whether at the expense of a licensee hereunder or of the United States, shall at all times be controlled by such reasonable rules and regulations in the interest of navigation; including the control of the pool caused by such dam or diversion structure as may be made from time to time by the Secretary of the Army. * * *

(ii) Federal Power Commission order No. 540 issued October 31, 1975, and published November 7,1975 (40 FR 51998), amending section 2.9 of the Commission's general policy and interpretations prescribed standardized conditions (forms) for inclusion in preliminary permits and licenses issued under part I of the Federal Power Act. As an example, article 12 of standard form L-3, titled: "Terms and Conditions of License for Constructed Major Projects Affecting Navigable Waters of the United States," sets out the Commission's interpretation of appropriate sections of the Act, which deal with navigation aspects, and attendant responsibilities of the Secretary of the Army in licensing actions as follows:

The United States specifically retains and safeguards the right to use water in such amount, to be determined by the Secretary of the Army, as may be necessary for the purposes of navigation on the navigable waterway affected; and the operation of the Licensee, so far as they affect the use, storage and discharge from storage of waters affected by the license, shall at all times be controlled by such reasonable rules and regulations as the Secretary of the Army may prescribe in the interest of navigation, and as the Commission may prescribe for the protection of life, health, and property, * * *, and the Licensee shall release water from the project reservoir at such rate * * *, as the Secretary of the Army may prescribe in the interest of navigation, or as the Commission may prescribe for the other purposes hereinbefore mentioned.

(3) Section 9 of Public Law 436, 83d Congress (68 Stat. 303) provides for the development of the Coosa River, Ala. and Ga., and directs the Secretary of the Army to prescribe rules and regulations for project operation in the interest of flood control and navigation as follows:

The operation and maintenance of the dams shall be subject to reasonable rules and regulations of the Secretary of the Army in the interest of flood control and navigation.

NOTE.—This Regulation will also be applicable to dam and reservoir projects operated under provisions of future legislative acts wherein the Secretary of the Army is directed to prescribe rules and regulations in the interest of flood control and navigation. The Chief of Engineers, U.S. Army Corps of Engineers, is designated the duly authorized representative of the Secretary of the Army to exercise the authority set out in the congressional acts. This regulation will normally be implemented by letters of understanding between the Corps of Engineers and project owner and will incorporate the provisions of such letters of understanding prior to the time construction renders the project capable of significant impoundment of water. A water control agreement signed by both parties will follow when deliberate impoundment first begins or at such time as the responsibilities of any corps-owned projects may be transferred to another entity. Promulgation of this regulation for a given project will occur at such time as the name of the project appears in the FEDERAL REGISTER in accordance with the requirements of § 208.11(d)(1). When agreement on a water control plan cannot be reached between the corps and the project owner after coordination with all interested parties, the project name will be entered in the FEDERAL REGISTER and the Corps of Engineers plan will be the officials water control plan until such time as differences can be resolved.

(c) *Scope and terminology.* This regulation applies to Federal authorized flood control and/or navigation storage projects, and to non-Federal projects which require the Secretary of the Army to prescribe regulations as a condition of the license, permit or legislation, during the planning, design and construction phases, and throughout the life of the project. In compliance with the authority cited above, this regulation defines certain activities and responsibilities concerning water control management throughout the Nation in the interest of flood control and navigation. In carrying out the conditions of this regulation, the owner and/or operating agency will comply with applicable provisions of Pub. L. 85-624, the Fish and Wildlife Coordination Act of 1958, and Pub. L. 92-500, the Federal Water Pollution Control Act Amendments of 1972. This regulation does not apply to local flood protection works governed by § 208.10, or to navigation facilities and associated structures which are otherwise covered by part 207 (Navigation Regulations) of title 33 of the code. Small reservoirs, containing less than 12,500 acre-feet of flood control or navigation storage, may be excluded from this regulation and covered under § 208.10, unless specifically required by law or conditions of the license or permit.

(1) The terms "reservoir" and "project" as used herein include all water resource impoundment projects constructed or modified, including natural lakes, that are subject to this regulation.

(2) The term "project owner" refers to the entity responsible for maintenance, physical operation, and safety of the project, and for carrying out the water control plan in the interest of flood control and/or navigation as prescribed by the Corps of Engineers. Special arrangements may be made by the project owner for "operating agencies" to perform these tasks.

(3) The term "letter of understanding" as used herein includes statements which consummate this regulation for any given project and define the general provisions or conditions of the local sponsor, or owner, cooperation agreed to in the authorizing legislative document, and the requirements for compliance with section 7 of the 1944 Flood Control Act, the Federal Power Act or other special congressional act. This information will be specified in the water control plan and manual. The letter of understanding will be signed by a duly authorized representative of the Chief of Engineers and the project owner. A "field working agreement" may be substituted for a letter of understanding, provided that the specified minimum requirements of the latter, as stated above, are met.

(4) The term "water control agreement" refers to a compliation of water control criteria, guidelines, diagrams, release schedules, rule curves and specifications that basically govern the use of reservoir storage space allocated for flood control or navigation and/or release functions of a water control project for these purposes. In general, they indicate controlling or limiting rates of discharge and storage space required for flood control and/or navigation, based on the runoff potential during various seasons of the year.

(5) For the purpose of this regulation, the term "water control plan" is limited to the plan of regulation for a water resources project in the interest of flood control and/or navigation. The water control plan must conform with proposed allocations of storage capacity and downstream conditions or other requirements to meet all functional objectives of the particular project, acting separately or in combination with other projects in a system.

(6) The term "real-time" denotes the processing of current information or data in a sufficiently timely manner to influence a physicial response in the system being monitored and controlled. As used herein the term connotes * * * the analyses for and execution of water control decisions for both minor and major flood events and for navigation, based on prevailing hydrometeorological and other conditions and constraints, to achieve efficient management of water resource systems.

(d) *Procedures.* (1) *Conditions during project formulation.* During the planning and design phases, the project owner should consult with the Corps of Engineers regarding the quantity and value of space to reserve in the reservoir for flood control and/or navigation purposes, and for utilization of the space, and other requirements of the license, permit or conditions of the law. Relevant matters that bear upon flood control and navigation accomplishment include: runoff potential, reservoir discharge capability, downstream channel characteristics, hydrometeorological data collection, flood hazard, flood damage charateristics, real estate acquisition for flowage requirements (fee and easement), and resources required to carry out the water control plan. Advice may also be sought on determination of and regulation for the probable maximum or other design flood under consideration by the project owner to establish the quantity of surcharge storage space, and freeboard elevation of top of dam or embankment for safety of the project.

(2) *Corps of Engineers involvement.* If the project owner is responsible for real-time implemenetation of the water control plan, consultation and assistance will be provided by the Corps of Engineers when appropriate and to the extent possible. During any emergency that affects flood control and/or navigation, the Corps of Engineers may temporarily prescribe regulation of flood control or navigation storage space on a day-to-day (real-time) basis without request of the project owner. Appropriate consideration will be given for other authorized project functions. Upon refusal of the project owner to comply with regulations prescribed by the Corps of Engineers, a letter will be sent to the project owner by the Chief of Engineers or his duly authorized representative describing the reason for the regulations prescribed, events that have transpired, and notification that the project owner is in violation of the Code of Federal Regulations. Should an impasse arise, in that the project owner or the designated operating entity persists in noncompliance with regulations prescribed by the Corps of Engineers, measures may be taken to assure compliance.

(3) *Corps of Engineers implementation of real-time water control decisions.* The Corps of Engineers may prescribe the continuing regulation of flood control storage space for any project subject to this regulation on a day-to-day (real-time) basis. When this is the case, consultation and assistance from the project owner to the extent possible will be expected. Special requests by the project owner, or appropriate operating entity, are preferred before the Corps of Engineers offers advice on real-time regulation during surcharge storage utilization.

(4) *Water control plan and manual.* Prior to project completion, water control managers from the Corps of Engineers will visit the project and the area served by the project to become familiar with the water control facilities, and to insure sound formulation of the water control plan. The formal plan of regulation for flood control and/or navigation, referred to herein as the water control plan, will be developed and documented in a water control manual prepared by the Corps of Engineers. Development of the manual will be coordinated with the project owner to obtain the necessary pertinent information, and to insure compatibility with other project purposes and with surcharge regulation. Major topics in the manual will include: Authorization and description of the project, hydrometeorology, data collection and communication networks, hydrologic forecasting, the water control plan, and water resource management functions, including responsibilities and coordination for water control decisionmaking. Special instructions to the dam tender or reservoir manager on data collection, reporting to higher Federal authority, and on procedures to be followed in the event of a communication outage under emergency conditions, will be prepared as an exhibit in the manual. Other exhibits will include copies of this regulation, letters of understanding consummating this regulation, and the water control agreements. After approval by the Chief of Engineers or his duly authorized representative, the manual will be furnished the project owner.

(5) *Water control agreement.* (i) A water control diagram (graphical) will be prepared by the Corps of Engineers for each project having variable space reservation for flood control and/or navigation during the year; e.g., variable seasonal storage, joint-use space, or other rule curve designation. Reservoir inflow parameters will be included on the diagrams when appropriate. Concise notes will be included on the diagrams prescribing the use of storage space in terms of release schedules, runoff, nondamaging or other controlling flow rates downstream of the damsite, and other major factors as appropriate. A water control release schedule will be prepared in tabular form for projects that do not have variable space reservation for flood control and/or navigation. The water control diagram or release schedule will be signed by a duly authorized representative of the Chief of Engineers, the project owner, and the designated operating agency, and will be used as the basis for carrying out this

regulation. Each diagram or schedule will contain a reference to this regulation.

(ii) When deemed necessary by the Corps of Engineers, information given on the water control diagram or release schedule will be supplemented by appropriate text to assure mutual understanding on certain details or other important aspects of the water control plan not covered in this regulation, on the water control diagram or in the release schedule. This material will include clarification of any aspects that might otherwise result in unsatisfactory project performance in the interest of flood contol and/or navigation. Supplementation of the agreement will be necessary for each project where the Corps of Engineers exercises the discretionary authority to prescribe the flood control regulation on a day-to-day (real-time) basis. The agreement will include delegation of the responsibility. The document should also cite, as appropriate, section 7 of the 1944 Flood Control Act, the Federal Power Act and/or other congressional legislation authorizing construction an/or directing operation of the project.

(iii) All flood control regulations published in the FEDERAL REGISTER under this section (part 208) of the code prior to the date of this publication which are listed in paragraph 208.11(e) are hereby superseded.

(iv) Nothing in this regulation prohibits the promulgation of specific regulations for a project in compliance with the authorizing acts, when agreement on acceptable regulations cannot be reached between the Corps of Engineers and the owner.

(6) *Hydrometeorological instrumentation.* The project owner will provide instrumentation in the vicinity of the damsite and will provide communication equipment necessary to record and transmit hydrometeorological and reservoir data to all appropriate Federal authorities on a real-time basis unless there are extenuating circumstances or are otherwise provided for as a condition of the license or permit. For those projects where the owner retains responsibility for real-time implementation of the water control plan, the owner will also provide or arrange for the measurement and reporting of hydrometeorological parameters required within and adjacent to the watershed and downstream of the damsite, sufficient to regulate the project for flood control and/or navigation in an efficient manner. When data collection stations outside the immediate vicinity of the damsite are required, and funds for installation, observation, and maintenance are not available from other sources, the Corps of Engineers may agree to share the costs for such stations with the project owner. Availability of funds and urgency of data needs are factors which will be considered in reaching decisions on cost sharing.

(7) *Project safety.* The project owner is responsible for the safety of the dam and appurtenant facilities and for regulation of the project during surcharge storage utilization. Emphasis upon the safety of the dam is especially important in the event surcharge storage is utilized, which results when the total storage space reserved for flood control is exceeded. Any assistance provided by the Corps of Engineers concerning surcharge regulation is to be utilized at the discretion of the project owner, and does not relieve the owner of the responsibility for safety of the project.

(8) *Notification of the general public.* The Corps of Engineers and other interested Federal and State agencies, and the project owner will jointly sponsor public involvement activities, as appropriate, to fully apprise the general public of the water control plan. Public meetings or other effective means of notification and involvement will be held, with the initial meeting being conducted as early as practicable but not later than the time the project first becomes operational. Notice of the initial public meeting shall be published once a week for 3 consecutive weeks in one or more newspapers of general circulation published in each county covered by the water control plan. Such notice shall also be used when appropriate to inform the public of modifications in the water control plan. If no newspaper is published in a county, the notice shall be published in one or more newspapers of general circulation within that county. For the purposes of this section a newspaper is one qualified to publish public notices under applicable State law. Notice shall be given in the event significant problems are anticipated or experienced that will prevent carrying out the approved water control plan or in the event that an extreme water condition is expected that could produce severe damage to property or loss of life. The means for conveying this information shall be commensurate with the urgency of the situation. The water control manual will be made available for examination by the general public upon request at the appropriate office of the Corps of Engineers, project owner or designated operating agency.

(9) *Other generalized requirements for flood control and navigation.* (i) Storage space in the reservoirs allocated for flood control and navigation purposes shall be kept available for those purposes in accordance with the water control agreement, and the plan of regulation in the water control manual.

(ii) Any water impounded in the flood control space defined by the water control agreement shall be evacuated as rapidly as can be safely accomplished without causing downstream flows to exceed the controlling rates; i.e., releases from reservoirs shall be restricted insofar as practicable to quantities which, in conjunction with uncontrolled runoff downstream of the dam, will not cause water levels to exceed the controlling stages currently in force. Although conflicts may arise with other purposes, such as hydropower, the plan or regulation may require releases to be completely curtailed in the interest of flood control or safety of the project.

(iii) Nothing in the plan of regulation for flood control shall be construed to require or allow dangerously rapid changes in magnitudes of releases. Releases will be made in a manner consistent with requirements for protecting the dam and reservoir from major damage during passage of the maximum design flood for the project.

(iv) The project owner shall monitor current reservoir and hydro- meteorological conditions in and adjacent to the watershed and downstream of the damsite, as necessary. This and any other pertinent information shall be reported to the Corps of Engineers on a timely basis, in accordance with standing instructions to the damtender or other means requested by the Corps of Engineers.

(v) In all cases where the project owner retains responsibility for real-time implementation of the water control plan, he shall make current determinations of: Reservoir inflow, flood control storage utilized, and scheduled releases. He shall also determine storage space and releases required to comply with the water control plan prescribed by the Corps of Engineers. The owner shall report this information on a timely basis as requested by the Corps of Engineers.

(vi) The water control plan is subject to temporary modification by the Corps of Engineers if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the project owner and shall include justification for the action.

(vii) The project owner may temporarily deviate from the water control plan in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such actions shall be immediately reported by the fastest

means of communication available. Actions shall be confirmed in writing the same day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Chief of Engineers, or his duly authorized representative.

(viii) Advance approval of the Chief of Engineers, or his duly authorized representative, is required prior to any deviation from the plan of regulation prescribed or approved by the Corps of Engineers in the interest of flood control and/or navigation, except in emergency situations provided for in paragraph (d)(9)(vii) of this section. When conditions appear to warrant a prolonged deviation from the approved plan, the project owner and the Corps of Engineers will jointly investigate and evaluate the proposed deviation to insure that the overall integrity of the plan would not be unduly compromised. Approval of prolonged deviations will not be granted unless such investigations and evaluations have been conducted to the extent deemed necessary by the Chief of Engineers, or his designated representatives, to fully substantiate the deviation.

(10) *Revisions.* The water control plan and all associated documents will be revised by the Corps of Engineers, as necessary, to reflect changed conditions that come to bear upon flood control and navigation, e.g., reallocation of reservoir storage space due to sedimentation or transfer of storage space to a neighboring project. Revision of the water control plan, water control agreement, water control diagram, or release schedule requires approval of the Chief of Engineers or his duly authorized representative. Each such revision shall be effective upon the date specified in the approval. The original (signed document) water control agreement shall be kept on file in the Office, Chief of Engineers, Department of the Army, Washington, D.C. Copies of the agreement shall be kept on file and may be obtained from the office of the project owner, or from the office of the appropriate Division Engineer, Corps of Engineers.

(11) *Federal Register.* The following information for each project subject to section 7 of the 1944 Flood Control Act and other applicable congressional acts shall be published in the FEDERAL REGISTER prior to the time the projects becomes operational and prior to any significant impoundment before project completion or * * * at such time as the responsibility for physical operation and maintenance of the Corps of Engineers owned projects is transferred to another entity: (i) Reservoir, dam, and lake names, (ii) stream, county, and State corresponding to the damsite location, (iii) the maximum current storage space in acre-feet to be reserved exclusively for flood control and/or navigation purposes, or any multiple-use space (intermingled) when flood control or navigation is one of the purposes, with corresponding elevations in feet above mean sea level, and area in acres at the upper and lower limits of said space, (iv) the name of the project owner, and (v) congressional legislation authorizing the project for Federal participation.

(e) *List of projects.* The following tables, "Pertinent Project Data—Section 208.11 Regulation," show the pertinent data for projects which are subject to this regulation.

(Sec. 7, Pub. L. 78-534, 58 Stat. 890 (33 U.S.C. 709); the Federal Power Act, 41 Stat. 1063 (16 U.S.C. 791(A)); and Sec. 9, Pub. L. 83-436, 68 Stat. 303.)

[FR Doc. 78-29100 Filed 10-12-78; 8:45 am]

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Alpine Dam	Keith Creek	Winnebago,IL	0.585	796.0	764.0	51.88	0	-	-	-	-	-	City of Rockford,IL	PWA Proj.
Agency Valley Dam & Res	N. Fork Malheur Riv.	Malheur,OR	-	-	-	-	-	60.0	3340.0	3263.21	1,900	0	Bureau of Reclamation	PL 68-292
American Falls Dam & Reservoir	Snake River	Power,ID	-	-	-	-	-	1,700	4343.2	4295.6	56,100	0	Bureau of Reclamation	FPC NO. 2259
Anderson Ranch Dam & Reservoir	S.Fk. Boise River	Elmore,ID	-	-	-	-	-	433.2	4196.0	4043.0	4,740	1,150	Bureau of Reclamation	Rec. Proj. Act of 19[illegible] (53 Stat. 1187)
Arrowrock Dam & Reservoir	Boise River	Elmore,ID	-	-	-	-	-	286.6	3216.0	2967.0	3,100	200	Bureau of Reclamation	Rec.Act of 17 Jun 1902 (32 Stat. 388)
Bear Creek Dam	Bear Creek	Marion & Ralls, MO	8.7	546.5	520.0	540	0	-	-	-	-	-	City of Hannibal,MO	PL 83-780
Bear Swamp Pumped Storage Proj.	Trib. of Deerfield River	Franklin, MA	-	-	-	-	-	(No specific FC/Nav. Storage Allocation)					New Eng Power CO.	Fed. Power Act.
Big Dry Creek and Diversion	Big Dry Creek and Dog Creek	Fresno,CA	16.25	425.0	393.0	1,530	0	-	-	-	-	-	Reclamation Board CA	PL 77-228
Bonny Dam & Reservoir	S. Fork Republican River	Yuma, CO	128.8	3710.0	3672.0	5,036	2,042	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Boysen Dam & Reservoir	Wind River	Fremont, WY	146.0	4732.0	4725.0	22,100	19,560	146.1	4725.0	4717.0	19,560	16,955	Bureau of Reclamation	PL 78-534
Brownlee Dam & Reservoir	Snake River	Baker,OR; Washington,ID	-	-	-	-	-	980.3	2077.0	1976.0	13,840	6,650	Idaho Power Company	FPC No. 1971-C
Bully Creek Dam & Reservoir	Bully Creek	Malheur,OR	-	-	-	-	-	31.65	2523.0	2456.8	1,082	140	Bureau of Reclamation	PL 86-248
Comanche Dam & Reservoir	Mokelumne River	San Joaquin, CA	-	-	-	-	-	200.0	235.5	205.1	7,600	5,507	East Bay Mun Util Dist. Oakland,CA	PL 86-645
Canyon Ferry Dam & Lake	Missouri Riv.	Lewis & Clark, MT	104.3	3800.0	3797.0	35,181	34,435	799.1	3797.0	3770.0	34,435	24,126	Bureau of Reclamation	PL 78-534

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Cedar Bluff Dam & Reservoir	Smoky Hill River	Trego, KS	191.9	2166.0	2144.0	10,790	6,869	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Clark Canyon Dam & Reservoir	Beaverhead River	Beaverhead, MT	79.1	5560.4	5546.1	5,903	5,160	50.4	5546.1	5535.7	5,160	4,496	Bureau of Reclamation	PL 78-534
Del Valle Dam & Reservoir	Alameda Creek	Alameda, CA	37.0	745.0	703.1	1,060	710	1.0	703.1	702.2	710	700	CA Dept of Water Resources	PL 87-874
East Canyon Dam & Reservoir	East Canyon Creek	Morgan, UT	-	-	-	-	-	48.0	5705.5	5577.0	684	127	Bureau of Reclamation	PL 81-273
Echo Dam and Reservoir	Weber River	Summit, UT	-	-	-	-	-	74.0	5560.0	5450.0	1,455	0	Bureau of Reclamation	PL 81-273
Emigrant Dam & Reservoir	Emigrant Creek	Jackson, OR	39.0	2241.0	2131.5	801	80	-	-	-	-	-	Bureau of Reclamation	PL 83-606
Enders Dam & Reservoir	Frenchman Creek	Chase, NB	30.0	3127.0	3112.3	2,405	1,707	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Folsom Dam & Lake	American River	Sacramento, CA	-	-	-	-	-	400.0	466.0	427.0	11,450	9,040	Bureau of Reclamation	PL 81-356
Friant Dam & Reservoir (Millerton Lake)	San Joaquin River	Fresno, CA	-	-	-	-	-	390.0	578.0	466.3	4,850	2,101	Bureau of Reclamation	PL 75-392 PL 76-868
Gaston-Roanoke Rapids Dam & Reservoir	Roanoke River	Northampton & Halifax, NC	63.0	203.0	200.0	22,500	20,300	-	-	-	-	-	VA Electric & Power Co.	Fed Power Act
Glen Elder Dam & Waconda Lake	Solomon River	Mitchell, KS	722.3	1488.3	1455.6	30,682	12,602	-	-	-	-	-	Bureau of Reclamation	PL 78-534 PL 79-526
Glendo Dam & Reservoir	N. Platte River	Platte, WY	271.9	4653.0	4635.0	17,986	12,365	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Grand Coulee Dam, Franklin D. Roosevelt Lake	Columbia River	Grant & Okanogan, WA	-	-	-	-	-	5185.45	1290.0	1208.0	82,280	45,592	Bureau of Reclamation	PL 89-561 3rd Powerhouse
Heart Butte Dam & Lake Techida	Heart River	Grant, ND	150.0	2094.5	2064.5	6,625	3,400	-	-	-	-	-	Bureau of Reclamation	PL 78-534

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE					MULTIPLE-USE					PROJECT OWNER	AUTH. LEGIS.
			FLOOD CONTROL/NAVIGATION					FLOOD CONTROL/NAVIGATION						
			STORAGE	ELEV. LIMITS		AREA		STORAGE	ELEV. LIMITS		AREA			
			1000 ac-ft	feet m.s.l. UPPER	LOWER	acres UPPER	LOWER	1000 ac-ft	feet m.s.l. UPPER	LOWER	acres UPPER	LOWER		
Hells Canyon Dam & Reservoir	Snake River	Wallowa, OR; Adams, ID	-	-	-	-	-	11.7	1688.0	1683.0	2,380	2,280	Idaho Power Company	FPC No. 1971-A
Hoover Dam & Lake Mead	Colorado River	Clark NV & Mohave, AZ	1500.0	1229.0	1219.6	162,700	156,500	15,853	1219.6	1083.0	156,500	83,500	Bureau of Reclamation	PL 70-642
Hungry Horse Dam & Reservoir	S. Fork Flathead Riv.	Flathead, MT	2982.0	3560.0	3336.0	23,800	5,400	-	-	-	-	-	Bureau of Reclamation	PL 78-329
Indian Valley Dam&Reservoir	N.Fork Cache Creek	Lake, CA	-	-	-	-	-	40.0	1485.0	1474.7	3,975	3,749	Yolo Cty Fl. Cont&WtrCons Dist.	PL 84-984
Jamestown Dam & Reservoir	James River	Stutsman, ND	185.4	1454.0	1432.67	13,206	2,555	6.6	1432.67	1429.8	2,555	2,085	Bureau of Reclamation	PL 78-534
Kerr Dam Flathead Lake	Flathead River	Lake, MT	-	-	-	-	-	1219.0	2893.0	2883.0	125,560	120,000	Montana Power Co.	FPC No. 5
Keyhole Dam & Reservoir	Belle Fourche	Crook, WY	140.2	4111.5	4099.3	13,686	9,394	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Kirwin Dam & Reservoir	N. Fork Solomon River	Phillips, KS	215.1	1757.3	1729.25	10,640	5,073	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Lamon Dam & Reservoir	Florida River	La Plata, Colorado	-	-	-	-	-	39.0	8148	8023	622	62	Bureau of Reclamation	PL 84-485
Lewis M. Smith Dam & Reservoir	Sipsey Fork Black Warrior Riv.	Cullman & Walker, AL	280.6	522.0	510.0	25,700	21,200	-	-	-	-	-	Alabama Power Co.	Fed. Power Act
Little Wood River Dam & Reservoir	Little Wood River	Blain, ID	30.0	5237.3	5127.8	574	0	-	-	-	-	-	Bureau of Reclamation	PL 84-993
Logan Martin Dam & Reservoir	Coosa River	Talladega, AL	245.3	477.0	465.0	76,310	15,260	-	-	-	-	-	Alabama Power Co.	PL 83-436
Los Banos Dam & Detention Res.	Los Banos Creek	Merced, CA	-	-	-	-	-	14.0	353.5	327.8	619	467	Bureau of Reclamation	PL 86-488
Lost Creek Dam & Res.	Lost Creek	Morgan, UT	-	-	-	-	-	20.0	6005.0	5912.0	365	93	Bureau of Reclamation	PL 81-273
Lovewell Dam & Reservoir	White Rock Creek	Jewell, KS	50.5	1595.3	1582.6	5,025	2,986	-	-	-	-	-	Bureau of Reclamation	PL 78-534

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Markham Ferry Dam & Lake Wash E. Hudson	Grand (Neosho) River	Mayes, OK	244.2	636.0	619.0	18,000	10,900	-	-	-	-	-	Grand River Dam Authority	PL 76-476
Mayfield Dam & Reservoir	Cowlitz River	Lewis, WA	-	-	-	-	-	21.4	425.0	415.0	2,070	1,825	City of Tacoma	FPC No. 2016-A
Medicine Creek Dam & Harry Strunk Lake	Medicine Creek	Frontier, NB	52.2	2386.2	2366.1	3,465	1,850	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Mossyrock Dam Davisson Lake	Cowlitz River	Lewis, WA	-	-	-	-	-	1397.0	778.5	621.5	11,800	5,000	City of Tacoma	FPC No. 2016-B
Navajo Dam Reservoir	San Juan River	Rio Arriba & San Juan, NM	-	-	-	-	-	1036.1	6085	5990	15,610	7,400	Bureau of Reclamation	PL 84-485
New Exchequer Dam & Lake McClure	Merced River	Tuolomne, CA	-	-	-	-	-	400.0	867.0	799.7	7,110	4,849	Merced Irrig. District	PL 86-645
Norton Dam & Reservoir	Prairie Dog Creek	Norton, KS	98.8	2331.4	2304.3	5,316	2,181	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Ochoco Dam & Reservoir	Ochoco Creek	Crook, OR	51.4	3136.2	3048.1	1,150	120	-	-	-	-	-	Bureau of Reclamation	PL 84-992
Oroville Dam & Lake	Feather River	Butte, CA	-	-	-	-	-	750.0	900.0	848.5	15,800	13,346	CA Dept of Wtr Resources	PL 85-500
Oxbow Dam & Reservoir	Snake River	Baker, OR; Adams, ID	-	-	-	-	-	5.0	1805.0	1800.0	1,165	1,115	Idaho Power Company	FPC No. 1971-B
Pactola Dam & Reservoir	Rapid Creek	Pennington, SD	43.0	4621.5	4580.2	1,232	860	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Palisades Dam & Reservoir	Snake River	Bonneville, ID	202.0	5620.0	5452.43	16,100	2,170	-	-	-	-	-	Bureau of Reclamation	PL 81-864
Paonia Dam & Reservoir	Muddy Creek	Gunnison, Colorado	-	-	-	-	-	17.0	6447.5	6373.0	334	120	Bureau of Reclamation	PL 80-117 PL 84-485
Pineview Dam & Reservoir	Odgen River	Weber, UT	-	-	-	-	-	110.0	4900.0	4818.0	2,874	0	Bureau of Reclamation	PL 81-273
Platora Dam & Reservoir	Conejos River	Conejos, CO	6.0	10034.0	10027.5	947	920	540.0	10027.5	994.5	920	0	Bureau of Reclamation	PL 76-640
Priest Rapids Dam & Reservoir	Columbia River	Grant, WA	-	-	-	-	-	44.0	488.0	481.5	7,100	6,500	Grant County PUD No. 2	FPC No. 2114-A
Prineville Dam & Reservoir	Crooked Creek	Crook, OR	153.0	3234.8	3112.0	2,990	120	-	-	-	-	-	Bureau of Reclamation	PL 84-992

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	ELEV. LIMITS feet m.s.l. UPPER	ELEV. LIMITS feet m.s.l. LOWER	AREA acres UPPER	AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Prosser Creek & Reservoir	Prosser Creek	Nevada, CA	-	-	-	-	-	20.0	5741.2	5703.7	745	334	Bureau of Reclamation	PL 84-858
Red Willow Dam & Hugh Butler Lake	Red Willow Creek	Frontier, NB	48.9	2604.9	2581.8	2,682	1,629	-	-	-	-	-	Bureau of Reclamation	PL 78-534 PL 85-783
Ririe Dam & Reservoir	Willow Creek Snake River	Bonneville, ID	-	-	-	-	-	90.0	5119.0	5023.0	1,560	360	Bureau of Reclamation	PL 87-874
Rocky Reach Dam Lake Entiat	Columbia River	Chelan, WA	-	-	-	-	-	37.0	707.0	703.0	9,600	0	Chelan Coty PUD No. 1	FPC No. 2145
Ross Dam & Reservoir	Skagit River	Whatcom, WA	-	-	-	-	-	530.5	1602.5	1475.0	6,000	2,168	City of Seattle	FPC No. 553-C
Savage River Dam & Res.	Savage River	Garrett, MD	-	-	-	-	-	16.028	1468.5	1400.0	366	127	Upper Potomac Riv Commission	PL 79-526
Shadehill Dam & Reservoir	Grand River	Perkins, SD	217.7	2302.0	2272.0	9,900	4,800	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Shasta Dam & Lake	Sacramento River	Shasta, CA	-	-	-	-	-	1300.0	1067.0	1018.6	29,570	23,894	Bureau of Reclamation	PL 75-392 PL 76-868
Smith Mtn & Leesville Dam & Res.	Roanoke River	Bedford, Campbell & Pittsylvania, VA	-	-	-	-	-	(No Specific FC/Nav. Storage Allocation)					Appalecian Power Co.	Fed. Power Act
Trenton Dam & Reservoir	Republican River	Hitchcock, NB	133.8	2773.0	2752.0	7,975	4,974	-	-	-	-	-	Bureau of Reclamation	PL 78-534
Turner Falls Res (Includes Northfield Mtn Pumped Storage Project)	Connecticut River (Briggs Brook)	Franklin, MA	-	-	-	-	-	(No Specific FC/Nav. Storage Allocation)					Northeast Utilities Service Co. Hartford, CT	Fed. Power Act
Twitchell Dam & Reservoir	Cuyama River	Santa Barbara, CA	89.0	651.5	623.0	3,690	2,650	-	-	-	-	-	Bureau of Reclamation	PL 83-774
Upper Baker Dam Baker Lake	Baker River	Whatcom, WA	-	-	-	-	-	220.63	724.0	655.0	4,890	0	Puget Sound Power & Light Co.	Sec. 201 PL 89-298 FPC No. - 2150-8

PERTINENT PROJECT DATA - SECTION 208.11 REGULATIONS

PROJECT NAME	STREAM	COUNTY & STATE	EXCLUSIVE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres UPPER	EXCLUSIVE FLOOD CONTROL/NAVIGATION AREA acres LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION STORAGE 1000 ac-ft	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION ELEV. LIMITS feet m.s.l. LOWER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres UPPER	MULTIPLE-USE FLOOD CONTROL/NAVIGATION AREA acres LOWER	PROJECT OWNER	AUTH. LEGIS.
Vallecito Dam Reservoir	Los Pinos River	La Plata, Colorado	-	-	-	-	-	115.4	7665	7600	2,723	693	Bureau of Reclamation	PL 61-288 PL 68-292
Wanapum Dam & Reservoir	Columbia River	Grant, WA	-	-	-	-	-	151.6	571.5	560.0	14,400	9,600	Grant County PUD No. 2	FPC No. 2114-B
Wanship Dam & Rockport	Weber River	Summit, UT	-	-	-	-	-	61.0	6037.0	5930.0	1,077	121	Bureau of Reclamation	PL 81-273
Warm Springs Dam & Res.	Middle Fork Malheur Riv.	Malheur, OR	-	-	-	-	-	191.0	3406.0	3327.0	4,600	90	50%Vale Irr Dist & 50% Bu. of Rec.	-
Waterbury Dam & Reservoir	Little River	Washington, VT	27.7	617.5	592.0	1,330	890	-	-	-	-	-	State of Vermont	PL 78-534
Weiss Dam & Reservoir	Coosa River	Cherokee, AL	397.0	574.0	564.0	50,000	30,200	-	-	-	-	-	Alabama Power Co.	PL 83-436
Wells Dam & Lake Pateros	Columbia River	Douglas, WA	-	-	-	-	-	74.0	779.0	771.0	10,700	7,730	Douglas Cnty PUD No. 1	FPC No. 2149
Webster Dam & Reservoir	S. Fork Solomon Riv.	Rooks, KS	183.4	1923.7	1892.45	8,480	3,766	-	-	-	-	-	Bureau of Reclamation	PL 534-78-2
Yellowtail Dam & Bighorn Lake	Bighorn River	Big Horn, MT	259.0	3657.0	3640.0	17,298	12,685	250.0	3640.0	3614.0	12,685	7,410	Bureau of Reclamation	PL 78-534

FOLSOM DAM AND LAKE
AMERICAN RIVER, CALIFORNIA

WATER CONTROL MANUAL

DECEMBER 1987

EXHIBIT C

FIELD WORKING AGREEMENT
FOR
FLOOD CONTROL OPERATION
OF
CENTRAL VALLEY PROJECT DAMS AND RESERVOIRS
IN
CALIFORNIA

DEPARTMENT OF THE ARMY
SACRAMENTO DISTRICT, CORPS OF ENGINEERS
SACRAMENTO, CALIFORNIA

FIELD WORKING AGREEMENT
BETWEEN
DEPARTMENT OF THE INTERIOR, BUREAU OF RECLAMATION
AND
DEPARTMENT OF THE ARMY, CORPS OF ENGINEERS
FOR
FLOOD CONTROL OPERATION
OF
CENTRAL VALLEY PROJECT DAMS AND RESERVOIRS
IN
CALIFORNIA

THIS agreement, made and entered into this 4th day of August, 1978, between the Bureau of Reclamation and the Corps of Engineers,

WITNESSETH THAT:

WHEREAS, the Department of the Interior, acting through the Bureau of Reclamation, represented by its appropriate Regional Director, has constructed or assumed operation of Federally constructed dams and reservoirs on the Sacramento and San Joaquin Rivers and their tributaries, and is responsible for normal operation and structural safety of the projects, and

WHEREAS, the Department of the Army, acting through the Corps of Engineers, represented by its appropriate District and Division Engineers, is responsible for the flood control operation plans of said dams and reservoirs in accordance with Section 7 of the 1944 Flood Control Act (33 U.S.C. 709) and as promulgated in Code of Federal Regulations, Title 33, Part 208.11, and

WHEREAS, there is a need for a working agreement to insure a clear understanding of the flood control regulations and information exchange required for the projects operation.

NOW, THEREFORE, it is mutually understood and agreed by and between the parties hereto that the Central Valley Project will be operated in accordance with the following criteria:

(a) Conservation operations shall be in accordance with Bureau of Reclamation criteria as determined by the Regional Director or his designated representative.

(b) Storage space in the Central Valley Project shall be made available on a seasonal basis and operated for flood control in accordance with the Flood Control Diagrams currently in force.

(c) Emergency operation shall be in accordance with the procedure set forth on the Emergency Spillway Release Diagrams or procedures currently in force.

(d) The Regional Director is responsible for the safety of the dam and appurtenant facilities and for regulation of reservoirs in the Central Valley Project during surcharge storage utilization. Emphasis upon the safety of the dam is especially important in the event surcharge storage is utilized, which results when the total storage space reserved for flood control is exceeded. Any assistance provided by the Corps of Engineers concerning surcharge regulation is to be utilized at the discretion of the Regional Director, and does not relieve the Regional Director of the responsibility for safety of the dams in the Central Valley Project.

(e) Revisions of the Flood Control or Emergency Spillway Release Diagrams and procedures may be developed as necessary by parties of this agreement. Each such revision shall be effective on the date specified.

(f) Except as necessary in order to comply with Emergency Operation procedures, the flood control regulations shall not be construed to require dangerously rapid changes in magnitude of releases. Releases will be made in a manner consistent with requirements for protecting the dam, reservoir and appurtenances from major damages.

(g) Any water impounded in the flood control space defined by the Flood Control Diagrams shall be evacuated as rapidly as can be safely accomplished without causing downstream flows to exceed the controlling rates; i.e., releases from the reservoir shall be restricted insofar as practicable to quantities which, in conjunction with uncontrolled runoff downstream of the dams, will not cause water levels to exceed the controlling stages currently in force. Although conflicts may arise with other purposes, such as hydropower, the plan of regulation may require releases to be completely curtailed in the interest of flood control or safety of the projects.

(h) The Regional Director shall procure such current basic hydrologic data and make such current determinations of required flood control space and releases at the reservoir as are required to accomplish the flood control objectives.

(i) The Regional Director shall keep the District Engineer advised of such reservoir operating data as the District Engineer may request. The minimum data required is reservoir storage, inflow, releases and streamflow at control points designated by the Flood Control Diagrams on a daily basis.

(j) The flood control regulations are subject to temporary modification by the Corps of Engineers if found necessary in time of emergency. Requests for and action on such modifications may be made by the fastest means of communication available. The action taken shall be confirmed in writing the same day to the office of the Regional Director and shall include justification for the action.

(k) The Regional Director may temporarily deviate from the flood control regulations in the event an immediate short-term departure is deemed necessary for emergency reasons to protect the safety of the dam, or to avoid other serious hazards. Such actions shall be immediately reported by the fastest means of communication available. Actions shall be confirmed in writing the same day to the Corps of Engineers and shall include justification for the action. Continuation of the deviation will require the express approval of the Division Engineer.

IN WITNESS WHEREOF, the parties hereto have caused this memorandum of agreement to be executed as the day and date first above written.

CORPS OF ENGINEERS

By: William E. Vanderburg
Division Engineer
South Pacific Division

BUREAU OF RECLAMATION

By: D. A. Cattino
Acting Regional Director
Mid Pacific Region