09

US Army Corps
of Engineers
Los Angeles District

WATER CONTROL MANUAL

LOPEZ DAM
PACOIMA WASH
California

JANUARY 1986

LOPEZ DAM AND RESERVOIR
PACOIMA WASH, CALIFORNIA

PERTINENT DATA
January 1986

Construction completion date	1 DEC 1954
Stream system	Pacoima Wash
Drainage area ... sq. miles	34
Reservoir:	
Elevation	
Streambed at dam ... ft., NGVD	1,253.72
Flood control pool (spillway crest) ... ft., NGVD	1,272.92
Spillway design surcharge level ... ft., NGVD	1,292.80
Top of dam ... ft., NGVD	1,298.92
Area	
Spillway crest ... acres	40.4
Spillway design surcharge level ... acres	69.9
Top of dam ... acres	80.8
Capacity, gross	
Spillway cresst ... acre-feet	441 (0.24*)
Spillway design surcharge level ... acre-feet	1,566.2 (0.86*)
Top of dam ... acre-feet	2,027.9 (1.12*)
Allowance for sediment (50-year) ... acre-feet	794 (0.44*)
Dam:	
Type	Earthfill
Height above original streambed ... ft	50
Top length ... ft	1,330
Top width ... ft	20
Freeboard ... ft	6.1
Slope, upstream and downstream face	1:2
Slope protection	Loose Rock
Spillway:	
Type	Broad-crested
Crest length ... ft	110
Design surcharge ... ft	19.9
Design discharge ... c.f.s	31,000
Outlets:	
Number and size-diameter ... ft	1-5' diameter
Length ... ft	428
Entrance invert elevation ... ft., NGVD	1,253.92
Standard project flood:	
Duration (inflow) ... days	3
Total volume ... acre-feet	14,100 (7.78*)
Inflow peak ... c.f.s	11,200
Outflow peak ... c.f.s	11,200
Probable maximum flood:	
Duration (inflow) ... days	1
Total volume ... acre-feet	19,900 (10.97*)
Inflow peak ... c.f.s	30,400
Outflow peak ... c.f.s	30,200
Historic maximums:	
Maximum inflow (mean hourly) ... c.f.s	12,940
Date	2-10-78
Maximum release ... c.f.s	13,000
Date	2-10-78
Maximum water surface elevation ... ft., NGVD	1,277.7
Date	2-10-78
Maximum storage ... acre-feet	686
Date	2-10-78

* inches of runoff

DEPARTMENT OF THE ARMY
SOUTH PACIFIC DIVISION, CORPS OF ENGINEERS
630 Sansome Street, Room 720
San Francisco, California 94111-2206

REPLY TO
ATTENTION OF:

CESPD-ED-W (1110-2-240b)

MAR 2 0 1991

MEMORANDUM FOR Commander, Los Angeles District
Commander, Sacramento District

SUBJECT: Planned Deviations from Approved Water Control Plans

1. All planned deviations from approved water control plans for reservoir projects within the South Pacific Division must be coordinated with the Coastal Engineering and Water Management Division at CESPD. Approval must be given prior to implementation of the deviation.

2. Emergency deviations do not require prior approval but coordination must still be made as soon as is practical.

ROGER E. YANKOSPE
Brigadier General, U.S. Army
Commanding

WATER CONTROL MANUAL

LOPEZ DAM

PACOIMA WASH, CALIFORNIA

January 1986

Prepared
by

U.S. Army Corps of Engineers
Los Angeles District
Reservoir Regulation Unit

Lopez Dam and Reservoir (view from downstream of dam, taken 5/14/85).

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 the manual current.

EMERGENCY REGULATION ASSISTANCE PROCEDURES

In the event that unusual conditions arise, contact can be made by telephone to the Reservoir Regulation Unit, Los Angeles District Office (FTS 798-4756 or 213-894-4756). See Plate 5-2 for other important telephone numbers for reservoir regulation assistance.

WATER CONTROL MANUAL

LOPEZ DAM AND RESERVOIR
PACOIMA WASH, CALIFORNIA

TABLE OF CONTENTS

		Page
PERTINENT DATA		Inside Front Cover
TITLE PAGE		i
AERIAL PHOTOGRAPHY		ii
NOTICE TO USERS OF THIS MANUAL		iii
TABLE OF CONTENTS		a
ABBREVIATIONS USED		e
Paragraph	**Title**	**Page**
	I - INTRODUCTION	
1-01	Authorization	1-1
1-02	Purpose and Scope	1-1
1-03	Related Manuals and Reports	1-1
1-04	Project Owner	1-1
1-05	Operating Agencies	1-1
1-06	Regulating Agencies	1-1
	II - DESCRIPTION OF PROJECT	
2-01	Location	2-1
2-02	Purpose	2-1
2-03	Physical Components	2-1
2-04	Related Control Facilities	2-3
2-05	Real Estate Acquisition	2-3
2-06	Public Facilities	2-3
	III - HISTORY OF PROJECT	
3-01	Authorization	3-1
3-02	Planning and Design	3-1
3-03	Construction	3-1
3-04	Related Projects	3-2
3-05	Modifications to Regulation	3-3
3-06	Principal Regulation Problems	3-6
	IV - WATERSHED CHARACTERISTICS	
4-01	General Characteristics	4-1
4-02	Topography	4-1
4-03	Geology and Soils	4-1
4-04	Sediment	4-1

TABLE OF CONTENTS (Continued)

Paragraph	Title	Page
4-05	Climate	4-1
4-06	Storms and Floods	4-2
4-07	Runoff Characteristics	4-2
4-08	Water Quality	4-2
4-09	Channel and Floodway Characteristics	4-6
4-10	Upstream Structures	4-6
4-11	Downstream Structures	4-6
4-12	Economic Data	4-6
	V - DATA COLLECTION AND COMMUNICATION NETWORKS	
5-01	Hydrometeorological Stations	5-1
5-02	Water Quality Stations	5-1
5-03	Sediment Stations	5-3
5-04	Recording Hydrologic Data	5-3
5-05	Communication Network	5-3
5-06	Communication with Project	5-3
5-07	Project Reporting Instructions	5-4
5-08	Warnings	5-4
	VI - HYDROLOGIC FORECASTS	
6-01	General	6-1
6-02	Flood Conditions Forecasts	6-1
6-03	Conservation Purposes Forecasts	6-2
6-04	Long-Range Forecasts	6-2
	VII - WATER CONTROL PLAN	
7-01	General Objectives	7-1
7-02	Major Constraints	7-1
7-03	Overall Plan for Water Control	7-2
7-04	Standing Instructions to Dam Tender	7-2
7-05	Flood Control	7-4
7-06	Recreation	7-4
7-07	Water Quality	7-4
7-08	Fish and Wildlife	7-4
7-09	Water Supply	7-6
7-10	Deviation from Normal Regulation	7-6
7-11	Water Control Planning Tools	7-7
	VIII - EFFECT OF WATER CONTROL PLAN	
8-01	General	8-1
8-02	Flood Control	8-1
8-03	Water Quality	8-2
8-04	Fish and Wildlife	8-2
8-05	Frequencies	8-2
8-06	Other Studies	8-3

TABLE OF CONTENTS (Continued)

Paragraph	Title	Page
	IX - WATER CONTROL MANAGEMENT	
9-01	Responsibilities and Organization	9-1
9-02	Interagency Coordination	9-1
9-03	Reports	9-2

LIST OF TABLES

Table No.	Title	Page
1-1	Related Manuals and Reports	1-2
4-1	Precipitation Data Recorded at Pacoima Dam	4-3
4-2	Statistical Parameters for Precipitation Data Recorded at Pacoima Dam	4-4
4-3	Pacoima Dam Outflow	4-5
5-1	Hydrometeorological Stations	5-2
7-1	Lopez Dam Reservoir Regulation Schedule	7-3
7-2	Lopez Dam Pool Drawdown	7-5
7-3	Lopez Dam Outlet Discharge in Cubic Feet Per Second	7-8
7-4	Lopez Dam Spillway Discharge	7-9
7-5	Lopez Dam Reservoir Area and Capacity	7-10
8-1	Inflow, Outflow, and Filling Frequency Values, Lopez Reservoir	8-4
8-2	Inflow, Outflow, and Filling Frequency Values, Pacoima Reservoir	8-5

LIST OF FIGURES

Figure No.	Title	Page
2-1	Photographs of Lopez Dam Embankment	2-4
2-2	Photographs of Lopez Dam Spillway	2-5
2-3	Photographs of Lopez Dam Outlet	2-6
2-4	Photographs of Lopez Dam Intake Tower and Low Level Inlet Structure	2-7
2-5	Photographs of Lopez Dam Gate and Recorder Structure	2-8
2-6	Photographs of Lopez Spreading Grounds	2-9
3-1	Photograph of Pacoima Spreading Grounds Diversion Structure, Looking Downstream	3-4
3-2	Aerial photograph of Pacoima Spreading Grounds	3-5
9-1	Flood Control Basin Operation Report	9-3
9-2	Record of Calls	9-4
9-3	Record of Data from Digital Recorders	9-5
9-4	Reservoir Computations	9-6

TABLE OF CONTENTS (Continued)

LIST OF PLATES

Plate No.	Title
2-1	Project Location Map
2-2	Storage Allocation Diagram
2-3	General Plan, Sections, and Real Estate Limits
2-4	Spillway Plan
2-5	Spillway Dimensional Details
2-6	Outlet Plan, Profile, and Sections
2-7	Outlet Details
3-1	Los Angeles County Drainage Area
3-2	Hydrometeorological Stations and Related LACDPW Water Supply Facilities
3-3	Downstream Channel Map
3-4	Drainage Area Map
4-1	Statistical Precipitation Parameters
4-2	Pacoima Dam Outflow (1937-1958)
4-3	Pacoima Dam Outflow (1959-1976)
4-4	Selected Pacoima Dam Outflow Hydrographs
4-5	Basin Unit Hydrograph
4-6	Pacoima Channel Profile (Sta. 0+00 - Sta. 80+00)
4-7	Pacoima Channel Profile (Sta. 80+00 - Sta. 160+80)
5-1	Pacoima Diversion Channel at Branford Street Rating Table
5-2	Corps of Engineers Organization Chart and Important Phone Numbers
7-1	Lopez Dam Outlet Rating Curve
7-2	Lopez Dam Spillway Discharge Curve
7-3	Lopez Dam Area-Capacity Curves
8-1	Spillway Design Flood Routing
8-2	Standard Project Flood Routing
8-3	Discharge Frequency Curves for Lopez Dam
8-4	Discharge Frequency Curve for Pacoima Dam
8-5	Filling Frequency Lopez Dam
8-6	Filling Frequency Pacoima Dam

LIST OF EXHIBITS

Exhibit No.	Subject
A	Pertinent Data, Pacoima Dam and Reservoir
B	Pertinent Data for Other Reservoirs Affecting Los Angeles River
C	Gate Operation Schedule and Instructions to Dam Operator

ABBREVIATIONS USED

AF	Acre-Feet
ALERT	Automatic Local Evaluation in Real-Time
cfs	cubic feet per second
COE	U.S. Army Corps of Engineers
F	Fahrenheit
ft	feet
LACDA	Los Angeles County Drainage Area
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LAD	Los Angeles District, U.S. Army Corps of Engineers
NGVD	National Geodetic Vertical Datum
NWS	National Weather Service
PMF	Probable Maximum Flood
ppm	parts per million
SPF	Standard Project Flood
VHF	Very High Frequency

I - INTRODUCTION

1-01 AUTHORIZATION

This Lopez Dam Water Control Manual was prepared in compliance with the following directives: ER 1110-2-240, EM 1110-2-3600, and ETL 1110-2-251.

1-02 PURPOSE AND SCOPE

This water control manual provides a detailed plan for regulation of Lopez Dam and Reservoir on Pacoima Wash for the purpose of flood control. Lopez Dam is located approximately 2.2 miles northeast of the city of San Fernando, California. Major topics in this manual include: authorization, history, and description of the project; watershed characteristics; hydrometeorology; data collection and communication networks; hydrologic forecasting; the water control plan; and responsibilities and coordination for water control management.

1-03 RELATED MANUALS AND REPORTS

Manuals and reports with data and information relevant to the information in this manual are listed in Table 1-1.

1-04 PROJECT OWNER

Lopez Dam and Reservoir was constructed and is owned and operated by the U.S. Army Corps of Engineers, Los Angeles District (LAD).

1-05 OPERATING AGENCIES

a. The LAD is responsible for the operation and maintenance of the dam, reservoir, and outlet works. The outlet gate is operated manually, as needed, and the dam is not normally manned. The operator for Hansen Dam serves as the Lopez Dam operator when necessary.

b The Los Angeles County Department of Public Works (LACDPW) is responsible for the operation and maintenance of an adjacent diversion works for the Lopez Spreading Grounds.

1-06 REGULATING AGENCIES

a. The LAD is responsible for developing the flood control operation plan for Lopez Dam and Reservoir. The LAD is responsible for the flood control regulations and operation of the dam.

b. The LACDPW is responsible for the regulation of the diversion works for the downstream Lopez Spreading Grounds used for groundwater replenishment.

TABLE 1-1

RELATED MANUALS AND REPORTS

1. U.S. Army Corps of Engineers, Los Angeles District, "Hydrology-Pacoima Wash Channel and Lopez Flood-Control Basin," March, 1950.

2. U.S. Army Corps of Engineers, Los Angeles District, "Design Memorandum No. 1 on Lopez Flood Control Reservoir," January, 1953.

3. U.S. Army Corps of Engineers, Los Angeles District, "Design Memorandum No. 1 on Pacoima Wash Channel Improvement-Lopez Dam to Arleta Avenue," March, 1953.

4. U.S. Army Corps of Engineers, Los Angeles District, "Design Memorandum No. 1 on Pacoima Wash Channel Improvement-Arleta Avenue to Tujunga Wash," March, 1953.

5. U.S. Army Corps of Engineers, Los Angeles District, "Design Memorandum No. 2 on Lopez Flood Control Reservoir," February, 1954.

6. U.S. Army Corps of Engineers, Los Angeles District, "Design Memorandum No. 3 on Lopez Flood Control Reservoir," February, 1954.

7. U.S. Army Corps of Engineers, Los Angeles District, "Operation and Maintenance Manual for Lopez Flood Control Reservoir," July, 1963.

8. U.S. Army Corps of Engineers, Los Angeles District, "Lopez Dam and Reservoir-Periodic Inspection and Continuing Evaluation Report No. 1," May, 1970.

9. U.S. Army Corps of Engineers, Los Angeles District, "Lopez Dam and Spillway-Supplemental Report on Earthquake Damage," June, 1971.

10. U.S. Army Corps of Engineers, Los Angeles District, "Lopez Dam-Dam, Outlet Works and Spillway Periodic Inspection Report No. 2," July, 1975.

11. U.S. Army Corps of Engineers, Los Angeles District, "Interim Report on Hydrology and Hydraulic Review of Design Features of Existing Dams for Los Angeles County Drainage Area Dams," June, 1978.

12. U.S. Army Corps of Engineers, Los Angeles District, "Lopez Dam-Dam, Outlet Works and Spillway Periodic Inspection Report No. 3," May, 1980.

II - DESCRIPTION OF PROJECT

2-01 LOCATION

Lopez Dam and Reservoir are located on Pacoima Wash in the northcentral part of the San Fernando Valley, about 2.2 miles northeast of the city of San Fernando and entirely within the city and county of Los Angeles, in California. Lopez Dam is approximately 3.5 miles northwest of Hansen Dam. The location of Lopez Dam and Reservoir is shown on Plate 2-1.

2-02 PURPOSE

Lopez Dam and Reservoir are an integral unit on the Pacoima-Tujunga Wash system of tributaries to the Los Angeles River. The purpose of the project, a unit under the approved comprehensive plan for flood control in the Los Angeles County Drainage Area (LACDA), is to provide protection against debris-laden floodwaters for large areas between the dam site and the Los Angeles River. Important improvements in these areas include valuable industrial, business, and residential properties and transportation systems. The dam also forms a headworks to direct flows into the Pacoima Wash channel. The storage allocation for Lopez Reservoir is shown on Plate 2-2.

2-03 PHYSICAL COMPONENTS

a. Embankment. The earth-fill embankment has a crest length of approximately 1,300 feet and a maximum height of approximately 50 feet above the bed of Pacoima Wash. The crown width at the crest elevation of 1,298.9 is 20 feet. Upstream and downstream slopes of the embankment are 1 vertical on 2 horizontal throughout. The embankment has an impervious inner core with a crest width of 12 feet at elevation 1,292.8 with slopes of 1 vertical to 1 horizontal upstream and downstream. The upstream and downstream portions of the embankment are pervious zones constructed of material excavated from within the reservoir upstream of the dam and rock excavation from the spillway site. A three feet layer of loose rock on the upstream and downstream slopes of the embankment serves as protection against erosion. Information related to the embankment is shown on Plate 2-3. Photographs of the embankment are shown on Figure 2-1.

b. Spillway. The reinforced concrete spillway structure is located at the left abutment (looking downstream) of the dam. The spillway was designed as a combined outlet and spillway. The design discharge for the downstream channel is 11,000 cubic feet per second (cfs) and for the spillway, the design discharge is 31,000 cfs. The spillway is an uncontrolled broadcrested type with the crest at elevation 1,272.9. The spillway consists of a rectangular channel, extending about 92 feet upstream and about 470 feet downstream from the axis of the dam. The channel converges from a width of 110 feet at the crest, or axis of the dam (station 10+00), to a width of 30 feet at the end of the spillway transition (station 14+70.48) where it joins the Pacoima Wash channel. An overflow section is provided in the right wall of the spillway channel between station 12+13 and station 14+70.48 to spill flows in excess of 14,000 cfs during a spillway design flood.

The upstream approach channel has a reinforced concrete invert and vertical walls diverging upstream from the crest (at the same rate as the downstream convergence) to a channel base width of 122.0 feet at the beginning of the invert. The vertical walls terminate in quadrant walls forming the spillway approach. The tops of these quadrant walls are at elevation 1,293.1. A concrete cutoff wall extending to a depth of 8 feet into rock is constructed beneath the approach channel invert slab at its upstream edge (station 9+10) and along the right side to station 10+10. Details, dimensions, and other information related to the spillway are shown on Plate 2-4 and Plate 2-5. Figure 2-2 shows photographs of the spillway.

c. Reservoir Outlet. A low level outlet is provided to empty the reservoir pool remaining after flow over the spillway has ceased and during low flows. The outlet is a cast-in-place, reinforced concrete conduit with a flat invert and an inside diameter of 60 inches. Other appurtenant features include a low level intake, a perforated intake tower, and a combination gate well and recorder well. Plate 2-6 and Plate 2-7 show pertinent information pertaining to the reservoir outlet.

The low level intake structure is equipped with removable steel grates spaced to permit the entry of water but to prevent the entry of trash and debris. The invert elevation of the low level intake is 1,253.9. The intake tower is a cast-in-place, reinforced concrete structure opening into the conduit. The tower is 5 feet square inside and extends to elevation 1,273.9 (one foot above spillway crest). It is perforated with 4-inch diameter formed openings which permits the pool to be drained down in the event the low level intake becomes inoperative. Photographs of the low level intake structure and the intake tower are shown in Figure 2-3, and Figure 2-4.

The gate well and float recorder well-structure consists of a 2-compartment, reinforced concrete shaft, 10.5 feet by 3 feet and 42 feet deep inside, located in the upstream embankment near the axis of the dam (at station 2+44). A concrete block and steel structure covers the recorder well shaft and houses the recording equipment. Photographs of the gate and recorder structure are shown in Figure 2-5. The recorder well is fed from an intake structure in the reservoir, near the pool drain intake, through a 6-inch diameter steel pipe, encased in concrete. The recorder well compartment is also connected with the gate chamber by a short length of 3-inch diameter cast iron pipe equipped with a gate valve. This connection permits flushing of the recorder well and permits the recorder well to be fed either from the reservoir intake or from the gate well when the 60-inch slide gate is closed.

A heavy-duty circular 60-inch diameter slide gate with bronze seats is installed in the gate well. This gate is raised and lowered by means of a single gear pedestal lift, which is mounted on top of the gate well and equipped with a handcrank mechanism. One inch movement of the gate requires 16 turns of the handcrank. Approximately 2½ inches of the stem is exposed above the lift nut when the gate is closed. The height of the gate opening is determined by measuring the length of the stem above the lift nut.

A 3-inch brass gate valve with nonrising stem is provided at the flanged end of the short 3-inch diameter cast iron pipe connecting the float recorder well and the gate chamber. The valve operating handle is located just below

the floor level of the recorder house. For satisfactory operation of the recorder, this gate valve must be kept closed when the slide gate is open and water is flowing through the conduit.

2-04 RELATED CONTROL FACILITIES

A diversion structure is located near the downstream end of the outlet pipe, immediately upstream of where the outlet pipe discharges into the spillway channel (see Plate 2-4). The diversion structure consists of a reinforced concrete box provided with slots for stop logs and a 30-inch diameter circular slide gate. The diversion structure was constructed with Lopez Dam in 1954 by the COE for the purpose of providing flows to the Lopez Spreading Grounds. The 30-inch gate remains closed and the stop logs are removed at all times except when spreading operations are in progress (Figure 2-6).

Other facilities located in the vicinity which are impacted by or affect the operation of Lopez Dam and Reservoir are described in Section 3-04.

2-05 REAL ESTATE ACQUISITION

Lopez Dam and Reservoir Project lands comprise 101.4 acres as shown on Plate 2-3.

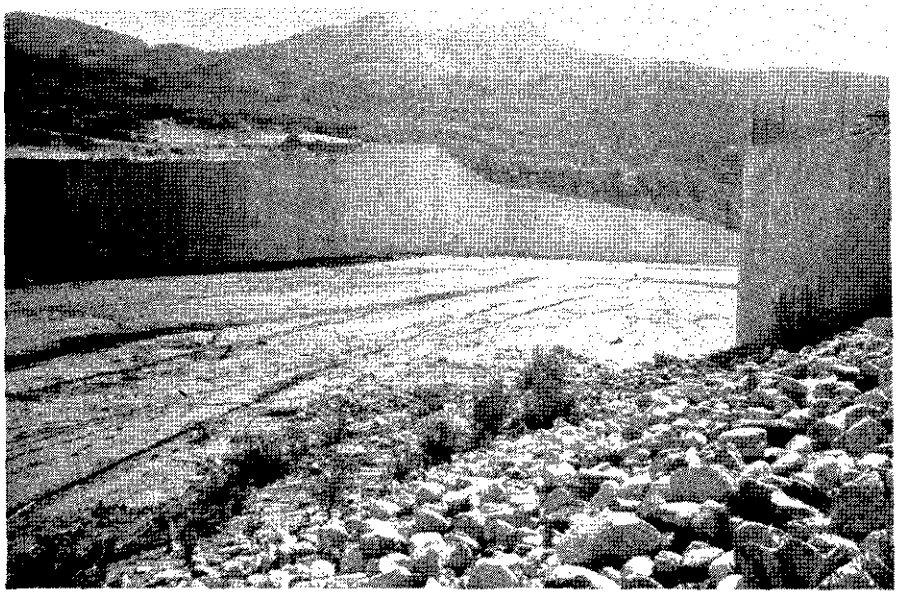
2-06 PUBLIC FACILITIES

No public facilities are included in the Lopez Dam and Reservoir Project.

(a) Downstream Slope.

(b) Upstream Slope

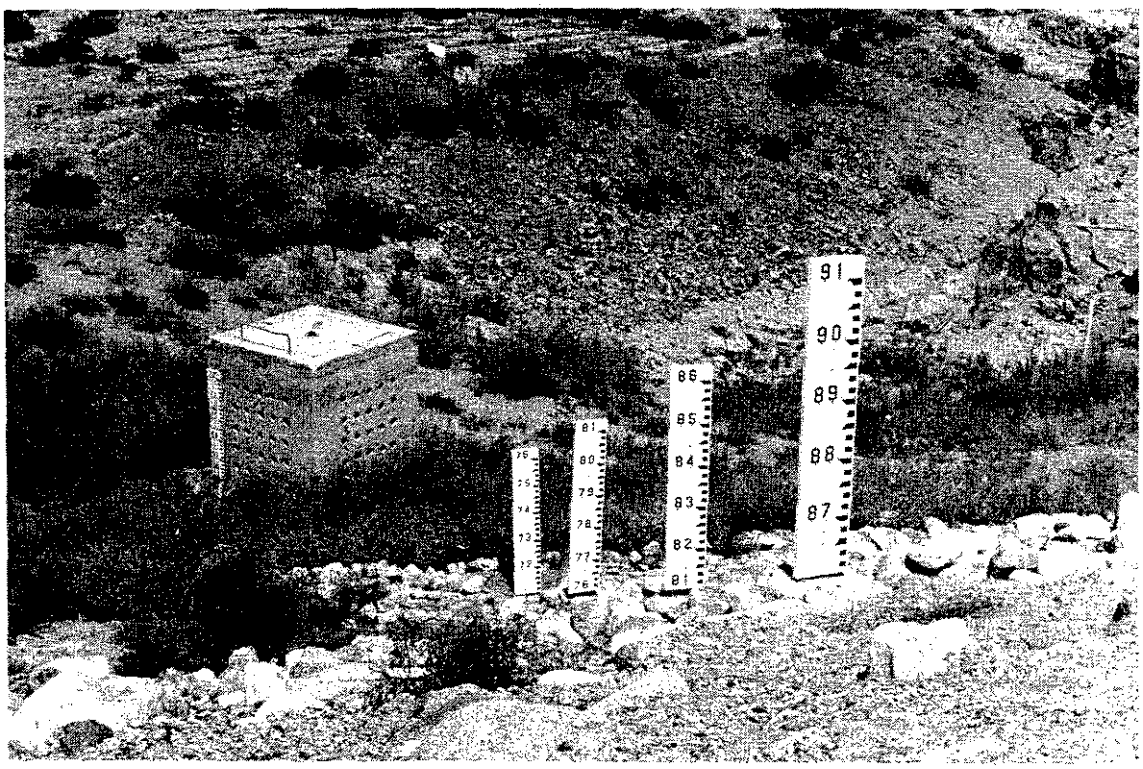
Figure 2-1. Photographs of Lopez Dam Embankment.



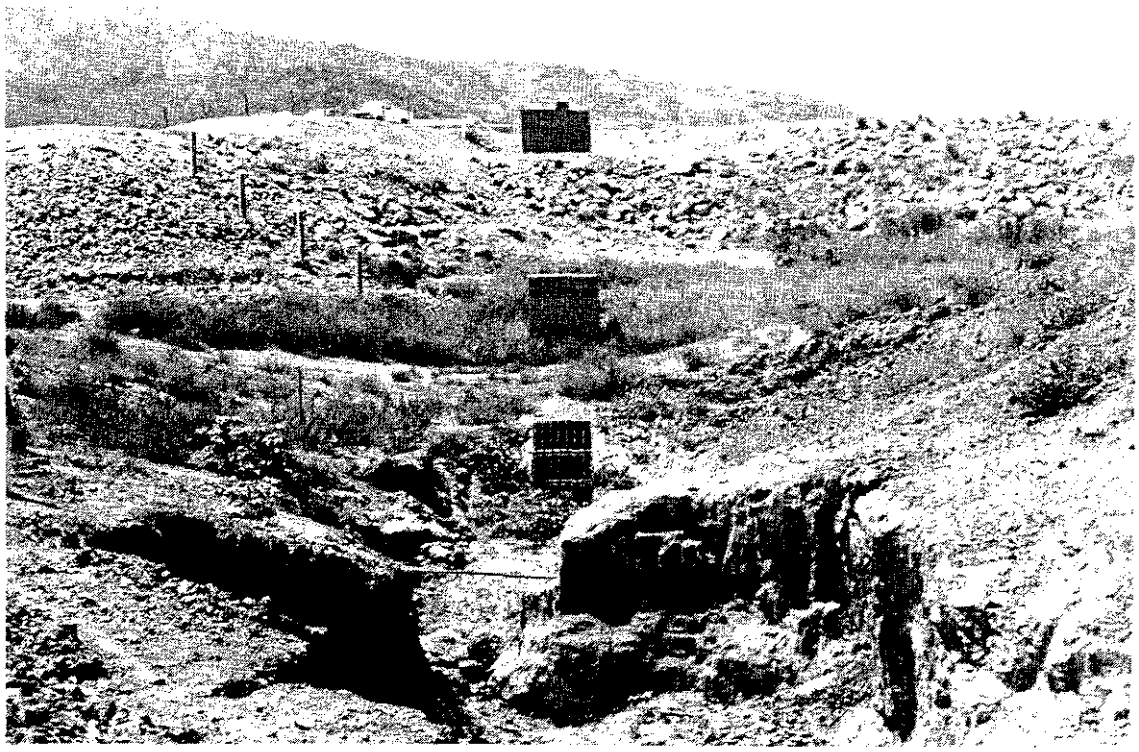
(a) Looking Downstream.

(b) Looking Upstream.

Figure 2-2. Photographs of Lopez Dam Spillway.



(a) Intake Tower.



(b) Low Level Inlet Structure.

Figure 2-3. Photographs of Lopez Dam Outlet.

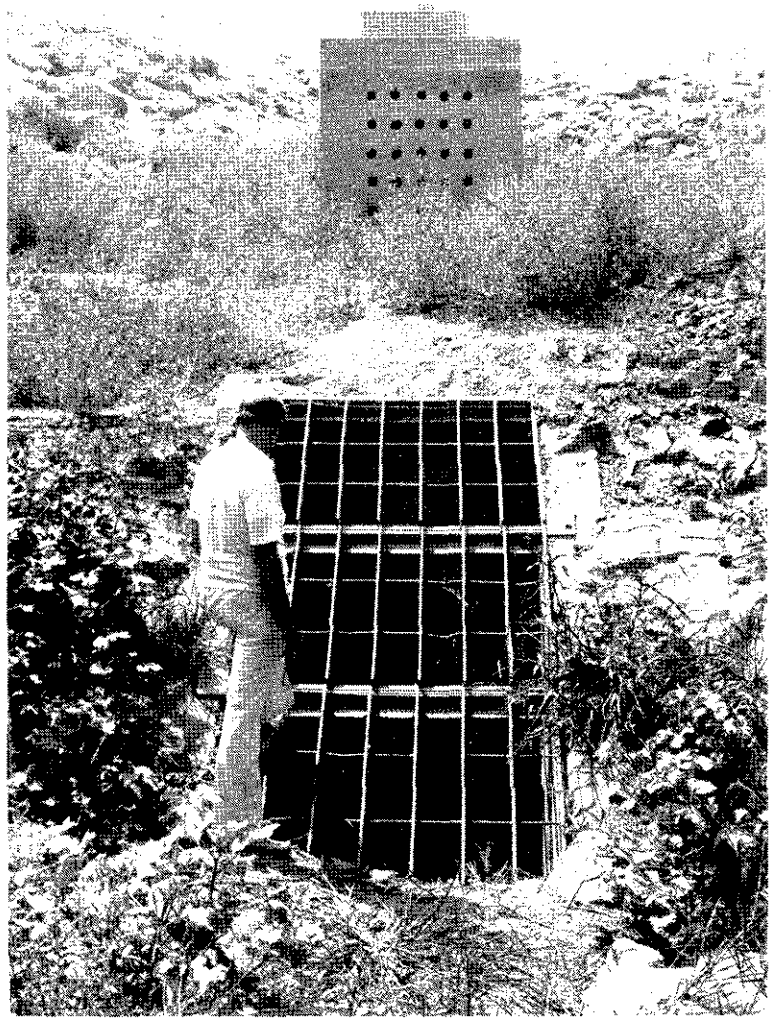
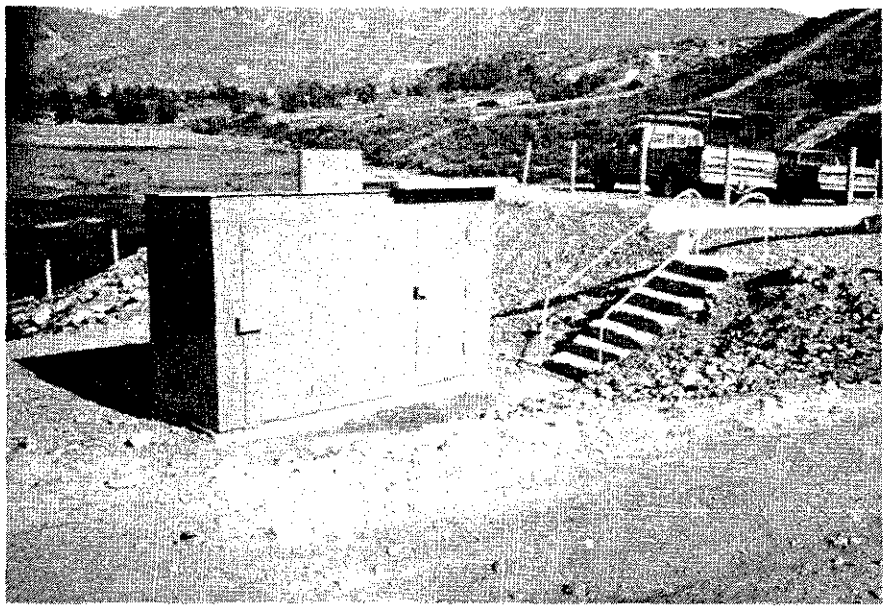
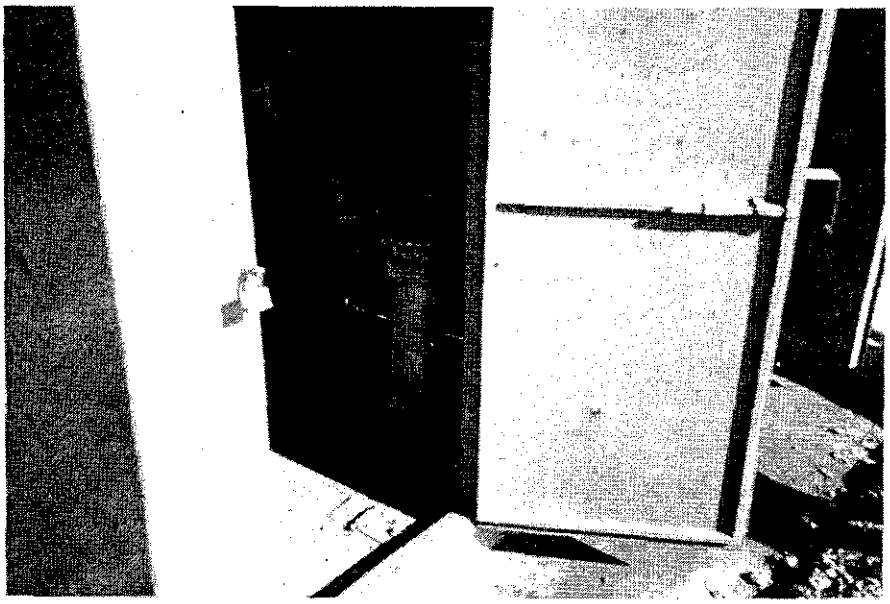


Figure 2.4. Photographs of Lopez Dam Intake Tower and Low Level Inlet Structure.

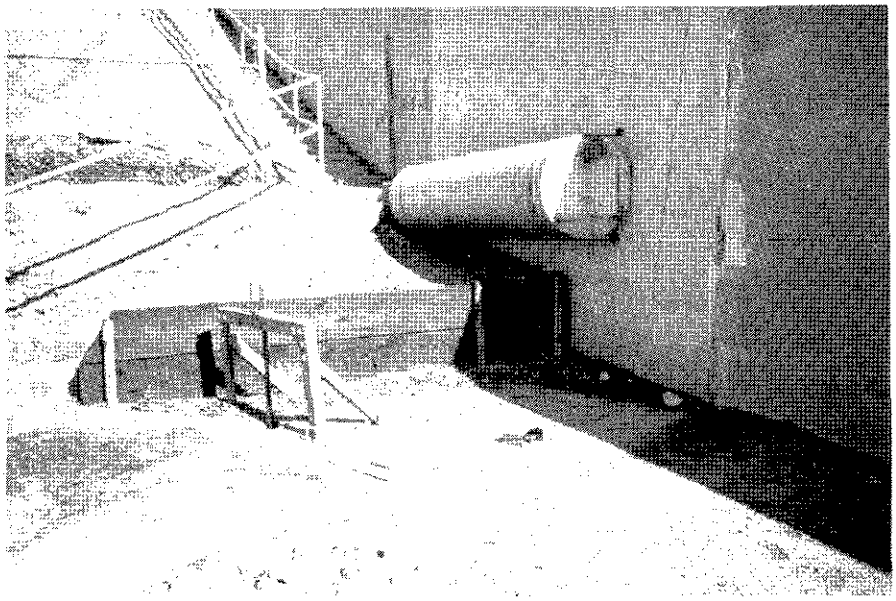


(a) Gate and Recorder Structure.

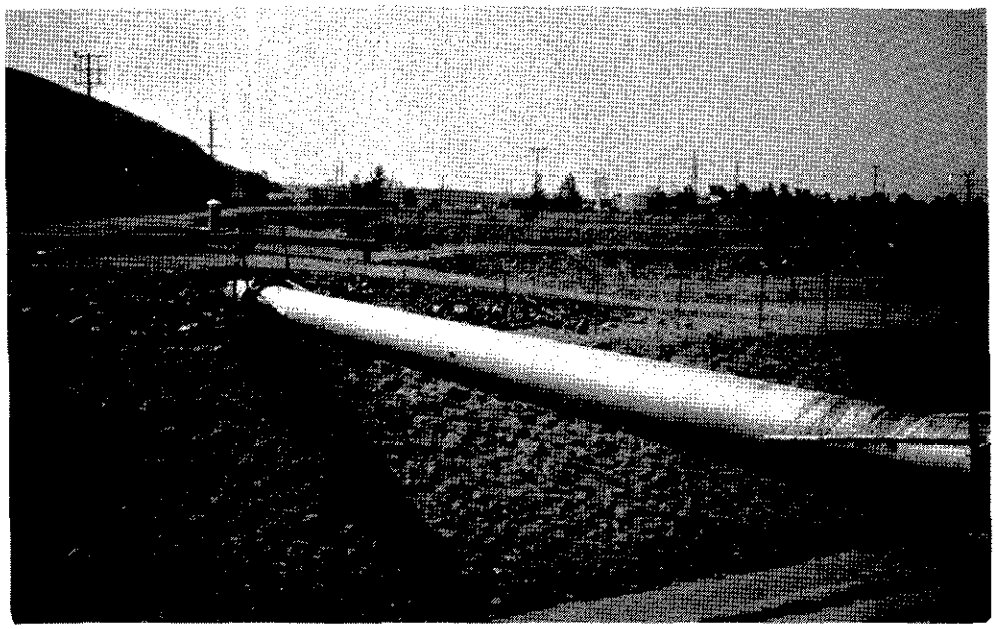


(b) Handrank Mechanism for Slide Gate.

Figure 2-5. Photographs of Lopez Dam Gate and Recorder Structure.



(a) Diversion Structure, Manhole.
(The CMP is used to store equipment.)



(b) Spreading Facility.

Figure 2-6. Photographs of Lopez Spreading Grounds.

III - HISTORY OF PROJECT

3-01 AUTHORIZATION

Lopez Dam was authorized by the Flood Control Act, approved 22 June 1936 (Public Law 738, 74th Congress) and extended and amended by subsequent Flood Control Acts of 1937, 1938, 1941, 1944, and 1946. The plan for construction, in accordance with the recommendations contained in the report dated 11 April 1940 by the Chief of Engineers, and submitted in House Document 838, 76th Congress, 3rd session, was authorized by the Flood Control Act, approved 18 August 1941.

3-02 PLANNING AND DESIGN

The planning for Lopez Dam was conducted by the LAD in conjunction with local interests including the Los Angeles County Flood Control District (LACFCD). A comprehensive plan for flood control in the Los Angeles County drainage area was presented by the LACFCD at a public hearing conducted by the Los Angeles District, U.S. Army Corps of Engineers (LAD) on 31 March 1936. The plan included provisions for improvement of the Pacoima Wash channel. The LAD subsequently began an investigation for flood control alternatives in the Pacoima Wash basin. The investigation was comprised of several alternatives including: locations for Lopez Dam, improvements to the Pacoima Wash channel, and diversion plans for flow from Lopez Canyon.

Design Memorandum No. 1 on Lopez Reservoir was prepared by the LAD in January, 1953. Design Memoranda Nos. 2 and 3 were prepared in February, 1954. Design Memorandum No. 1 contains the following principal departures from the original project-document plan: (1) constructing Lopez Dam at a more economical site on Pacoima Wash; (2) diverting flow from Lopez Canyon into Hansen Reservoir; (3) providing for a debris-control reservoir instead of a flood- control reservoir; (4) increasing the design peak outflow from 3,000 to 11,000 cubic feet per second; and (5) increasing the capacity of Pacoima Wash channel downstream from Lopez Dam. These departures involve changes in dimensions and elevation of the dam and changes in alignment of the channel. The spillway was intended for routine use. The purpose of Lopez Dam is to provide protection against debris-laden floodwaters for large areas between the dam site and the Los Angeles River. Some degree of flood reduction may be realized due to the physical location of the dam.

3-03 CONSTRUCTION

Construction for Lopez Dam started 1 April 1954 with the work being completed and accepted by the U.S. Army Corps of Engineers (COE) on 1 December 1954. The project was constructed by Vinnell Company, Inc. and copies of the construction contract (Contract No. DA-04-353 ENG-3198) and "as-constructed" drawings (File Nos. 145/1 through 145/22) are on file in the COE LAD office.

On 9 February 1971, an earthquake violently shook the San Fernando area in Los Angeles County. The tremors lasted for approximately 60 seconds. The earthquake was rated 6.6 on the Richter magnitude scale at the California Institute of Technology Seismological Laboratory at Pasadena, California, and

the epicenter was located 9 miles from Lopez Dam. The earthquake resulted in a general uplift of the dam and reservoir of approximately 6.9 feet and significant damage was sustained by the embankment, concrete spillway, spillway subdrain pipes, and pool drain conduit. Repairs were made resulting in the project being restored to original "as-constructed" conditions as shown on the as-constructed record drawings dated July 16, 1971, with the exception of the elevation changes due to the general uplift.

3-04 RELATED PROJECTS

Plate 3-1 shows related projects for the entire Los Angeles County drainage area. Related LACDPW water supply facilities in the Pacoima Wash drainage area are shown on Plate 3-2.

a. Pacoima Dam. Pacoima Dam is located on Pacoima Creek approximately 1.5 miles upstream of the Lopez Dam site. The concrete-arch structure, completed in 1929, is operated and maintained by the LACDPW for flood control and water conservation. Information pertaining to Pacoima Dam and Reservoir is given in Exhibit A.

b. Harding Street Bridge. The highway bridge across Pacoima Wash at Harding Street is located at the upstream end of the reservoir. It was designed for a discharge of 4,000 cfs at a depth of flow of 6 feet. Harding Street is the primary access route to Pacoima Dam.

c. Lopez Spreading Grounds. Lopez Spreading Grounds is owned and operated by the LACDPW. The facility is located approximately 1,500 feet downstream of Lopez Dam. The Lopez Dam outlet is used by the LACDPW to divert water into the spreading grounds as discussed in Section 2-04. Photographs of the diversion structure and the spreading facility are shown on Figure 2-5. Pertinent information concerning Lopez Spreading Grounds is listed below:

Maximum basin intake capacity	25 cfs
Maximum basin outlet discharge	7 cfs
Allowable water quality sediment limit	1,000 ppm
Storage capacity	25 AF
Percolation rate	7 cfs
* Basin gage height limits	5.0 and 6.0 ft

* Basin gage height limit refers to the depth of water in the basin during spreading operations.

d. Pacoima Wash Channel. The Pacoima Wash channel has been improved from Lopez Dam to the Pacoima Spreading Grounds. The channel improvement projects were completed by the COE as the lead agency with engineering and financial cooperation from the cities of Los Angeles and San Fernando, and the LACDPW. The improvements consisted of channelization, new bridges, drainage confluence and side drainage structures, and utilities relocation. The improved channel cross section varies from rectangular to trapezoidal. The channel capacity is 11,000 cfs at Lopez Dam and increases to 17,000 cfs at the Golden State Freeway crossing as shown on Plate 3-3. The rectangular channel is lined with reinforced concrete. The trapezoidal channel is lined with a combination of reinforced concrete and grouted stone.

e. Pacoima Spreading Grounds. Pacoima Spreading Grounds is owned and operated by the LACDPW. The facility is located approximately 3.5 miles downstream of Lopez Dam. A radial gate (55 feet long and 8.5 feet high) across Pacoima Diversion Channel diverts flows through the intake structure into the spreading grounds. The intake structure consists of four slide gates (each 5 feet x 5 feet). A photograph of the diversion structure is shown on Figure 3-1. An aerial photograph of the spreading facility is shown on Figure 3-2. Pertinent information concerning Pacoima Spreading Grounds is listed below:

Maximum basin intake capacity	600 cfs during storm releases 400 cfs during conservation releases
Maximum basin outlet discharge	Minimal (10 cfs) unless for emergency
Allowable water quality sediment limit	500 ppm
Storage capacity	392 AF
Percolation rate	100 cfs
*Basin gage height limit	5.0 ft

* Basin gage height limit refers to the depth of water in the basin during spreading operations.

The LACDPW removes the radial gate from the channel and does not lower the gate into the channel when flows reach 1,800 cfs.

f. Pacoima Diversion Channel. The Pacoima Diversion channel extends from the Pacoima Spreading Grounds to the Tujunga Wash. It is located southwest of and parallel to the Golden State Freeway, as shown on Plate 3-3. This channel is a man-made structure and was constructed as a part of the Lopez Dam Project. The channel capacity is 17,000 cfs. The trapezoidal section of the channel is lined with a combination of reinforced concrete and grouted stone. The rectangular section is lined with reinforced concrete. The section limits are shown on Plate 3-3.

g. Branford Spreading Grounds. Branford Spreading Grounds are owned and operated by the LACDPW. The facility is located near the Pacoima Diversion Channel/Tujunga Wash confluence. The facility discharges water into the Pacoima Diversion Channel and has no capability of diverting water from the channel. Pertinent information concerning Branford Spreading Grounds is listed below:

Maximum basin intake capacity	1,540 cfs
Maximum basin outlet discharge	1,520 cfs
Storage capacity	250 AF

3-05 MODIFICATIONS TO REGULATION

Design Memorandum No. 1 prepared in January 1953 did not provide for a gate on the outlet conduit. The outlet was designed to drain the low pool after each storm and to discharge material sluiced through Pacoima Dam. The size of the outlet was determined on the basis of free flow for a discharge of 300 cubic feet per second which was the estimated capacity of the sluice outlet of Pacoima Dam.

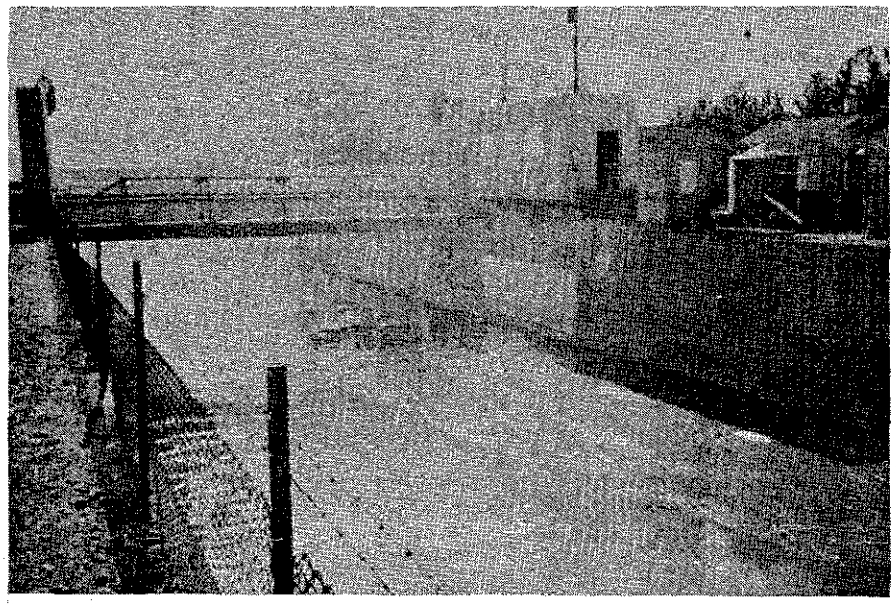


Figure 3-1. Photograph of Pacoima Spreading Grounds Diversion Structure, Looking Downstream.

Figure 3-2. Aerial Photograph of Pacoima Spreading Grounds.

Design Memorandum No. 2 prepared in February 1954 included a gate on the outlet conduit. The gate was added to the design following a model study in which it was determined that conduit flow emerging from the pool drain outlet to join the flow over the spillway would set up undesirable wave turbulence in the downstream spillway channel. The gate allowed the conduit to be closed during spillway flow.

Although no formal water control plan has existed, it was the intent of the original design for the gate to be closed during spillway flow or storms and opened to drain the low pool after each storm or to discharge material sluiced through Pacoima Dam. This procedure has been followed since operation of the dam began in 1954. A temporary modification was in effect from 1959 to 1964. A 1959 agreement allowed the LACDPW to operate the project for water supply purposes. However, the agreement expired in 1964 and has not been renewed. In addition, LAD has allowed temporary closure of the gate to trap material sluiced through Pacoima Dam. This was done with the understanding that LACDPW be responsible for removal of the trapped debris.

This water control manual includes the first formal water control plan for Lopez Dam. The water control plan is consistent with the intent of the original design. The gate will remain fully open except during spillway flow, when it will be fully closed.

3-06 PRINCIPAL REGULATION PROBLEMS

Other than the damage resulting from the February 1971 earthquake described in Section 3-03, there have been no major problems associated with the regulation of Lopez Dam and Reservoir. However, two minor problems have been identified that affect the regulation.

The first problem is associated with non-vegetative debris accumulation. The design for Lopez Dam included a sediment storage space large enough to hold the debris of a 50-year accumulation plus the debris produced by a single flood. Using a one percent debris surface slope projected upstream from the spillway crest, a debris storage allowance of 1,280,000 cubic yards (794 acre-feet) was originally provided. This storage was completely filled with debris by February 1969, only 15 years after completion of the dam. Debris removal is required more frequently due to this higher debris production.

The second problem pertains to seepage that occurs along the downstream toe of Lopez Dam. The seepage occurs when the reservoir level is at the spillway crest or above. The seepage does not appear to be detrimental to the integrity of the dam. However, stability problems could possibly arise at higher water levels or if the water level is maintained at the spillway crest level or above for prolonged time periods. The seepage problem creates a constant need for COE personnel to monitor the dam and limits prolonged reservoir storage. Seepage is also a cause of considerable concern to the local residents.

IV - WATERSHED CHARACTERISTICS

4-01 GENERAL CHARACTERISTICS

Lopez Dam is located on Pacoima Wash in the northcentral part of the San Fernando Valley, about 2.2 miles northeast of the city of San Fernando, and entirely within the city of Los Angeles. The drainage area is 34 square miles, about 15 miles long and from 1.5 to 3 miles wide. Pacoima Dam, owned and operated by the LACDPW, has flood control and conservation storage and is located 1.5 miles upstream of Lopez Dam. The drainage area located between Pacoima Dam and Lopez Dam is 6 square miles.

4-02 TOPOGRAPHY

The elevations in the drainage area range from a peak of 6,532 feet above National Geodetic Vertical Datum (NGVD) on Mount Gleason in the San Gabriel Mountains to 1,250 feet above NGVD at Lopez Dam. The longest water course in the area, Pacoima Wash, is about 19 miles in length with an average gradient of 275 feet per mile.

4-03 GEOLOGY AND SOILS

The soils in the mountains, which are derived mainly from metamorphic and igneous rocks, are shallow and stony. In the valleys, the soil consists of silt, sand, and gravel with some boulders and is relatively deep. The canyon slopes have a sparse cover of live oak, chaparral, and native grass.

4-04 SEDIMENT

The original design for Lopez Dam was based on providing a debris control reservoir to retain the debris of a 50-year accumulation plus the debris produced by a single flood. Using a 1 percent debris surface slope projected upstream from the spillway crest, a debris storage allowance of 1,280,000 cubic yards (794 acre-feet) was originally provided. This storage was completely filled with debris by February 1969, only 15 years after completion of the dam. As a result of this higher debris production, either the spillway crest should be raised 16.5 feet to provide the necessary debris storage, or, more likely, debris should be removed more frequently.

4-05 CLIMATE

The climate of the watershed is characterized by warm, dry summers and cool, moist winters. The climate varies throughout the watershed due to the variation in elevation. The higher elevations are generally slightly cooler and receive more precipitation than the lower portion of the watershed. Nearly all the precipitation occurs during the months of December through March. Elevations above 5,000 feet frequently experience snowfall with the snow usually melting rapidly except on higher peaks and northern slopes. The average annual temperature at the city of San Fernando is 63.6 degrees F. The lowest average monthly temperature is 54.2 degrees F in January and the highest average monthly temperature is 74.6 degrees F in August. The average annual rainfall recorded at the San Fernando station is 16.12 inches. The average monthly rainfall for this station is heaviest in January (3.39 inches)

and is lightest in July (0.02 inches).

4-06 STORMS AND FLOODS

Precipitation in the Lopez Dam drainage area occurs both in the form of general winter storms associated with extratropical cyclones of North Pacific origin and convective type storms generally occurring during the summer. Estimates of probable maximum precipitation furnished by the U.S. Weather Bureau indicate that the highest rate of discharge from the drainage area for Lopez Dam would result from a 6-hour convective type storm.

Precipitation in the area is highly variable as shown by the monthly precipitation recorded at Pacoima Dam (Table 4-1). The variability in the precipitation can be illustrated by inspecting the statistical parameters presented in Table 4-2. A comparison of the highest on record values with the mean or median values shows the wide variation. The four quartile mean values and median values are shown graphically on Plate 4-1.

4-07 RUNOFF CHARACTERISTICS

The annual runoff from the Lopez Dam drainage area is also highly variable. A summary of the outflow from Pacoima Dam is shown in Table 4-3. The annual runoff is also shown on Plate 4-2 (1937-1958) and Plate 4-3 (1959-1976). Selected Pacoima Dam outflow hydrographs are plotted on Plate 4-4. A basin unit hydrograph has been developed and is shown on Plate 4-5.

4-08 WATER QUALITY

The watershed for Lopez Dam lies almost entirely in the unpopulated and undeveloped Angeles National Forest. No agricultural or industrial activity is present upstream from Lopez Reservoir. Under these conditions, water quality of inflow to Lopez Reservoir is expected to be high (low concentrations of heavy metals, pesticides and other pollutants).

In the past, high concentrations of suspended solids and nonvegetative debris from storm runoff and sluicing operations at upstream Pacoima Reservoir have resulted in a continual problem of sediment deposition in Lopez Reservoir. This has necessitated frequent clean-out operations to allow operation of the dam outlet and to ensure that adequate debris storage exists for a potential future flood.

TABLE 4-1

PRECIPITATION DATA RECORDED AT PACOIMA DAM*

(Value in inches)

Year	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	TOTAL
1929	0.35	1.66	2.76	1.85	2.02	1.69	2.18	0	0.18	0	0	0.30	12.99
1930	0.16	0	6.37	1.04	5.60	0.37	1.72	0.15	0	T	0	0.08	15.49
1931	0.55	3.52	0	4.13	5.96	0.02	2.76	0.84	0.23	0	0.27	0.09	8.37
1932	0.24	2.61	7.36	2.21	9.47	0.22	1.26	0.36	0.36	0	0	0.07	24.16
1933	0.07	0	1.49	11.16	0.08	0.37	0.86	1.03	0.35	0	0.07	0	15.48
1934	0.59	0.19	6.63	4.31	3.33	0.04	0.03	0.01	0.96	0	T	0.33	16.42
1935	3.74	2.51	6.50	3.57	2.12	3.84	2.50	0.07	0	0.18	0.14	0	25.17
1936	0.57	1.38	0.68	0.40	11.28	2.48	0.65	0.03	0.04	0.05	0.02	0.21	17.79
1937	2.01	0.06	8.55	4.27	8.02	4.83	0.58	1.02	0.05	0.01	0	T	29.40
1938	0	0.03	5.01	1.95	10.09	12.84	1.96	0.35	0.30	0	0.06	0.06	32.65
1939	0.27	T	10.27	3.55	1.45	1.96	0.23	0.18	0	0	0	4.07	21.98
1940	0.20	0.23	0.82	6.97	6.18	1.43	2.17	0.04	0	0	0	0.06	18.13
1941	1.52	0.21	7.72	3.35	13.00	8.98	5.27	0.07	0.03	0.22	0.04	0	40.41
1942	2.00	0.15	5.89	0.36	0.98	1.25	3.04	0.03	0	0	0.79	0	14.49
1943	1.41	0.64	1.20	16.08	4.50	5.22	1.22	0.01	0.03	0	0	0	30.27
1944	0.32	0.28	8.12	1.39	11.80	4.16	1.05	0.18	0.59	0	0	0.09	27.98
1945	0	5.13	1.44	0.09	5.62	4.22	0.59	0.01	0.18	0.12	0.90	0	18.18
1946	1.41	0.36	6.38	0.24	1.38	5.77	0.83	0.37	0	0.12	0	0	16.86
1947	2.50	8.27	6.10	0.75	0.15	1.50	0.33	0.61	0.12	0	0.13	0.46	20.92
1948	0.12	0.02	1.70	0	1.78	3.36	1.83	0.17	0.48	0	0	0	9.46
1949	0.12	0	3.01	2.74	2.37	1.48	0.12	2.14	0.03	0	T	0	12.01
1950	0.06	1.99	3.31	2.61	2.31	1.09	1.15	0.29	0.23	T	0	0.96	14.00
1951	0.61	1.48	0.16	4.21	0.95	0.70	2.87	0.10	0	0	0.74	0	11.82
1952	0.99	2.16	7.38	13.10	0.54	9.12	3.06	0	0.01	0	0	0.11	36.47
1953	0	4.12	3.72	1.77	0.36	1.06	1.81	0.23	0.08	0	0	0	13.15
1954	0	0.99	0.27	6.51	2.71	4.79	0.42	0.11	0.07	0	0	0	15.87
1955	0	1.77	1.23	4.40	1.67	0.28	3.04	1.88	0.01	0	0.06	0	14.34
1956	0	1.77	2.38	7.19	0.84	0	4.45	1.12	T	0	0.01	0	17.76
1957	1.16	0	0.40	6.30	1.95	2.08	1.33	2.04	0.40	0	0	T	15.66
1958	2.25	0.72	4.48	2.53	7.54	6.13	6.06	0.08	0	0	0.03	0.69	30.56
1959	0.37	0.26	0	2.85	4.87	0	0.95	0.02	0.01	T	T	0.07	9.40
1960	0.03	T	1.36	3.10	2.52	1.01	1.62	T	0	0	0	T	9.64
1961	0	5.12	0.26	1.39	0.03	0.61	0.51	0.10	0	0.01	0.58	0.13	8.74
1962	0	2.07	2.39	4.01	14.51	1.45	0.12	0.41	T	0	0	0	24.96
1963	0.26	0.03	T	0.83	4.10	3.04	3.00	0.07	0.67	0	T	1.11	13.11
1964	0.99	3.19	0.06	3.09	T	3.02	1.91	0.06	0.31	0	T	T	12.63
1965	0.75	2.39	2.64	0.72	0.62	2.01	6.86	T	0.06	0.17	0.02	1.98	18.22
1966	0	15.66	4.68	1.00	1.38	0.35	0	0.33	0	T	0	0.61	24.01
1967	0.15	3.93	7.91	6.98	0.17	4.89	5.73	0.65	T	0	0	1.58	31.99
1968	0	6.96	1.06	1.66	1.95	3.50	0.63	T	T	0	0.12	0.03	15.91
1969	0.50	0.38	1.56	16.55	9.45	1.49	1.45	0.02	0.25	0.12	0	T	31.77
1970	0	2.25	0.11	2.05	4.20	5.84	T	0.02	0.12	T	0	0	14.59
1971	0.03	6.75	6.76	1.53	0.94	1.06	0.88	1.38	0.05	0.02	0	0.15	19.55
1972	0.51	0.71	8.24	T	0.21	0	0.14	0.08	0.06	T	0.11	0.03	10.09
1973	1.60	2.39	2.08	4.07	12.70	4.02	0.08	0.01	0.09	0	T	T	27.04
1974	0.54	2.01	0.79	8.69	0	4.22	0.62	0.01	0.03	T	0	0	16.91
1975	1.05	0.13	3.48	0.29	3.08	5.08	3.35	0.12	0.04	0	0	0.10	16.72
1976	0.62	0.01	0.78	0.00	4.25	1.92	1.54	0.24	0.21	0.01	0.34	4.33	14.25
1977	2.97	0.58	0.67	4.96	0.13	2.15	0	5.16	0.04	0	2.90	T	19.56
1978	0.02	0.23	5.13	7.79	8.01	14.01	2.93	T	T	0	0	0.98	39.10
1979	0.16	2.72	1.83	8.20	4.05	5.74	0.03	0.34	0.16	0	0.07	0.02	23.32
1980	1.20	0.70	0.55	7.41	12.52	5.59	0.69	0.85	T	0.04	0	0	29.55
1981	0	0	0.85	3.49	1.38	4.63	1.49	T	0	0	0	0	11.84
1982	0.59	2.72	0.28	2.70	1.00	6.59	2.74	0.06	0.21	0	0	1.32	18.21
1983	0.32	4.92	1.85	6.46	5.68	12.00	4.41	0.19	0.02	0	4.12	2.10	42.07
x	0.65	1.97	3.10	4.08	3.99	3.47	1.74	0.46	0.13	0.02	0.21	0.40	20.21
s	0.84	2.74	2.91	3.78	4.06	3.25	1.67	0.85	0.19	0.05	0.69	0.90	8.46
x_y	0.40	1.15	2.26	2.99	2.80	2.53	1.26	0.22	0.07	0.01	0.06	0.16	18.64
s_y	2.69	2.82	2.21	2.20	2.32	2.21	2.24	3.38	2.91	4.09	4.81	3.83	1.49

LACDPW STATION NO. 33A

x = normal mean s = normal standard deviation x_y = log-normal mean s_y = log-normal standard deviation

TABLE 4-2

STATISTICAL PARAMETERS FOR PRECIPITATION DATA RECORDED AT PACOIMA DAM*

(Values in inches unless noted otherwise)

Parameter	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Total
Mean	0.65	1.97	3.10	4.08	3.99	3.47	1.74	0.46	0.13	0.02	0.21	0.40	20.21
Median	0.32	0.99	1.85	3.10	2.31	2.48	1.26	0.11	0.04	0	0	0.03	17.79
First Quartile Mean	0.004	0.03	0.25	0.53	0.36	0.41	0.17	0.01	0	0	0	0	11.65
Second Quartile Mean	0.18	0.46	1.28	2.33	1.60	1.71	0.85	0.07	0.02	0	0	0.004	16.02
Third Quartile Mean	0.61	2.03	3.64	4.36	4.09	4.11	1.95	0.27	0.11	0	0.03	0.11	21.05
Fourth Quartile Mean	1.91	5.62	7.53	9.47	10.35	7.96	4.16	1.57	0.41	0.08	0.86	1.58	33.02
Highest on Record	3.74	15.66	10.27	16.55	14.51	14.01	6.86	5.16	0.96	0.22	4.12	4.33	42.07
Lowest on Record	0	0	0	0	0	0	0	0	0	0	0	0	8.74
Percentage of Years with Measurable Precipitation	78.2	87.3	92.7	94.6	96.4	94.6	94.6	87.3	69.1	21.8	38.2	52.7	100.00

*LACDPW STATION NO. 33A

TABLE 4-3

PACOIMA DAM OUTFLOW*

Season	Annual Outflow (AF)	Instantaneous Peak Outflow (cfs)	Date of Peak
1937-38	26796	2062	3-2
1938-39	3080	66	1-20
1939-40	3133	169	2-4
1940-41	25942	430	3-5
1941-42	2032	97	7-15
1942-43	20407	598	1-23
1943-44	15167	326	3-2
1944-45	4911	397	2-2
1945-46	2904	241	2-5
1946-47	6029	237	1-7
1947-48	335	8	6-29
1948-49	740	10	6-24
1949-50	1019	231	4-11
1950-51	69	6	9-30
1951-52	14325	634	1-18
1952-53	3500	163	11-17
1953-54	2941	292	4-5
1954-55	737	39	4-21
1955-56	1252	66	5-17
1956-57	773	47	5-7
1957-58	15808	420	2-5
1958-59	708	242	6-18
1959-60	271	4	8-1
1960-61	11	0	N/A
1961-62	6279	511	4-7
1962-63	228	24	9-25
1963-64	722	117	6-15
1964-65	1041	5	5-7
1965-66	15214	664	11-23
1966-67	23600	197	7-6
1967-68	3833	105	11-22
1968-69	42998	2715	2-25
1969-70	2308	153	3-3
1970-71	4994	85	12-26
1971-72	802	90	2-11
1972-73	7383	1540	2-11
1973-74	4154	460	1-8
1974-75	2526	83	8-19
1975-76	1614	66	6-6
1976-77	507	470	4-4
1977-1984 not available for this study			

N/A - Not Applicable

* Outflow data provided by Los Angeles County Department of Public Works (LACDPW) for Pacoima Creek Flume below Pacoima Dam. LACDPW Station No. F/188B-R.

4-09 CHANNEL AND FLOODWAY CHARACTERISTICS

The basin channel upstream of Lopez Dam is natural with no channel improvements for flood control. Flood control channel improvements have been constructed on Pacoima Wash downstream of Lopez Dam as described in Section 3-04. The channel has been divided into three sections in terms of nomenclature:

Section	Name	Description
1	Pacoima Creek	Watershed up to Pacoima Dam
2	Pacoima Wash	Pacoima Dam to Pacoima Spreading Grounds
3	Pacoima Diversion	Pacoima Spreading Grounds to Tujunga Wash Channel

A profile of the channel from Tujunga Wash to the watershed crest is shown on Plate 4-6 (Sta. 0+00-Sta. 80+00) and Plate 4-7 (Sta. 80+00-Sta. 160+80).

4-10 UPSTREAM STRUCTURES

Pacoima Dam. Pacoima Dam is located on Pacoima Creek approximately 1.5 miles upstream of the Lopez Dam site (see Plate 3-1). The concrete-arch structure, completed in 1929, is operated and maintained by the LACDPW for flood control and water conservation. Information pertaining to Pacoima Dam and Reservoir is given in Exhibit A.

4-11 DOWNSTREAM STRUCTURES

(a) Hansen Dam. Located along Tujunga Wash, 9 miles above its confluence with Los Angeles River (see Plate 3-1), Hansen Dam is a major flood-control facility owned, operated, and maintained by the LAD, as part of the LACDA flood-control project. Hansen Dam controls floods on the downstream portions of Los Angeles River, as well as on Tujunga Wash, immediately downstream of Hansen Dam. Pertinent data for Hansen Dam are included in Exhibit B.

(b) Sepulveda Dam. Sepulveda Dam is a major flood control dam owned, operated and maintained by the LAD. It is located along Los Angeles River, 43 miles above the mouth of the river, and 6 miles above the confluence of Tujunga Wash and Los Angeles River. The dam is in the southcentral portion of the San Fernando Valley, just northwest of the junction of the Ventura Freeway (U.S. Highway 101) and the San Diego Freeway (Interstate Highway 405) (see Plate 3-1). Pertinent data for Sepulveda Dam are included in Exhibit B.

4-12 ECONOMIC DATA

a. Population. The watershed for Lopez Dam lies almost completely in the Angeles National Forest. This is an unpopulated and unincorporated part of Los Angeles County. The downstream area is located in the cities of San Fernando and Pacoima. The population estimates below are from the State of California, Department of Finance, Population Research Unit, and are of January, 1984:

Pacoima	74,662
San Fernando	18,966

b. Agriculture. The downstream area was once primarily an agricultural and ranch area. The postwar era has brought increasing urbanization to the area which has virtually replaced all agriculture and ranching.

c. Industry. The downstream area is heavily residential and supports general office and commercial development. There are a number of business/industrial parks. Most of the manufacturing is light industry.

d. Flood Damages. Since completion of the project, flood damages prevented through fiscal year 1984 are estimated to be $159,584,000. The reason this much damage has been prevented is because Lopez Dam serves as a debris collection basin. If this debris was allowed to flow downstream it would damage the channel lining thus causing greater flood damages for a particular event than if the channel lining was intact.

V - DATA COLLECTION AND COMMUNICATION NETWORKS

5-01 HYDROMETEOROLOGICAL STATIONS

a. Facilities. Plate 3-2 shows the precipitation, reservoir, and stream gages in the watershed above Lopez Dam, plus the stream gage on Pacoima Diversion Channel at Branford Street. These gages, along with their latitudes, longitudes, and elevations, are listed in Table 5-1.

There is one precipitation gage (Pacoima Dam) within the Lopez Dam watershed and it is a Los Angeles telemetry system gage. The water level in Pacoima Reservoir and at the Pacoima Outlet channel gage is also reported by the telemetry system. The closest downstream channel gage is the "Pacoima Diversion Channel at Branford Street" gage operated by the LACDPW. The Branford Street gage is not on the telemetry system. A rating table for the gage is shown on Plate 5-1.

b. Reporting. Telemetry gages report in real-time. Data from the gages are either recorded locally onto charts or tapes (recording type gages) or are observed daily or more frequently (non-recording gages).

Of those which report via telemetry, there are two types:

(1) Interrogated Gages. The Los Angeles telemetry system gages, owned and operated by the COE are interrogated (usually once each hour or more frequently during storm conditions) by a radio located at the LAD Office in downtown Los Angeles. The data are compiled and processed by the LAD's Water Control Data System Computer for printout and for hydrologic forecasting.

(2) Event-Reporting Gages. The telemetry gages, installed by the LACDPW in cooperation with National Weather Service (NWS) report via Very High Frequency (VHF) radio on an event basis. Example events reported include incremental changes in accumulated rainfall depths or predetermined incremental changes in streamflow or reservoir gage heights. The greater the intensity of rainfall or the change in gage height, the more frequent the gage reports.

These gages form a part of a network, labeled by the NWS, as the ALERT (Automatic Local Evaluation in Real-Time) system. The LAD monitors these gages, along with its own interrogative telemetry gages.

c. Maintenance. Each operating agency is responsible for the maintenance of its own gages and/or telemetry radio equipment. In many cases, the gage is owned by the USGS, and the telemetry attachments are owned by the LAD or LACDPW.

5-02 WATER QUALITY STATIONS

There are no water quality stations in the watershed above Lopez Dam.

TABLE 5-1

HYDROMETEOROLOGICAL STATIONS

Plate 3-2 Designation	Name	Latitude	Longitude	Elevation	Description
#1	Pacoima Dam	34, 20' 05"	118, 23' 51"	1650	Recording and nonrecording precipitation, temperature, reservoir stage, and reservoir discharge. Operated by LACDPW. On LAD telemetry system.
#2	Lopez Dam	34, 18' 15"	118, 24' 30"	1249	Recording reservoir stage. Operated by LAD. Not on LAD telemetry system.
#3	Pacoima Diversion Channel at Branford Street	34, 14' 07"	118, 25' 13"	855	Recording streamflow. Operated by LACDPW. Not on LAD telemetry system.

5-03 SEDIMENT STATIONS

There are no sediment stations in the watershed above Lopez Dam. There are no sediment ranges in Lopez Reservoir.

5-04 RECORDING HYDROLOGIC DATA

Each agency maintains records of its own data. The NWS data are placed in archives at the National Climatic Center in Asheville, North Carolina. Precipitation and other data are published monthly by the National Climatic Center in Climatological Data and Hourly Precipitation Data.

The State of California, Department of Water Resources, publishes the data from the ALERT telemetry gage network on a monthly basis. The LACDPW maintains their recording and non-recording data bases and furnish data to other agencies upon request. The LAD maintains a data base from its recording and telemetry gages and provides selected data to the NWS for publication. Real Time Reports received from the ALERT gages and the Los Angeles Telemetry System gages are stored in a database on the Water Control Data System Computer.

5-05 COMMUNICATION NETWORK

The LAD maintains a voice radio communication network for its entire operations activities. This routinely includes communications between the District Office and the various dam tenders, as well as vehicles in the field.

During periods of significant runoff, communications to the dam tenders becomes vital. The existing radio network, which has proven itself reliable, is backed up by a second radio network; and both of these are backed up by the local telephone system.

Power at the District Office is backed up by an emergency generator system; and if all fails at the District Office, there is a complete radio system at the LAD Base Yard. The Base Yard is located a few miles east of the District Office.

5-06 COMMUNICATION WITH PROJECT

a. Regulating Office with Project Office. During the flood season (15 November through 15 April), a routine radio call is made at least once each weekday from the LAD Office to the dam tender for Hansen Dam. The Hansen Dam operator is also the operator for Lopez Dam. This "Morning Report" is usually made at 0800 hours, Monday through Friday. Other routine or non-routine radio or telephone calls are made as needed. There are no telephone or electrical services at Lopez Dam. Direct communication with the operator while he is at Lopez Dam is possible by calling his Mobile Radio (WUK 4121).

In the event that all communications with the COE District Office, including the COE Base Yard, should be interrupted, a set of "Standing Instructions to Dam Tender" have been compiled for Lopez Dam and a copy of these instructions are included in this manual. The COE organization chart and important phone numbers for reservoir operations decisions at Lopez Dam are given in Plate 5-2.

b. Between Project Offices and Others. No routine communication exists between Lopez Dam and other agencies.

c. Between Regulating Office and Others. Before and during the earliest stages of any reservoir impoundment, the COE notifies offices of other agencies and selected private interests of the impending rises in the reservoir water surface elevation and corresponding outflow. A list of agencies to notify, with applicable office and home telephone numbers, is published annually in the LAD's Instructions for Reservoir Operations Center Personnel (the so-called "Orange Book"). During major runoff events, the LAD Reservoir Operations Center is in constant contact with the LACDPW Hydraulics Branch to fully coordinate the operations of both agencies. The LACDPW is directly tied into the LAD radio and telephone system. The LAD Reservoir Operations Center is also in direct radio contact with channel observor's dispatched to patrol the Los Angeles River during large floods.

5-07 PROJECT REPORTING INSTRUCTIONS

During periods of water operations, communications between the LAD Office and each affected dam tender are made on a frequent basis. Normal communications occur once each hour and more frequent communications are sometimes required. If a gate change is required, the Reservoir Operations Center (ROC) staff provide the radio operator at the LAD Office with the gate change instructions. These instructions are then broadcast to the dam tender. When the gate change is completed, the dam tender calls back to the District radio operator with information on the change. The radio operator then informs the ROC engineer who initiated the change. The dam tender records pertinent information associated with the gate change on the form shown on Figure 9-1. This report form is subsequently submitted to the LAD Office.

Other special instructions to dam tenders are conducted in a similar manner. This network of radio communications is also used by the dam tender to report any failure of machinery or other equipment or any other unusual conditions at the dam.

5-08 WARNINGS

The responsibility for issuing all weather watches and warnings and all flood and flash flood watches and warnings rests with the NWS. Local emergency officials of cities and counties are responsible for issuing any other public warnings including unusual overflows, evacuations, unsafe roads or bridges, and toxic spills. The COE is responsible for providing these officials with up-to-date information, and forecasts where possible, of water rises within Lopez Reservoir and release rates into the channel downstream of Lopez Dam. The LAD ROC should notify the Los Angeles Police Department (Foothill Division) to initiate evacuation if a dam break is imminent.

VI - HYDROLOGIC FORECASTS

6-01 GENERAL

a. Role of Corps of Engineers. The LAD does not make any formal hydrologic forecasts, published or unpublished, for Lopez Dam. Despite the lack of formal hydrologic forecasts, the LAD does carefully monitor the reservoir water surface elevation in Lopez Reservoir, and does notify other agencies of any significant changes or anticipated changes as described in Section 5-06.

The LAD continues to improve its monitoring capabilities of conditions not only at Lopez Dam, but in adjacent watersheds. Improved and increased numbers of automatic telemetry rain and stream gages help in this manner not only directly, but also in the development of computerized rainfall-runoff forecast models. The long-term goal of the LAD is to be able to provide relatively accurate predictions of inflows and reservoir surface elevations as far in advance as possible. It is intended that these predictions will become accurate and reliable enough that they can be shared with the NWS, the LACDPW, city and county emergency officials, and others to be used as a basis for reservoir systems operations during the upcoming years.

The LAD Meteorologist prepares special quantitative precipitation forecasts for Los Angeles River drainages and other watersheds including the Lopez Dam watershed. These are used in determining the potential for significant runoff into Lopez and other reservoirs. Research is progressing into the direct incorporation of these quantitative precipitation forecasts into the rainfall-runoff forecast models being developed.

b. Role of Other Agencies. No agency has any specific forecast responsibility for water surface elevations in Lopez Reservoir or for discharges on Pacoima Wash, either upstream or downstream of Lopez Dam. The NWS issues Flash Flood Warnings for rivers and other watercourses in the San Fernando Valley.

The LAD does receive real-time weather reports and forecasts, as well as historical weather data, from the NWS. This is accomplished by means of weather facsimile pictures and teletype data and forecasts transmitted by the NWS and received by a LAD facsimile recorder and teletype printer. Close coordination is maintained with the NWS forecast office located in Los Angeles.

Historical precipitation and streamflow data are available from the LACDPW. These data, while not of use in real-time, are important to studies of historical storms and floods which aid in the development and refinement of computerized rainfall-runoff forecast models.

6-02 FLOOD CONDITIONS FORECASTS

Forecasts of flood hydrographs are currently not made. However, routine evaluation of precipitation, resulting inflow, and forecast precipitation provides valuable subjective predictions of flood situations. Using such information, the LAD Reservoir Operations Center can evaluate if an ongoing flood will increase or decrease over the next 24 hours.

6-03 CONSERVATION PURPOSE FORECASTS

Since Lopez Dam is strictly a flood control facility, forecasts for other purposes including water conservation are not made.

6-04 LONG-RANGE FORECASTS

Since the watershed above Lopez Dam is relatively small (34 square miles), and since water is impounded behind Lopez Dam for short time periods, there is little direct need for long-range forecasts in the operation of Lopez Dam. Only in the event of major impoundment at Lopez Reservoir, as well as simultaneously at other reservoirs affecting the downstream channel and Los Angeles River, would a forecast of more than one day be of immediate significance to the operation of Lopez Dam. In such a case, the forecast of another impending major storm or lack of such storm might influence the release rate of water from Lopez Dam. The primary consideration of the release rates from all of the dams in the Los Angeles River system is to prevent or minimize downstream damages.

VII - WATER CONTROL PLAN

7-01 GENERAL OBJECTIVES

Lopez Dam and Reservoir are integral flood control facilities in the Pacoima-Tujunga Wash system of tributaries to the Los Angeles River. The purpose of the dam, a unit under the approved comprehensive plan for flood control in the LACDA, is to provide protection against debris-laden floodwaters for large areas between the dam site and Los Angeles River. Important improvements in these areas include valuable industrial, business, and residential properties and transportation systems. A secondary use for the dam is that it also forms a headworks to direct flows into the Pacoima Wash Channel and/or the Lopez Spreading Grounds operated by the LACDPW.

7-02 MAJOR CONSTRAINTS

Several physical constraints at Lopez Dam result in regulation limitations, including:

a. Seepage occurs along the downstream toe of the dam when the reservoir level is at the spillway crest or above. The seepage has not been detrimental to the integrity of the dam. However, with pool elevations exceeding a 12-foot spillway surcharge, some instability may develop. Prolonged reservoir storage should be limited and COE personnel should monitor the dam whenever the reservoir contains water, especially at water levels above the spillway crest.

b. The capacity of the reservoir outlet conduit is relatively small compared to the standard project flood (SPF) discharge of 11,200 cfs and the probable maximum flood (PMF) discharge of 30,400 cfs. The maximum discharge capacity of the outlet for the water level at the spillway crest is 422 cfs.

c. The reservoir outlet discharges directly into the spillway channel which creates turbulence and affects the spillway flow. The outlet gate should be closed during flow over the spillway to eliminate spillway flow interference.

d. Greater amounts of non-vegetative debris accumulate in the reservoir than was originally anticipated. The original design was based on retaining a 50-year accumulation of debris plus the debris produced by a major flood. The debris allowance was determined to be 794 acre-feet. This storage was completely filled with debris by February, 1969, only 15 years after completion of the dam. The greater amount of debris production results in decreased flood control storage and debris removal on a more frequent basis is required.

e. Vegetative debris can plug the low level inlet to the reservoir drain under certain conditions. No structural improvements have been incorporated into the project for the specific purpose of controlling vegetative debris. Reservoir ponding will not occur while the outlet gate is at the full-open position until the reservoir content reaches approximately 45 acre-feet and the inflow exceeds 144 cfs.

f. Long term reservoir impoundment could be a safety hazard due to the fact that the reservoir is located in a residential area. There is a potential for children drowning, as well as several other safety concerns.

7-03 OVERALL PLAN FOR WATER CONTROL

Due to the very limited flood control capability of Lopez Dam, the overall plan for water control at Lopez Dam has been formulated to address the following objectives and criteria: (a) minimization of sedimentation; (b) minimization of pool depths to reduce seepage through the embankment; (c) maintenance of a debris pool to avoid clogging the inlet trash rack on the outlet works with vegetative and miscellaneous debris; (d) gate closure during spillway flow to avoid outlet flow disturbance of flow in the spillway channel; and (e) ease of operation while providing for flexibility.

The objectives of the overall water control plan can be achieved by operating the reservoir outlet as if it were uncontrolled during all conditions except during spillway flow. For all inflow conditions when the water surface is below the spillway crest, the outlet gate is to be full-open. The outlet gate should be closed at all times when spillway flow is occurring. After spillway flow has ceased, the outlet gate is to be opened to the full-open position to allow draining of the pool.

7-04 STANDING INSTRUCTIONS TO DAM TENDER

The standing instructions to the dam tender for the regulation of Lopez Dam and Reservoir are given in Table 7-1. At all times when there is no spillway flow (water surface elevation less than 1,273 ft.-NGVD), the reservoir outlet gate should be set at the full-open position of 5 feet. At all times during spillway flow, the gate should be closed to avoid interference with spillway flow. After spillway flow has ceased, and unless instructed otherwise, the gate opening should be reset to the full-open position.

The dam operator should follow the communication guidelines for normal and emergency operating conditions given below:

a. <u>Communication with the District Office is available</u>:

1. Notify the Reservoir Operations Center when a gate change will be required according the the schedule given in Table 7-1.

2. Notify the ROC if unable to set the gates as instructed.

b. <u>Communication with the District Office is not available</u>:

1. Try to reestablish communication through the LACDPW.

2. Allow a period of one-half hour to pass to reestablish communication with the District Office. If after one-half hour communication is not reestablished, follow the gate operation schedule given in Table 7-1.

TABLE 7-1

LOPEZ DAM RESERVOIR REGULATION SCHEDULE

Step No.	When Reservoir Water Surface is Between Elevations (feet - NGVD)	Gate Setting (feet of opening)	Computed Outlet Discharge (cfs)	Spillway Discharge (cfs)
1	1,254-1,273	5.0	0-422	0
2	1,273-1,299	0	0	0-44,500

NOTES: Spillway Crest Elevation 1,273 ft, NGVD.
Top of Dam Elevation 1,299 ft, NGVD.
Follow Step 1 at all times when there is no spillway flow
Follow Step 2 at all times during spillway flow

DAM OPERATOR INSTRUCTIONS

1. Communication with the District Office is available.
   a. Notify the Reservoir Operations Center when a gate change will be required according to the schedule.
   b. Notify the Reservoir Operations Center if unable to set the gate as instructed.

2. Communication with the District Office is not available.
   a. Try to reestablish communication through the Los Angeles County Department of Public Works.
   b. Allow a period of one half hour to pass to reestablish communication with the District Office. If after one half hour communication is not reestablished, follow the gate operation schedule.

7-05 FLOOD CONTROL

Because of the limited storage capacity of Lopez Dam and the large channel capacity downstream of the dam, the flood control provided by the dam is due to the configuration of the dam and channel rather than to the operation of the outlet gate. The dam acts to divert flows coming from the unimproved Pacoima Wash upstream into the concrete lined channel downstream. The capacity of the downstream channel is about the same as the SPF Inflow Peak for Lopez Dam. Therefore, the water control plan for Lopez Dam has been developed considering the supplemental objectives and criteria discussed in Section 7-03 and the constraints listed in Section 7-02. The maximum operational benefits will be obtained by following the reservoir regulation schedule given in Table 7-1. The basic water control plan specifies that the reservoir outlet gate remain in the full-open position at all times unless spillway flow is occurring. The gate is to be closed during spillway flow to insure optimal flow conditions in the spillway channel. After spillway flow has ceased, and as a general rule, the reservoir outlet is to be opened again to the full-open position to allow draining of the pool. The reservoir pool drawdown from the spillway crest to the outlet invert, assuming no inflow into the reservoir, and the gate in the full-open position, is approximately 30 hours. It may be desirable to delay the drawdown time during certain conditions. The drawdown times for select gate openings are provided in table 7-2.

Maximum open channel flow of the outlet conduit is 144 cfs. Based on available information, this is probably less than the debris carrying discharge. Therefore, there is no requirement to close the outlet gate at the start of inflow in order to build a debris pool, because once inflow becomes greater than 144 cfs and debris starts to form, reservoir impoundment will begin, and a debris pool will build up.

7-06 RECREATION

There are no existing recreational facilities or activities associated with Lopez Dam and Reservoir.

7-07 WATER QUALITY

Since flood control operation of Lopez Dam has limited effect on water quality, no special provisions for water quality control are included in normal regulation. At various times in the past, LAD has cooperated with LACDPW in modifying its gate operating schedule to trap sediment being sluiced from upstream Pacoima Reservoir behind Lopez Dam. A 1959 agreement allowed the LACDPW to operate the outlet for purposes of lowering the concentration of suspended solids in water being delivered to downstream spreading grounds. This agreement expired in 1964.

7-08 FISH AND WILDLIFE

The Lopez Reservoir encompasses approximately 80 acres of vacant land. No vegetation exists within the reservoir basin. The margins of the basin have a scattered covering of tree tobacco (Nicotiana glauca) and broom baccharis

TABLE 7-2

LOPEZ DAM POOL DRAWDOWN

Gate Opening (feet)	Drawdown Time* (hours)
0.5	332.0
1.0	113.5
1.5	66.5
2.0	49.0
2.5	42.5
3.0	38.0
3.5	35.0
4.0	32.5
4.5	31.0
5.0	29.5

*Assuming reservoir inflow equal to zero and pool initially full at spillway crest.

(Baccharis sarothroides), which intergrades into the California coastal scrub of the surrounding hills.

The basin does not provide suitable habitat for wildlife. The lack of cover and intermittent flooding make the area unsuitable for most species. During periods in which the reservoir is holding water the basin provides marginal habitat for wading birds and migrating water fowl.

7-09 WATER SUPPLY

The Lopez Dam water control plan does not provide for regulation for water supply. In some instances LAD has coordinated regulation of Lopez Dam with LACDPW's water supply operations of upstream Pacoima Dam and downstream spreading grounds.

Currently no formal agreement exists with LACDPW with respect to the operation of Lopez Dam. However, from 1959 to 1964, LACDPW operated the gated outlet under license from LAD in order to maintain a small debris pool behind Lopez Dam. Suspended solids in water conservation releases from Pacoima Dam settled out in this pool resulting in higher quality water released to downstream spreading grounds. The agreement required LACDPW to remove accumulated sediments resulting from their operations. Because LACDPW felt the cost of sediment removal exceeded the water supply benefits, LACDPW allowed the license to expire without renewal in 1964.

LAD has also periodically cooperated with LACDPW in allowing closure of the gated outlet at Lopez Dam and trapping sediment sluiced from Pacoima Reservoir in Lopez Reservoir. This operation facilitates removal of sediment from Pacoima Reservoir and has been allowed on the condition LACDPW remove the debris deposited in Lopez Reservoir.

7-10 DEVIATION FROM NORMAL REGULATION

There may be instances when it is necessary for the operation of Lopez Dam to deviate from the established flood control plan. Prior approval of deviations is required from District Engineer, LAD, except for emergencies and minor deviations as discussed in subparagraphs a and b, below.

a. Emergencies. Some emergencies that can be expected are: drownings and other accidents, and failure of operation facilities. Necessary action under emergency conditions should be taken immediately unless such action would create equal or worse conditions. The Reservoir Regulation Unit, LAD, is to be informed of any deviations as soon as practical.

b. Unplanned Minor Deviations. There are unplanned instances that create a temporary need for minor deviations from the normal regulation of the reservoir, although they are not considered emergencies. Construction activities account for the major portion of such incidents and often include utility stream crossings, facility maintenance, bank protection work, and channel maintenance and major construction contracts. Changes in releases are sometimes necessary for maintenance and inspection. Requests for changes of release rates are generally for a few hours to a few days. Each request is

analyzed on its own merits. Consideration is given to upstream watershed conditions, potential flood threat, conditions of reservoirs, and possible alternative measures. In the interest of maintaining good public relations, the requests are usually complied with, providing there are no foreseen adverse effects on the overall operation of the project for the authorized purposes. Approval for these minor deviations will normally be obtained from the Reservoir Regulation Unit, LAD, by telephone with subsequent written confirmation.

c. Planned Deviations. These are planned instances, which require deviations from the normal regulation. Each condition is to be analyzed on its own merits. Sufficient data on flood potential, reservoir and watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other projects and useful purposes will be presented by letter or telephone to Reservoir Regulation Unit, LAD, along with recommendations for approval.

7-11 WATER CONTROL PLANNING TOOLS

Specific planning tools have been utilized in the development of the flood control plan. These tools are also used to evaluate and set operation rules for planned deviations and also to facilitate operation of the dam during emergencies and unplanned minor deviations. Water control planning tools used for Lopez Dam and Reservoir include:

a. Pool Drawdown Table (Table 7-2),

b. Outlet Rating Curve and Table (Plate 7-1 and Table 7-3),

c. Spillway Discharge Curve and Table (Plate 7-2 and Table 7-4), and

d. Area-Capacity Curves and Tables (Plate 7-3 and Table 7-5).

Table 7-3. Lopez Dam Outlet Discharge in Cubic Feet Per Second

ELEVATION	GATE OPENING IN FEET									
	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0
1254	0	0	0	0	0	0	0	0	0	0
1255	6	10	10	10	10	10	10	10	10	10
1256	9	21	30	30	30	30	30	30	30	30
1257	11	27	49	62	62	62	62	62	62	62
1258	12	32	60	82	99	99	99	99	99	99
1259	13	36	67	92	116	130	144	144	144	144
1260	14	40	73	101	127	147	162	170	175	186
1261	14	44	80	109	138	160	178	191	206	232
1262	15	47	85	117	147	171	194	211	233	266
1263	16	49	90	124	155	182	208	230	256	288
1264	17	52	94	131	164	192	221	248	276	306
1265	18	54	99	138	171	203	233	264	293	321
1266	18	55	102	144	180	213	246	279	308	336
1267	19	57	106	149	188	223	258	292	322	350
1268	20	58	110	155	195	232	269	304	334	363
1269	20	60	113	160	202	241	280	315	346	376
1270	21	61	116	165	210	250	290	326	358	388
1271	21	62	119	170	217	258	300	337	368	400
1272	22	64	122	175	224	267	309	347	379	411
1273*	22	66	124	180	231	275	319	356	388	422
1274	23	67	127	185	237	283	327	365	400	433
1275	23	68	130	189	243	291	335	373	410	444
1276	24	70	132	194	249	299	344	381	420	454
127	24	71	135	198	255	306	352	389	429	464
1278	25	72	138	202	261	313	360	398	438	474
1279	26	74	140	206	266	320	367	406	448	484
1280	26	76	143	210	272	326	374	414	456	493
1281	27	78	146	214	277	333	381	422	464	502
1282	27	79	148	218	282	339	388	430	472	510
1283	27	81	151	222	287	344	394	438	480	519
1284	28	82	153	225	292	350	401	446	487	527
1285	28	84	156	228	297	356	406	453	495	535
1286	28	86	158	232	302	361	412	460	502	543
128	29	87	160	235	306	365	418	467	510	551
1288	29	88	163	238	310	370	425	474	518	559
1289	29	89	166	241	314	375	431	480	525	567
1290	30	90	168	244	319	380	437	486	532	574
1291	30	91	170	247	323	386	443	492	539	582
1292	30	92	172	250	326	391	449	499	547	589
1293	30	93	175	253	330	396	455	506	554	596
1294	31	94	178	256	334	401	461	512	561	603
1295	31	95	180	259	338	406	467	518	568	610
1296	31	96	182	262	341	411	473	525	575	617
1297	31	96	184	265	344	416	479	532	582	624
1298	32	97	186	267	346	420	484	538	589	631
1299**	32	98	187	270	348	424	490	545	596	638

Note: Elevation given is water surface elevation in feet above NGVD.
*Spillway Crest
**Top of Dam

Table 7-4

LOPEZ DAM SPILLWAY DISCHARGE

Elevation	Discharge (cfs)	Elevation	Discharge (cfs)
1273.0	0	1286.5	16,688
1273.5	119	1287.0	17,603
1274.0	336	1287.5	18,554
1274.5	617	1288.0	19,522
1275.0	950	1288.5	20,506
1275.5	1,328	1289.0	21,507
1276.0	1,746	1289.5	22,523
1276.5	2,200	1290.0	23,554
1277.0	2,688	1290.5	24,601
1277.5	3,208	1291.0	25,663
1278.0	3,757	1291.5	26,739
1278.5	4,334	1292.0	27,830
1279.0	4,939	1292.5	28,936
1279.5	5,569	1293.0	30,056
1280.0	6,224	1293.5	31,190
1280.5	6,902	1294.0	32,338
1281.0	7,604	1294.5	33,500
1281.5	8,328	1295.0	34,676
1282.0	9,073	1295.5	35,864
1282.5	9,840	1296.0	37,067
1283.0	10,626	1296.5	38,282
1283.5	11,433	1297.0	39,510
1284.0	12,260	1297.5	40,751
1284.5	13,105	1298.0	42,005
1285.0	13,969	1298.5	43,271
1285.5	14,851	*1299.0	44,550
1286.0	15,751		

Note: Elevation given is water surface elevation in feet above NGVD.

*Top of Dam

TABLE 7-5

LOPEZ DAM RESERVOIR AREA AND CAPACITY

Elevation	Capacity (acre-feet)	Area (acres)	Elevation	Capacity (acre-feet)	Area (acres)
1254	0	0	1277	622.7	48.4
1255	2.1	3.7	1278	671.8	49.7
1256	7.7	7.6	1279	722.1	51.1
1257	17.2	11.3	1280	774.1	52.8
1258	29.9	14.0	1281	827.8	54.6
1259	45.2	16.4	1282	883.3	56.5
1260	62.9	18.9	1283	940.7	58.2
1261	83.0	21.2	1284	999.6	59.6
1262	104.9	22.7	1285	1059.8	60.8
1263	128.4	24.1	1286	1121.2	61.9
1264	153.2	25.5	1287	1183.7	63.1
1265	179.3	26.8	1288	1247.3	64.1
1266	206.8	28.1	1289	1311.9	65.1
1267	235.9	29.6	1290	1377.5	66.0
1268	265.9	31.1	1291	1444.0	67.0
1269	297.9	32.8	1292	1511.4	67.9
1270	331.6	34.7	1293	1579.9	69.2
1271	367.3	36.6	1294	1649.8	70.7
1272	404.8	38.4	1295	1721.4	72.4
*1273	441.1	40.4	1296	1794.7	74.3
1274	485.6	42.6	1297	1870.0	76.4
1275	529.4	44.9	1298	1947.6	79.0
1276	575.2	46.6	**1299	2027.9	80.8

Notes: (1) Table based on survey dated March, 1979.
(2) Elevation given is water surface elevation in feet above NGVD.

*Spillway Crest
**Top of Dam

VIII - EFFECT OF WATER CONTROL PLAN

8-01 GENERAL

The operation of Lopez Dam has resulted in a reduction in the magnitude of flows along the lower portion of Pacoima Wash. The dam has successfully provided a headworks to direct flows into the downstream flood control channel. Indirect benefits have also resulted from operations by controlling flows for conservation diversions into Lopez Spreading Grounds and the downstream channel.

8-02 FLOOD CONTROL

a. Spillway Design Flood. The spillway of a dam must be designed in order to pass, without danger to the structure of the dam or threat of overtopping the dam, the greatest rate of discharge that could be expected from the most severe combination of rainfall and runoff conditions that could reasonably occur. This hypothetical flood is called the PMF.

(1) Original Criteria. The spillway at Lopez Dam was designed for a peak outflow of 32,000 cfs, with 21 feet of surcharge. An additional 5 feet of freeboard to handle runup by waves from the water surface was incorporated, which set the top of the dam at elevation 1,298.9 feet.

The original spillway design flood resulted from a 24-hour stable orographic-type storm. The average precipitation depth over the drainage area for the probable maximum storm was 21.5 inches with an effective total precipitation of 17.9 inches. The probable maximum flood (PMF) peak inflow to Lopez Dam was 32,000 cfs. The total 2-day flood volume, including base flow, was 37,800 acre-feet. The maximum water surface elevation obtained during the PMF routing was 1293.9 feet, approximately 5 feet below the top of the dam.

(2) Revised Criteria. In a subsequent 1978 study, the adequacy of the Lopez Dam spillway was reviewed under modern criteria. This led to the development of a revised PMF resulting from a probable maximum storm based on a 6-hour convective-type storm. The average depth of precipitation for 1/2, 1, 3, and 6 hours during the probable maximum storm for the drainage area above Lopez Dam were 4.1, 5.9, 8.7, and 11.3 inches, respectively. The total flood volume, including base flow, was 19,900 acre-feet.

The revised PMF (peak inflow of 30,400 cfs) was routed, assuming that the outlet conduit was plugged and that the debris storage pool was filled. The peak outflow would be 30,200 cfs and the maximum pool elevation would be 1292.8 feet. This provides 6.1 feet of freeboard which exceeds the required freeboard of 5 feet. The inflow, outflow, and water surface elevation hydrographs for the revised spillway design routing are shown in Plate 8-1.

b. Standard Project Flood. The SPF represents the runoff event that would result from the most severe combination of rainfall and watershed conditions that are considered reasonably characteristic for the region in

question. The COE generally applies the SPF as the criteria for protecting urban areas. Thus, since approximately 1952, the SPF has been used as the Reservoir Design Flood for the construction of new dams.

For the rainfall to be used in the determination of the SPF at a given site, a Standard Project Storm is normally selected as the most severe reasonably characteristic storm of record within a climatically homogeneous region surrounding the site, and is then transposed to the drainage area above the target site.

The SPF has been routed through the reservoir assuming that the reservoir outlet was closed and that the debris storage of 794 acre-feet was full. The SPF was based on a general type storm having a duration of 48 hours. The average precipitation depth over the drainage area is 21.2 inches with an effective total precipitation of 7.8 inches. The SPF peak inflow and outflow are both 11,200 cfs. The total flood volume, excluding base flow, is 14,100 acre-feet. The maximum water surface elevation obtained during the SPF routing is 1,283.2 feet, approximately 16 feet below the top of the dam. Plate 8-2 shows the inflow, outflow, and water surface elevation hydrographs for the SPF routing.

8-03 WATER QUALITY

At most times during most years, inflows are not detained in the reservoir, but pass immediately downstream, with little change in water quality. Impoundment of water occurs in the winter storm season for debris control purposes. These impoundments are of such short duration that little adverse effect on water quality will occur. In fact, whatever effect would probably be beneficial as suspended solids and debris would settle out and result in higher quality releases downstream. In most instances, water flowing from Lopez Reservoir should meet Federal and state water quality standards and be suitable for the identified beneficial uses, primarily groundwater recharge.

8-04 FISH AND WILDLIFE

Any impacts on biological resources resulting from the new flood control operation plan are expected to be minor. No vegetation exists within the reservoir basin. The margins of the basin have a scattered covering of tree tobacco (Nicotiana glauca) and broom baccharis (Baccharis Sarothroides). The existing vegetation either tolerates inundation well or can quickly reestablish itself after inundation. Prolonged inundation does not occur within the reservoir basin.

The basin does not provide suitable habitat for wildlife. The lack of cover and intermittent flooding makes the area unsuitable for most species. There are no State or Federally listed threatened or endangered species within the general vicinity of the reservoir.

8-05 FREQUENCIES

a. Peak Inflow and Outflow Probabilities. Plate 8-3 is a graph of the inflow and outflow frequencies at Lopez Dam, computed from a December 1984 LACDA review study. The values from which these curves were derived are

listed in Table 8-1. The inflow curve is affected by the Water Control Plan for Pacoima Dam, as discussed in Section 4-07. The inflow and outflow frequencies at Pacoima Dam are presented on Plate 8-4. Table 8-2 contains the values from which the curves on Plate 8-3 were derived. The inflow curve, is of course not affected by the Water Control Plan for Lopez Dam, which has bearing only upon regulation of the outflow and consequently the impoundment of water behind the dam.

The outflow curve of Plate 8-3, on the other hand, does reflect the Lopez Dam Water Control Plan. The sharp break in the slope of the curve at water surface elevation 1,273 feet reflects the fact that the water surface elevation in Lopez Dam has reached the spillway crest 1,273. The outflow rate increases rapidly for any additional rise in the reservoir water surface above elevation 1,273 feet.

b. Pool Elevation Duration and Frequency. Plate 8-5 is the computed filling frequency curve for Lopez Dam. Plate 8-6 shows a similar curve for Pacoima Dam. The curves on Plate 8-5 and Plate 8-6 are based upon, and have been adjusted for, 1984 conditions. These conditions include percent of impervious cover in the drainage area above Lopez and Pacoima Reservoirs, runoff routing conditions, and the gate operation schedule of the Water Control Plan for Lopez and Pacoima Dams. The values from which the curves of Plates 8-5 and 8-6 were constructed are listed in Tables 8-1 and 8-2, respectively. As with the outflow frequency curve (Plate 8-3), the relatively sharp change in slope of the filling frequency curve for Lopez Dam (Plate 8-5) reflects the fact that the outflow rate increases rapidly as the reservoir water surface elevation in Lopez Dam rises above elevation 1,273 feet, therefore, the rate of additional impoundment of water within the reservoir is reduced for a given increase in inflow.

8-06 OTHER STUDIES

a. Discharge-frequency values presented in this manual were derived from ongoing (1984) investigations in the COE LACDA study. The "Interim Report on Hydrology and Hydraulic Review of Design Features of Existing Dams for Los Angeles County Drainage Area Dams," dated June 1978, presents the derivation of the Probable Maximum and Standard Project Floods used in this manual.

b. No flood plain management studies addressing the downstream channel have been conducted by the COE since the downstream channel was constructed. Several flood insurance studies have been completed to date by the COE and LACDPW for the Federal Emergency Management Agency. These studies show no downstream flood problem. Currently (1984) the COE is conducting an ongoing review study of the entire LACDA system in order to reassess the adequacy of flood protection provided by the downstream channels.

TABLE 8-1

INFLOW, OUTFLOW, AND FILLING FREQUENCY VALUES, LOPEZ RESERVOIR

RETURN PERIOD (Years):	2	5	10	25	50	100	200	500
INFLOW (cfs)	156	323	616	1,130	2,720	2,990	3,390	4,630
OUTFLOW (cfs)	70	115	233	296	2,710	2,990	3,380	4,580
FILLING (max elevation, feet above NGVD)	1,257	1,258	1,261	1,264	1,276	1,277	1,277	1,279

NOTES:

1. These preliminary data values, which represent 1984 conditions, were obtained from a December 1984 LACDA review study performed by the Hydrologic Engineering Section of the U.S. Army Corps of Engineers, Los Angeles District.

2. Inflow and outflow frequency curves, drawn from the data values listed in this table, appear on Plate 8-3.

3. A filling frequency curve, drawn from the data values listed in this table, appears on Plate 8-5.

TABLE 8-2

INFLOW, OUTFLOW, AND FILLING FREQUENCY VALUES, PACOIMA RESERVOIR

RETURN PERIOD (Years):	2	5	10	25	50	100	200	500
INFLOW (cfs)	204	843	1,600	2,740	7,110	8,920	10,600	12,500
OUTFLOW (cfs)	200	405	799	1,370	2,720	2,990	3,390	4,630
FILLING (max elevation, feet above NGVD)	1,900	1,905	1,910	1,920	1,959	1,968	1,981	1,995

NOTES:

1. These preliminary data values, which represent 1984 conditions, were obtained from a December 1984 LACDA review study performed by the Hydrologic Engineering Section of the U.S. Army Corps of Engineers, Los Angeles District.

2. Inflow and outflow frequency curves, drawn from the data values listed in this table, appear on Plate 8-4.

3. A filling frequency curve, drawn from the data values listed in this table, appears on Plate 8-6.

IX - WATER CONTROL MANAGEMENT

9-01 RESPONSIBILITIES AND ORGANIZATION

a. Corps of Engineers. Lopez Dam is owned, operated, and maintained by the LAD, which has complete regulatory responsibility for the dam and the reservoir.

Reservoir operations at Lopez Dam and other COE facilities in the LAD are conducted by the Reservoir Regulation Unit of the Hydrologic Engineering Section. Plate 5-2 shows an organizational chart depicting the chain of command for Reservoir Regulation.

Gate regulation instructions to the dam tender are issued by the Reservoir Regulation Unit (see Sections 5-06 and 5-07). In the event that communications between the Reservoir Regulation Unit and Lopez Dam are interrupted, a set of Standing Instructions to Dam Tender are included in Section 7-04. Dam tenders are part of the Operation Branch, in the Construction-Operations Division.

b. Other Federal Agencies. The COE has complete responsibility for the operation of Lopez Dam; and although the COE receives data and information from other Federal and local agencies and informs these agencies of major decisions affecting Lopez Dam, no other agency has any responsibility in the operation of Lopez Dam. The U.S. Geological Survey operates stream gages in the LACDA.

c. State and County Agencies. LACDPW has maintenance responsibility for the Pacoima channel downstream of Lopez Dam and maintains and operates a number of projects in the drainage area. See Section 3-04.

9-02 INTERAGENCY COORDINATION

The COE coordinates with other Federal, State, County, and local organizations, as well as with the press, concerning the water control for Lopez Reservoir.

a. Local Press and Corps of Engineers Bulletins. The Public Affairs Office of the LAD, is responsible for interfacing with the press regarding operations at Lopez Dam and flows in the channel downstream of the dam. This is accomplished through interviews and the occasional issuance of press releases. The COE does not broadly issue flood watches or warnings or other status reports or forecasts to the general public. These are the responsibility of the NWS.

b. National Weather Service. The COE utilizes NWS data and forecasts in the operation of Lopez Dam, including the real-time telemetry data from gages installed in the watershed by the LACDPW in cooperation with the NWS. The COE shares data with the NWS and other agencies both on a real time basis and after the fact.

c. U.S. Geological Survey. The COE receives streamflow data from the U.S. Geological Survey, primarily on a historical basis in southern California. The COE coordinates with the U.S. Geological Survey in many different ways, and shares its data with the Geological Survey.

d. Los Angeles County Department of Public Works. The COE and LACDPW closely coordinate the operation of their reservoir projects and the maintenance and patrolling of their channels in the LACDA.

9-03 REPORTS

The LAD prepares and files several types of reports.

Each month during the runoff season, November through April, a flood situation and runoff potential report is prepared and sent to the South Pacific Division of the COE.

Four specific forms are also prepared in conjunction with the District's reservoir operation at Lopez Dam. A copy of each of these forms is included as Figures 9-01 through 9-04. These include: Flood Control Basin Operation Report (prepared by each dam tender), Record of Calls (both radio and telephone), Record of Data from Digital Recorders, and Reservoir Computations.

FLOOD CONTROL BASIN OPERATION REPORT

Reports Control Symbol
SPLCO – 7

Name | **Month** | **Year** | **OPERATOR**

Day	Reservoir W.S.Elev			Outlet channel		Gate operation																
	Time	Type of Gage	Gage reading in feet	Time	Gage height in feet	Time	Gate opening in feet															
							No.1	No.2	No.3	No.4	No.5	No.6	No.7	No.8	No.9	No.10	No.11	No.12	No.13	No.14	No.15	No.16

REMARKS:

SPL FORM 1 DEC 72 19 EDITION OF 1 MAR 55 MAY BE USED

Figure 9-01

RECORD OF CALLS ☐ Radio ☐ Telephone

DATE

LOCAL TIME	FROM		TO		CHECK REPTBLE CALLS*	MESSAGE OR REMARKS
	PERSON AND/OR CALL SIGN	TELEPHONE AND CITY	PERSON AND/OR CALL SIGN	TELEPHONE AND CITY		

Reportable telephone calls include collect calls, charge calls and long distance calls that can not be dialed without a code number. Calls are chargeable to MA 3-1311 unless otherwise indicated.

SPL FORM 29 APR 59 188 PREVIOUS EDITIONS ARE OBSOLETE

Figure 9-02

RECORD OF DATA FROM DIGITAL RECORDERS				NAME OF DAM	
DATE	TIME	WATER SURFACE	GAGE HEIGHT	PRECIPITATION	OPERATOR

SPL FORM 1 FEB 77 648

Figure 9-03

RESERVOIR COMPUTATIONS

☐ HOURLY ☐ DAILY

DAM	TIME OF READING (IF DAILY)	DATE

COMPUTED BY	CHECKED BY	DATA SOURCE

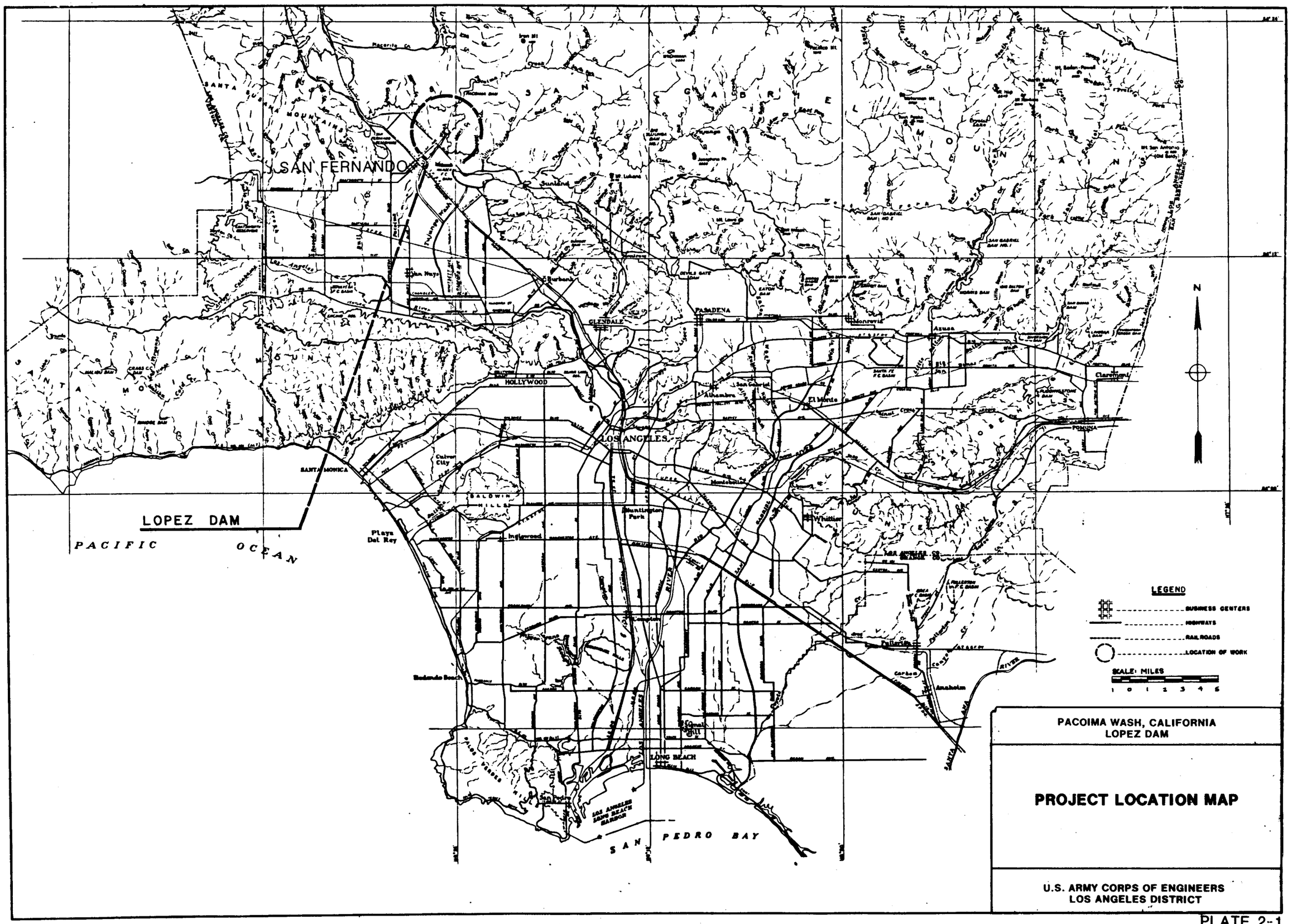
HR.	DA.	WATER SURFACE ELEV. FT.	STORAGE AC. FT.	GATE STEP NO.	INST. OUTFLOW			HRS.	STORAGE CHANGE		AV. OUT-FLOW CFS	AV. INFLOW CFS	GATE SETTINGS FT.
					OUT-LETS CFS	DOWNSTREAM G. HT. FT.	DOWNSTREAM FLOW CFS		ACRE-FEET	CFS			
PREVIOUS REPORT													
	1												
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	12												
	13												
	14												
	15												
	16												
	17												
	18												
	19												
	20												
	21												
	22												
	23												
	24												
	25												
	26												
	27												
	28												
	29												
	30												
	31												
								TOTAL					
								MEAN					

REMARKS

SPL FORM MAY 67 30 PREVIOUS EDITIONS MAY BE USED; REPLACES SPL FORM 29 WHICH MAY BE USED

ARMY - C. OF E. - LOS ANGELES

Figure 9-04

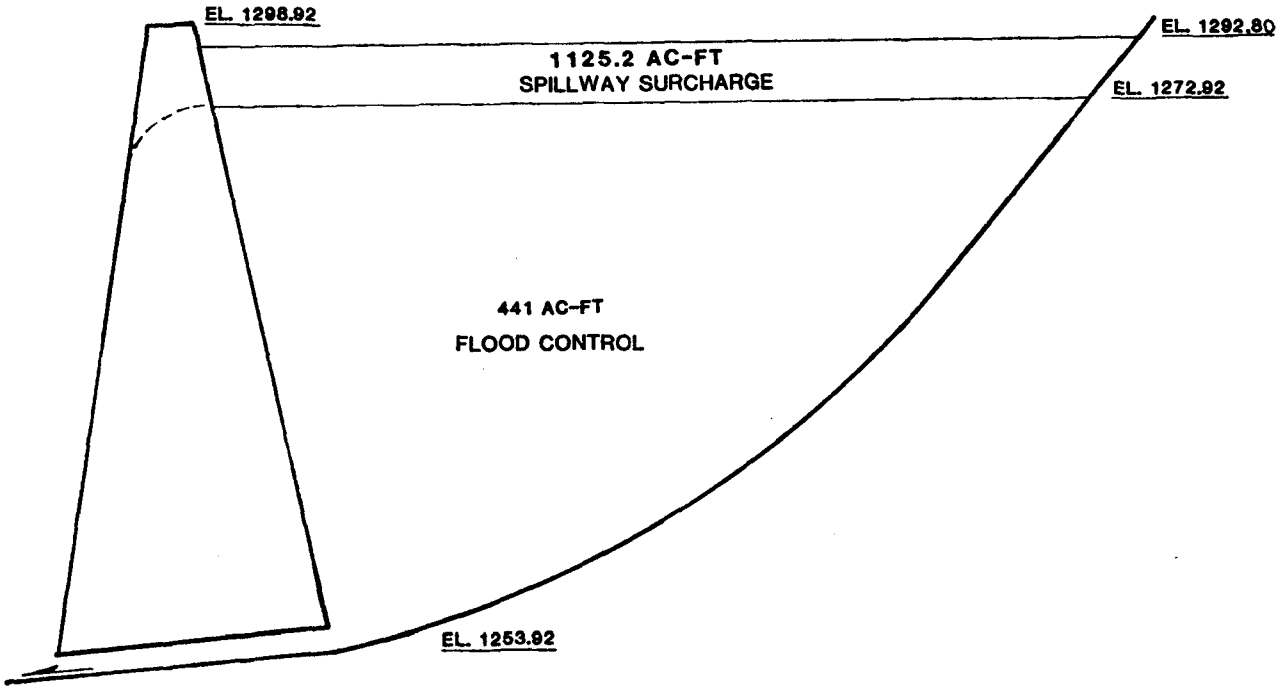


PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PROJECT LOCATION MAP

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 2-1

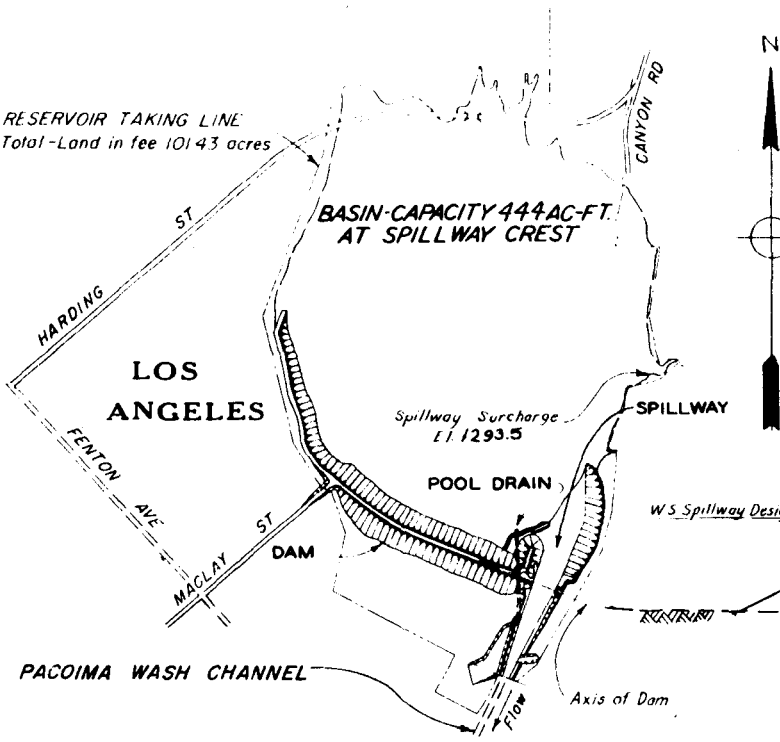


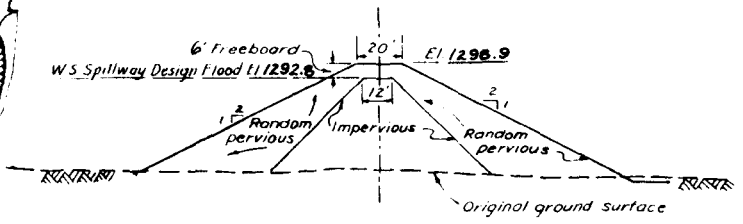
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

STORAGE ALLOCATION DIAGRAM

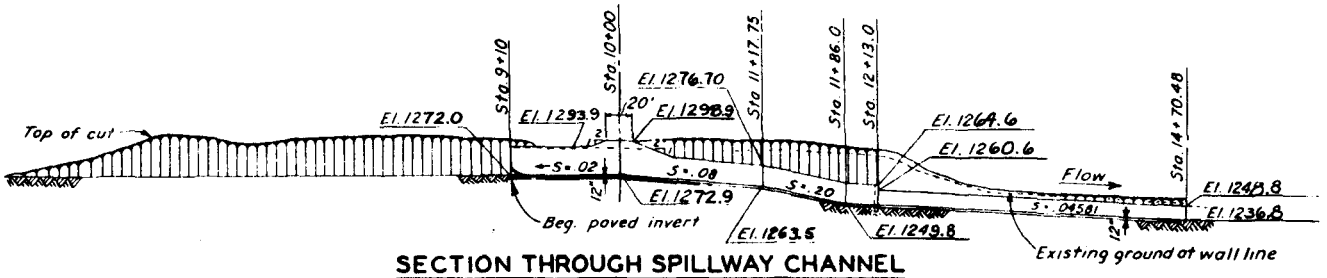
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 2-2

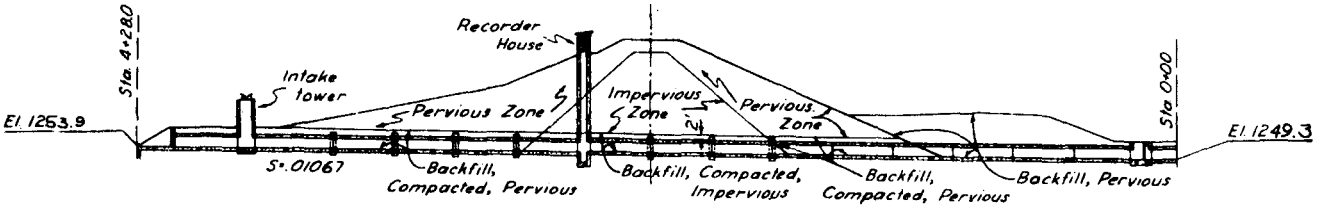




SECTION THROUGH DAM



SECTION THROUGH SPILLWAY CHANNEL



SECTION THROUGH POOL DRAIN

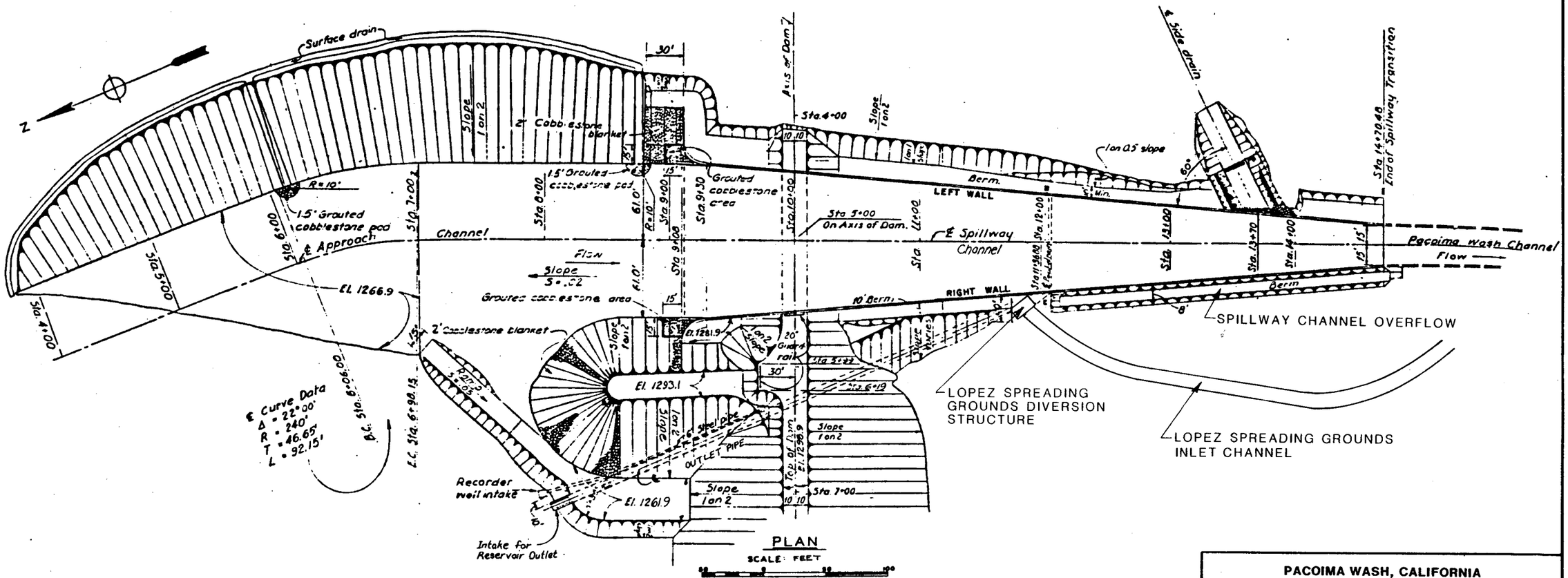
SCALE IN FEET

500 0 500 1000

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

GENERAL PLAN, SECTIONS AND REAL ESTATE LIMITS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



NOTES:

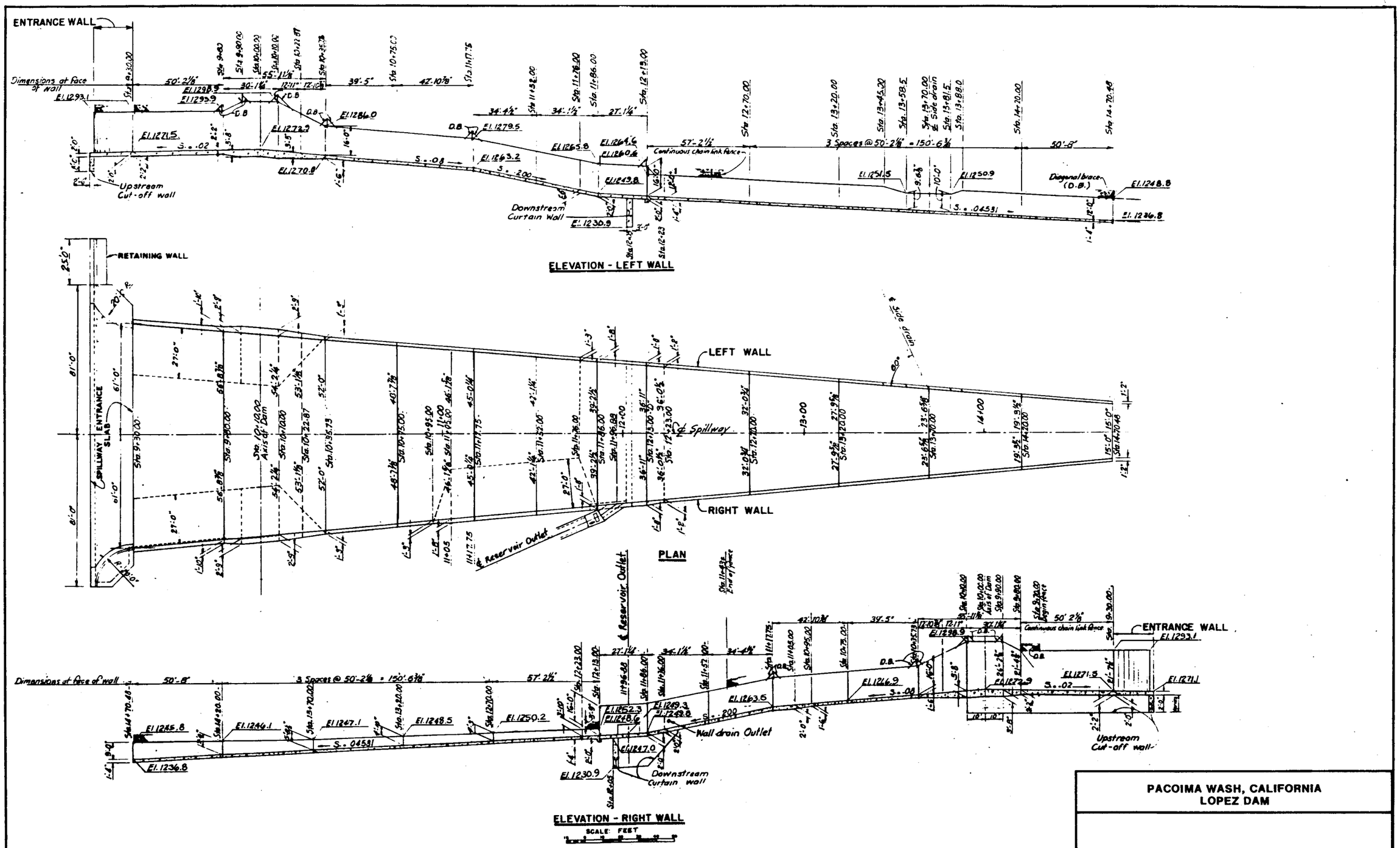
1) ORIGINAL DRAWING FROM AS-CONSTRUCTED RECORD DRAWING (FILE NO. 145/7) DATED FEBRUARY, 1954.

2) ALL ELEVATIONS HAVE BEEN ADJUSTED FOR CHANGE IN ELEVATION DUE TO FEBRUARY 9, 1971 EARTHQUAKE.

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

SPILLWAY PLAN

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



NOTES:

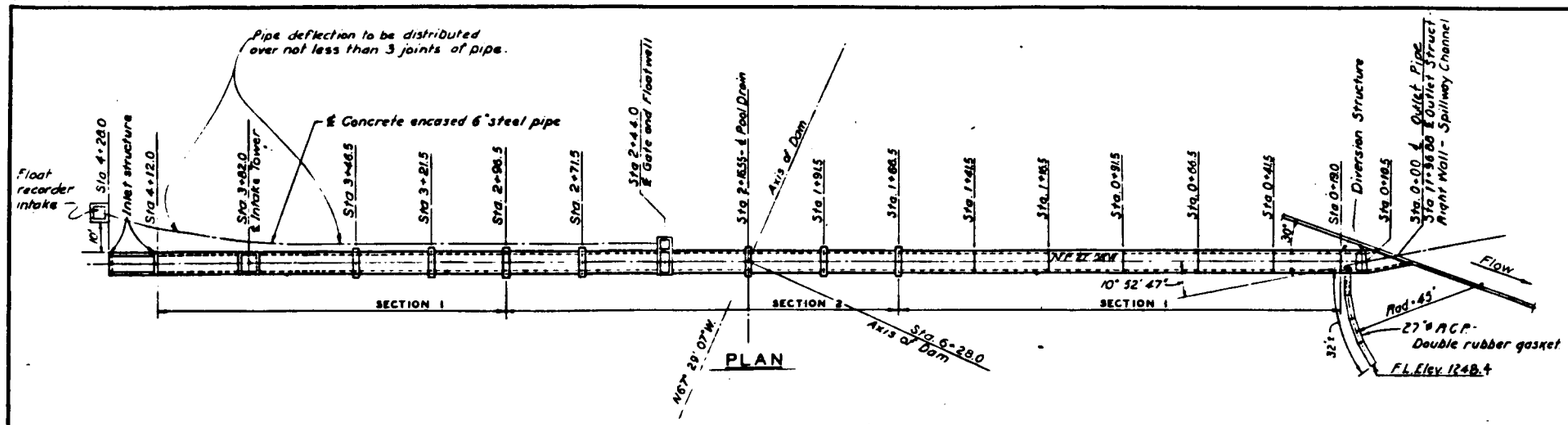
1) ORIGINAL DRAWING FROM AS-CONSTRUCTED RECORD DRAWING (FILE NO. 145/8) DATED FEBRUARY, 1954.

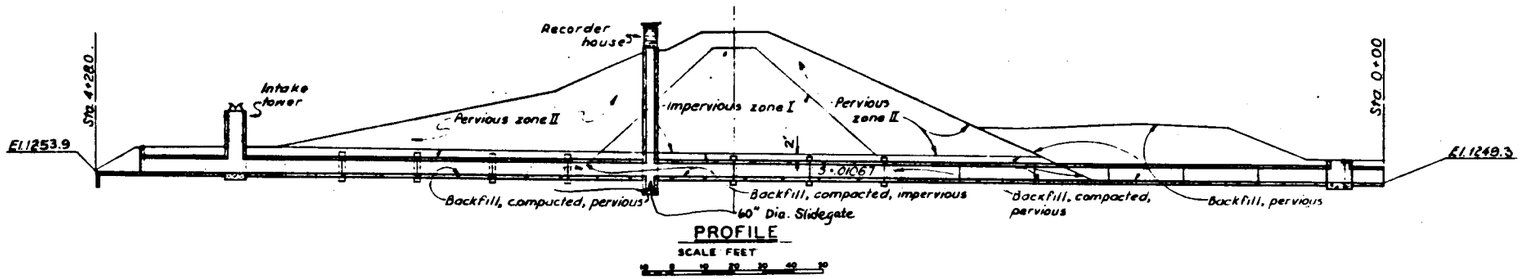
2) ALL ELEVATIONS HAVE BEEN ADJUSTED FOR CHANGE IN ELEVATION DUE TO FEBRUARY 9, 1971 EARTHQUAKE.

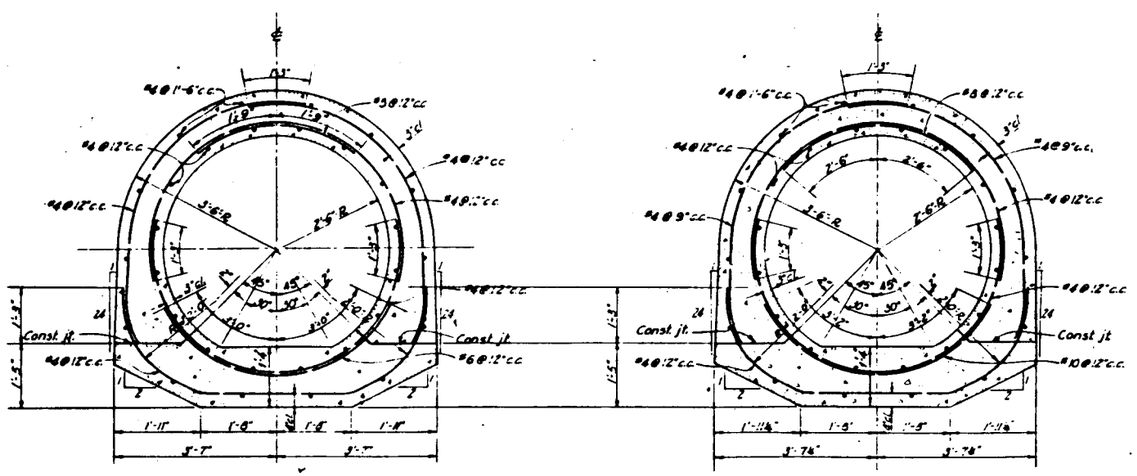
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

SPILLWAY DIMENSIONAL DETAILS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT







NOTES:

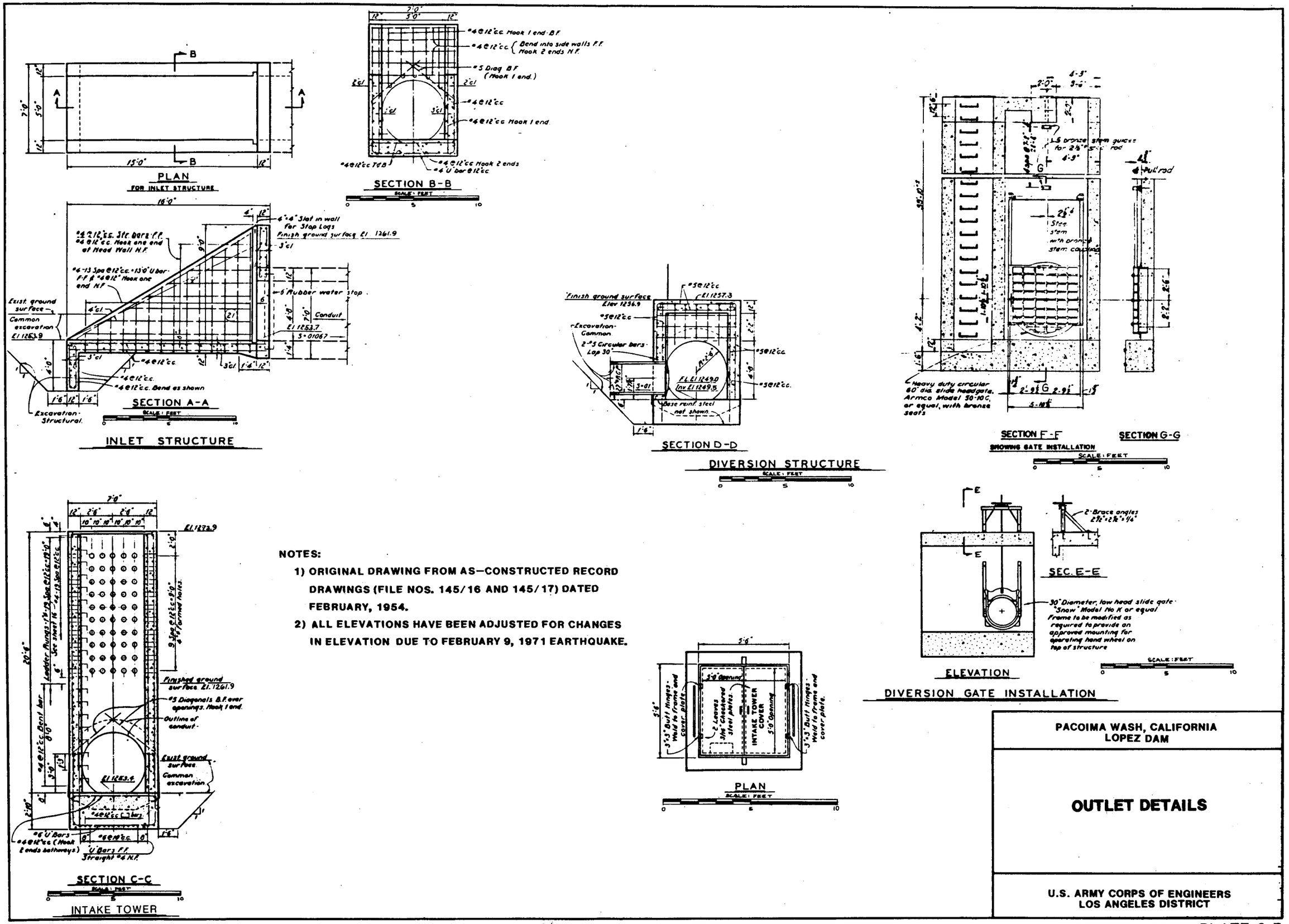
1) ORIGINAL DRAWING FROM AS-CONSTRUCTED RECORD DRAWING (FILE NO. 145/15) DATED FEBRUARY, 1954.

2) ALL ELEVATIONS HAVE BEEN ADJUSTED FOR CHANGE IN ELEVATION DUE TO FEBRUARY 9, 1971 EARTHQUAKE.

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

OUTLET PLAN, PROFILE AND SECTIONS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



NOTES:

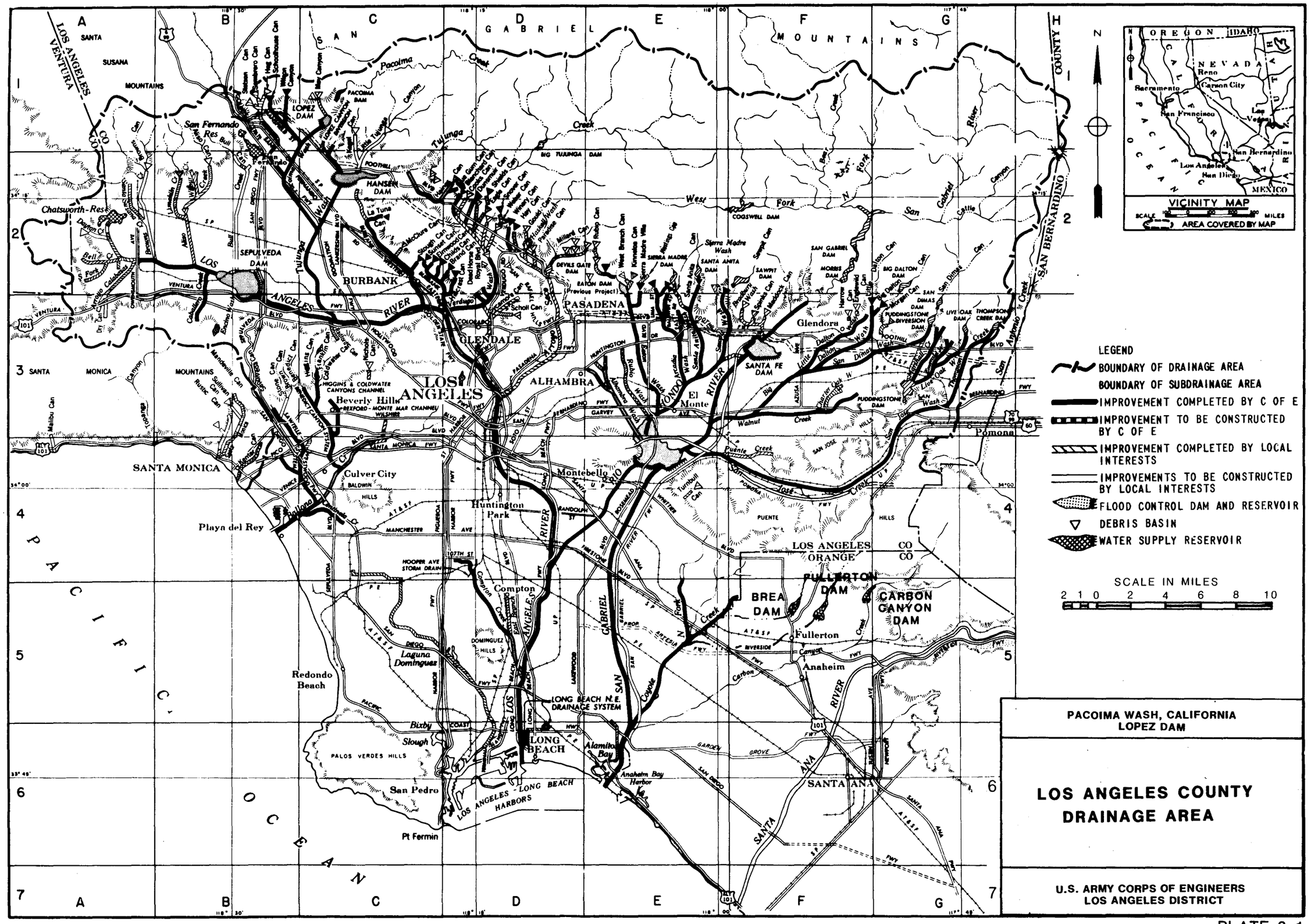
1) ORIGINAL DRAWING FROM AS-CONSTRUCTED RECORD DRAWINGS (FILE NOS. 145/16 AND 145/17) DATED FEBRUARY, 1954.

2) ALL ELEVATIONS HAVE BEEN ADJUSTED FOR CHANGES IN ELEVATION DUE TO FEBRUARY 9, 1971 EARTHQUAKE.

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

OUTLET DETAILS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



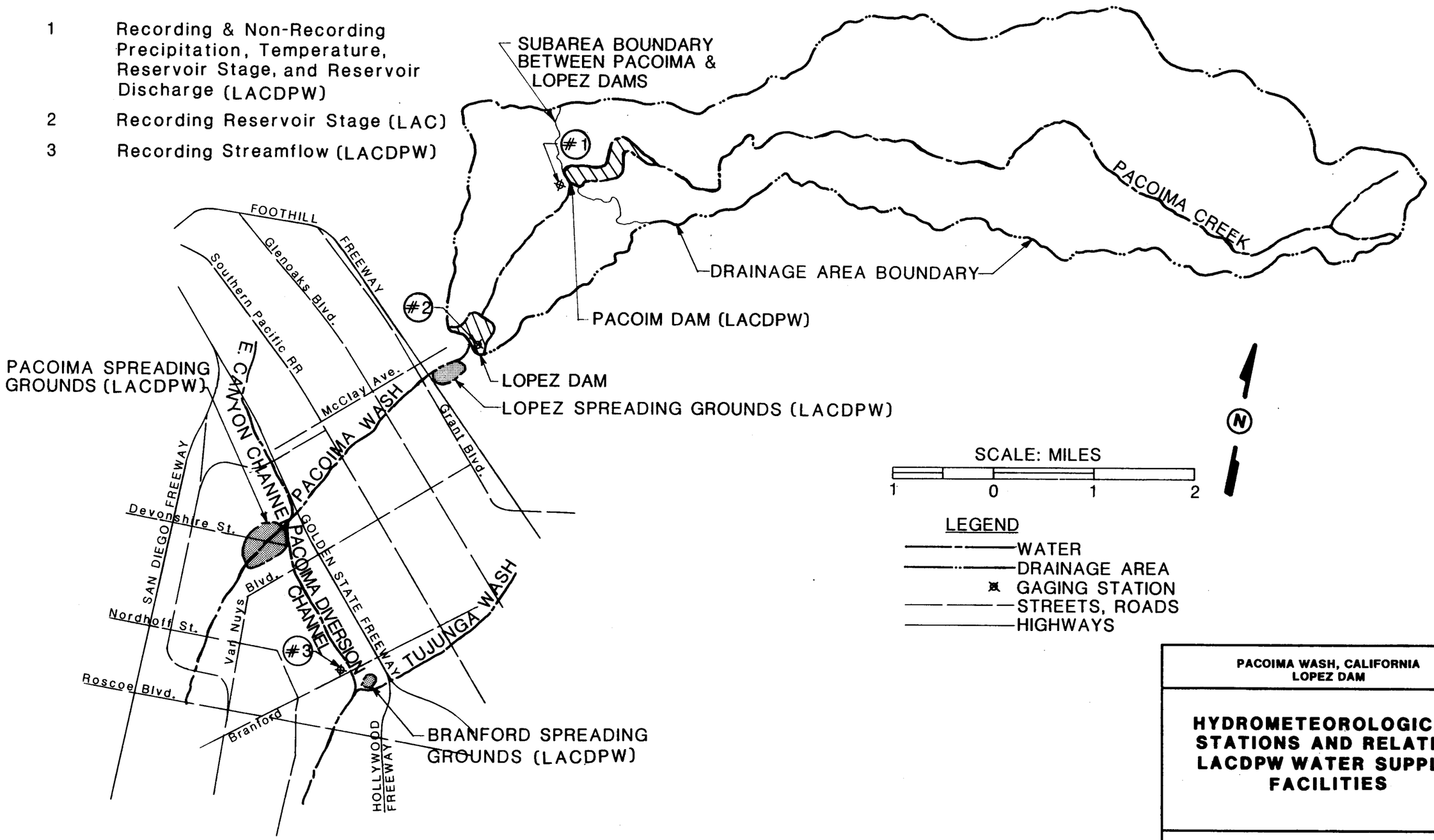
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

LOS ANGELES COUNTY DRAINAGE AREA

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 3-1

GAGE NO.	DESCRIPTION
1	Recording & Non-Recording Precipitation, Temperature, Reservoir Stage, and Reservoir Discharge (LACDPW)
2	Recording Reservoir Stage (LAC)
3	Recording Streamflow (LACDPW)



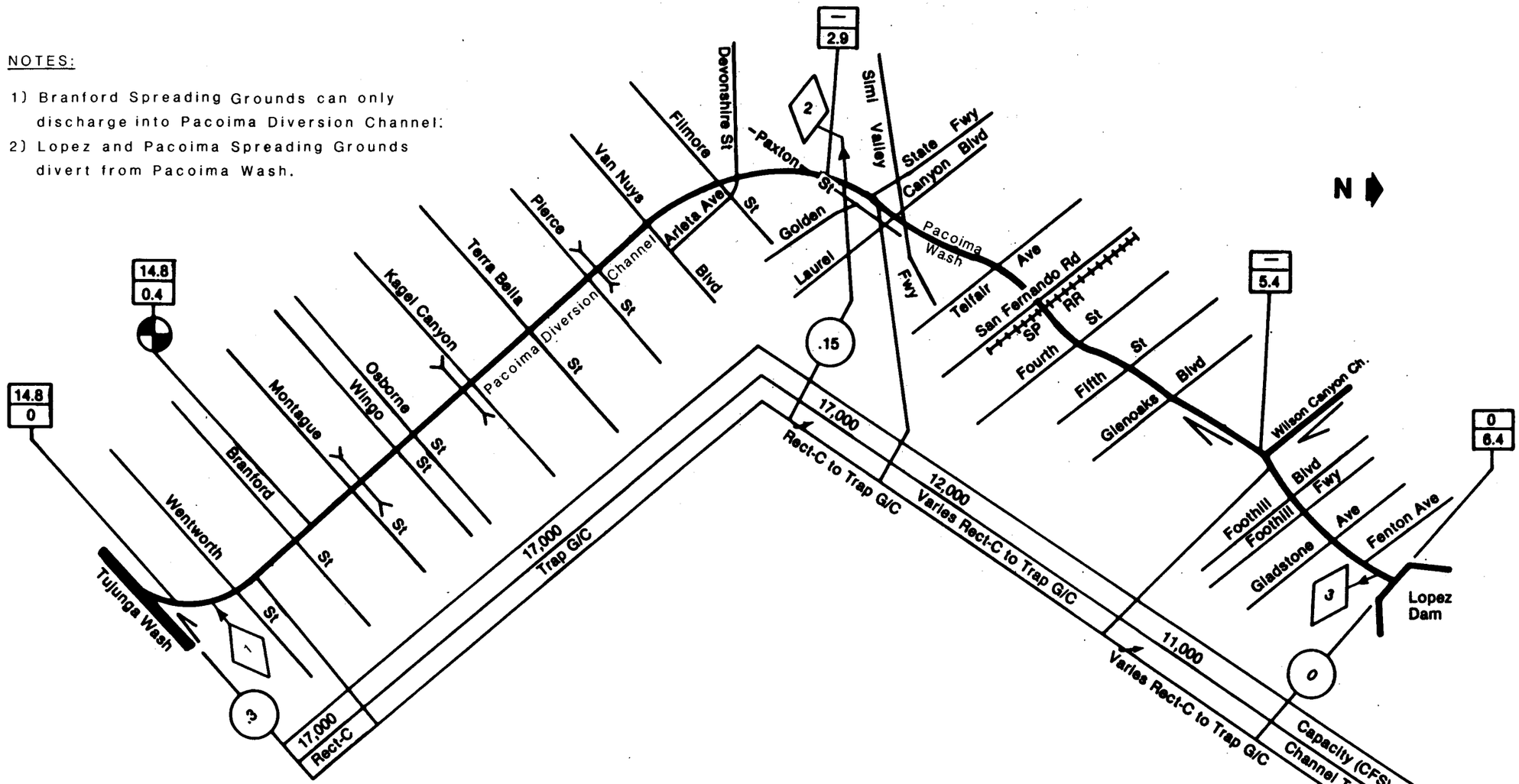
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

HYDROMETEOROLOGICAL STATIONS AND RELATED LACDPW WATER SUPPLY FACILITIES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

NOTES:

1) Branford Spreading Grounds can only discharge into Pacoima Diversion Channel.
2) Lopez and Pacoima Spreading Grounds divert from Pacoima Wash.



	Significant Features	Miles
◕	Pacoima Diversion Channel Near Branford (LACDPW)	0.4
1	Branford Spreading Grounds	0.4
2	Pacoima Spreading Grounds	2.9
3	Lopez Spreading Grounds	6.3

Legend

- Dam
- Recharge Basin
- Stream Gage
- Drainage Area
- Miles From Stream Mouth
- Travel Time (Hours)
- Foot Bridge
- C — Concrete
- G — Grouted Stone
- G/C — Side Slope / Bottom
- L — Levee

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

DOWNSTREAM CHANNEL MAP

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

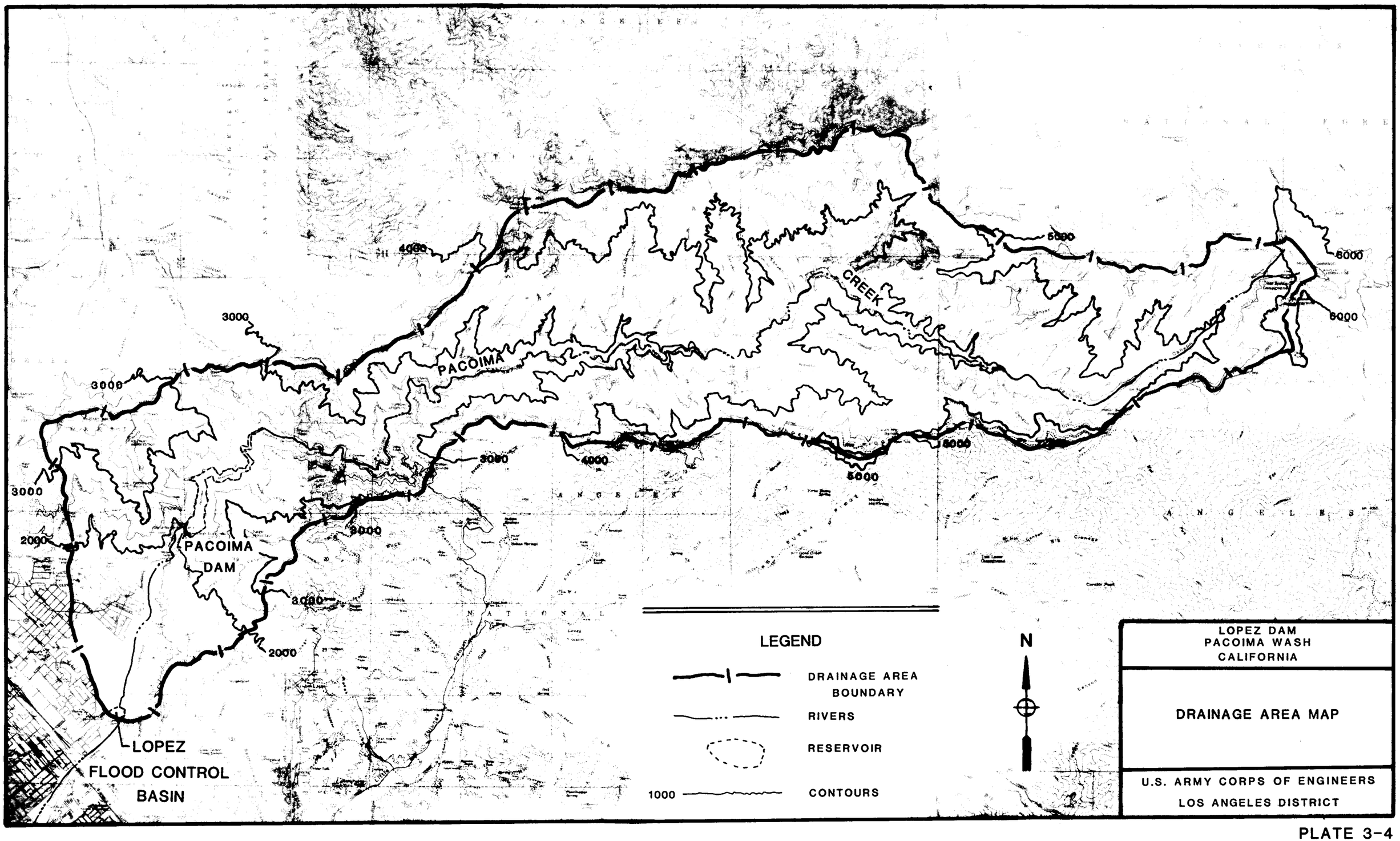
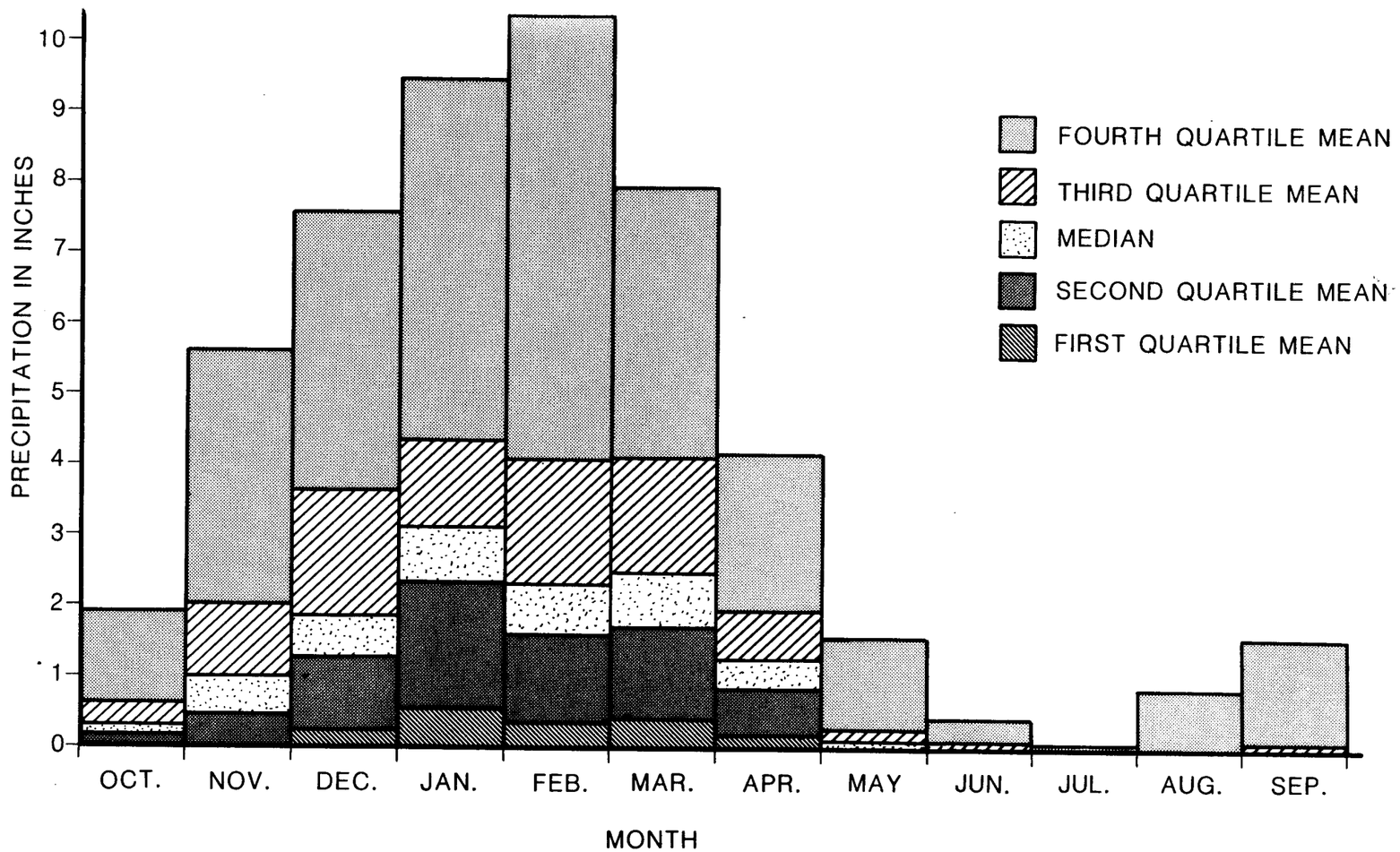

PACOIMA
CREEK
PACOIMA
DAM
LOPEZ
FLOOD CONTROL
BASIN
3000
4000
5000
6000
2000
LEGEND
DRAINAGE AREA
BOUNDARY
RIVERS
RESERVOIR
1000
CONTOURS
N
LOPEZ DAM
PACOIMA WASH
CALIFORNIA
DRAINAGE AREA MAP
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 3-4



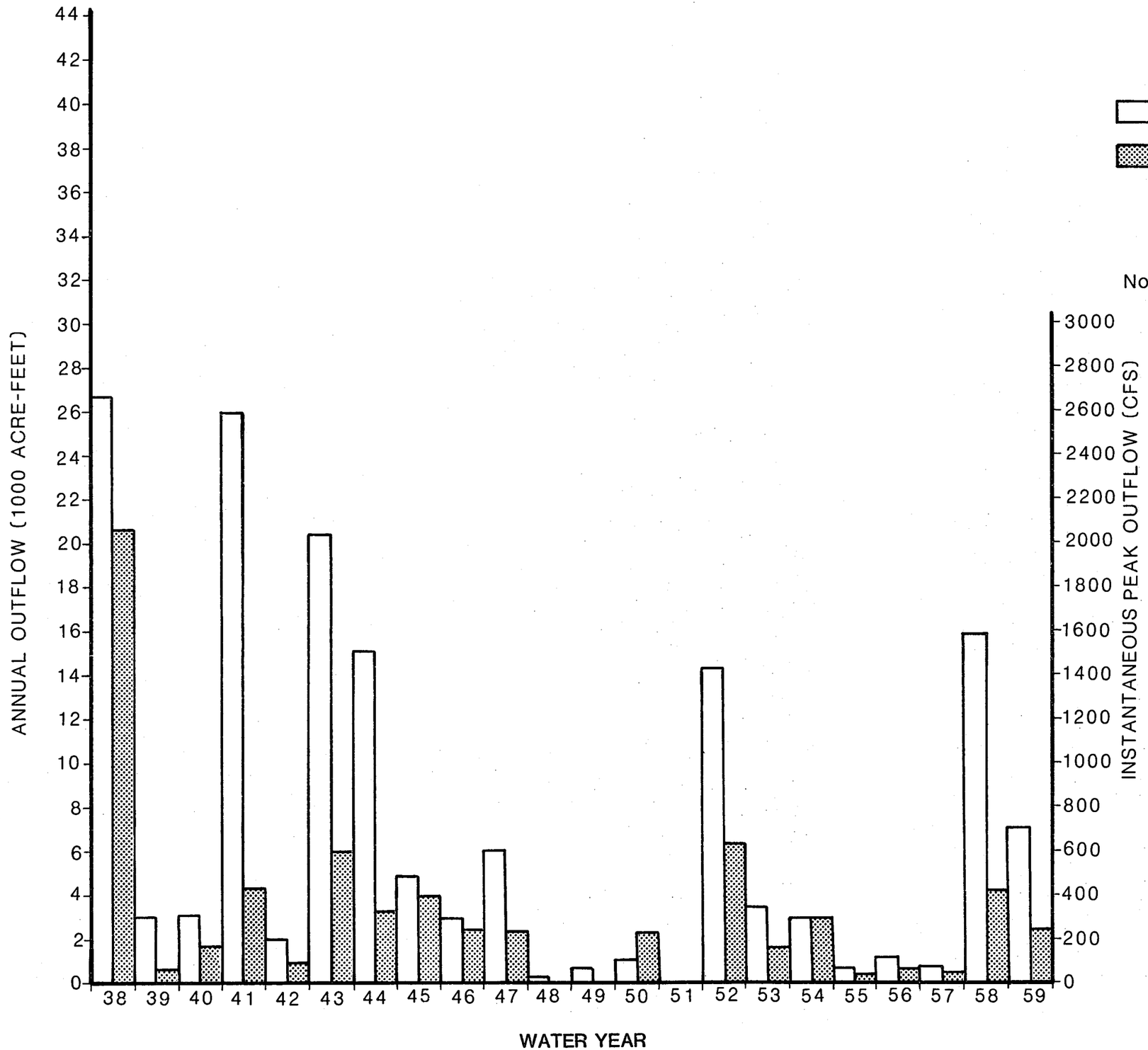
See Table 4-2 for the information used to develop this Plate

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

STATISTICAL PRECIPITATION PARAMETERS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 4-1



LEGEND

ANNUAL OUTFLOW

PEAK OUTFLOW

Note: Outflow data provided by Los Angeles Department of Public Works (LACDPW) for Pacoima Creek Flume below Pacoima Dam. LACDPW Station No. F118B-R.

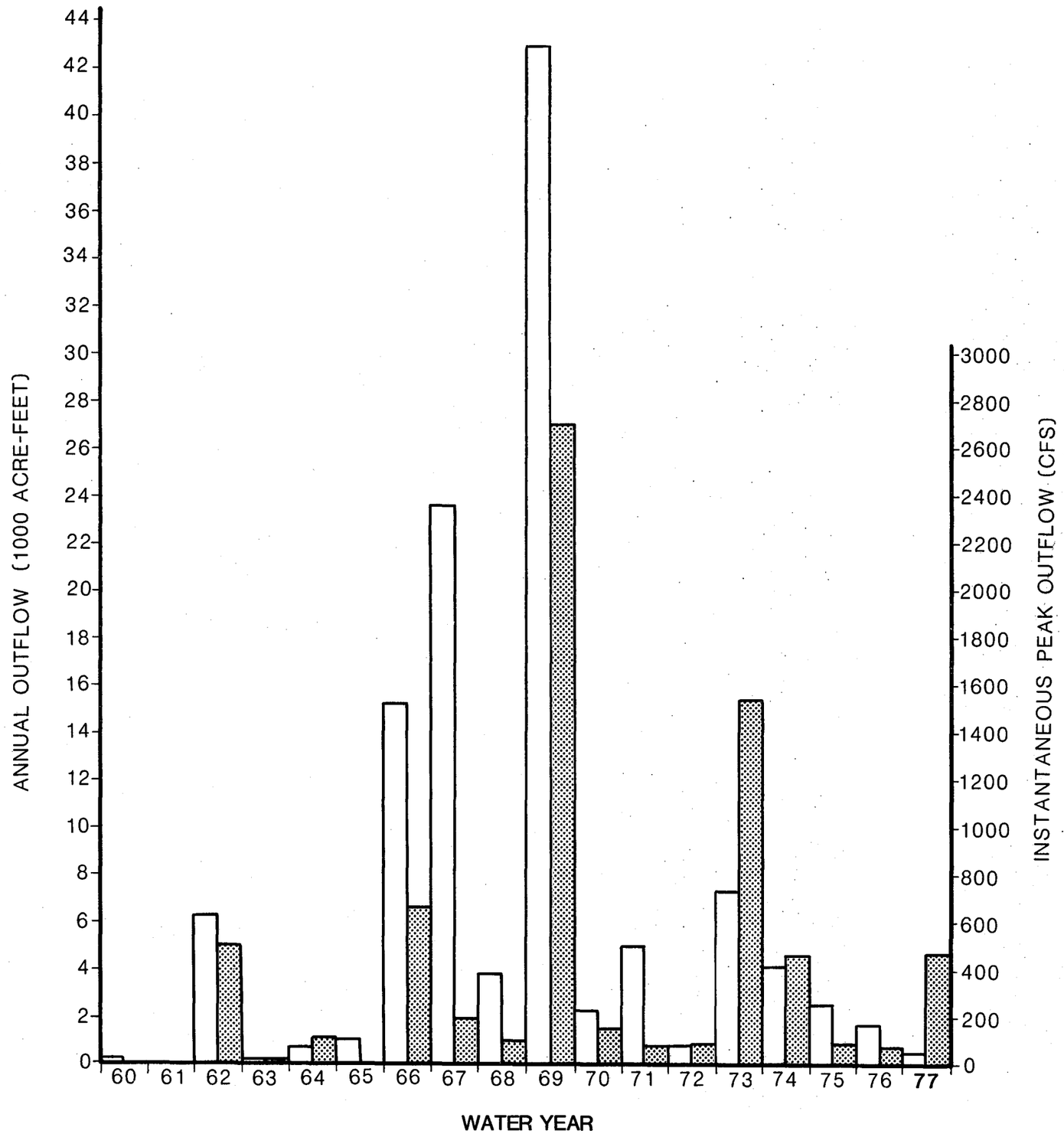
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA DAM OUTFLOW

(1938-1959)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 4-2



LEGEND

ANNUAL OUTFLOW

PEAK OUTFLOW

Note: Outflow data provided by Los Angeles County Department of Public Works (LACDPW) for Pacoima Creek Flume below Pacoima Dam. LACDPW Station No. F118B-R.

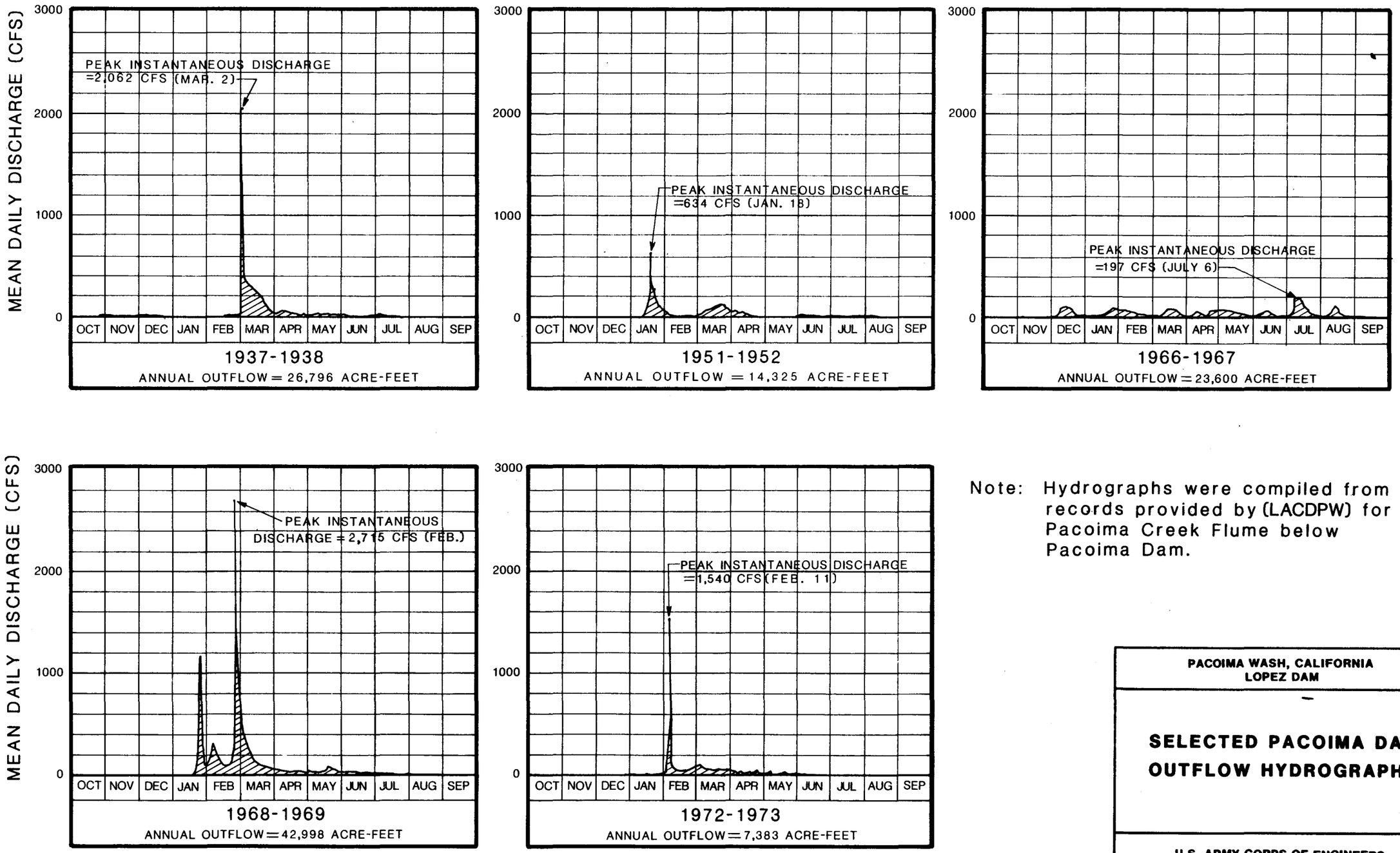
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA DAM OUTFLOW

(1960-1977)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 4-3



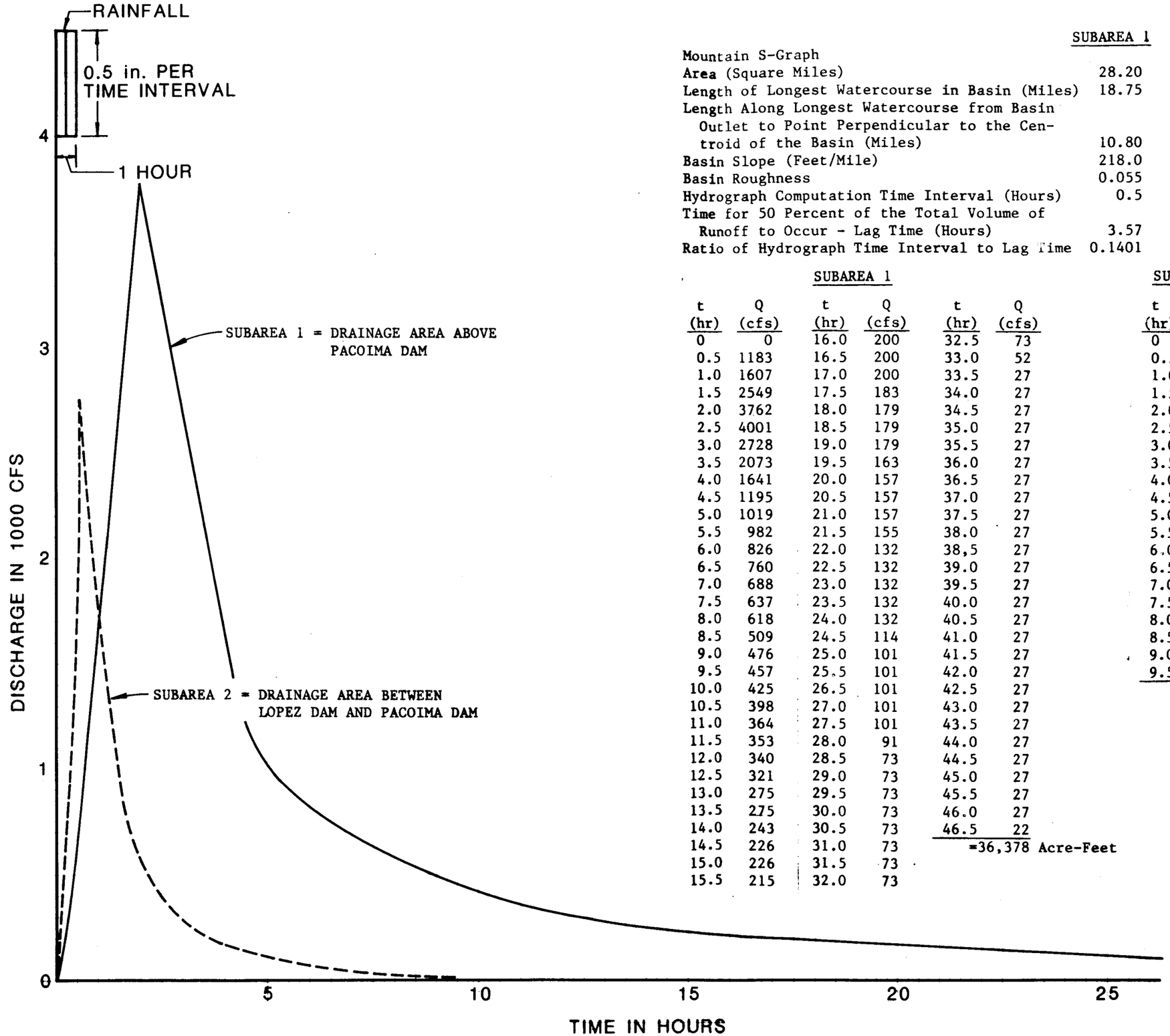
Note: Hydrographs were compiled from records provided by (LACDPW) for Pacoima Creek Flume below Pacoima Dam.

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

SELECTED PACOIMA DAM OUTFLOW HYDROGRAPHS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 4-4



	SUBAREA 1	SUBAREA 2
Mountain S-Graph		
Area (Square Miles)	28.20	5.80
Length of Longest Watercourse in Basin (Miles)	18.75	4.06
Length Along Longest Watercourse from Basin Outlet to Point Perpendicular to the Centroid of the Basin (Miles)	10.80	1.91
Basin Slope (Feet/Mile)	218.0	578.0
Basin Roughness	0.055	0.045
Hydrograph Computation Time Interval (Hours)	0.5	0.5
Time for 50 Percent of the Total Volume of Runoff to Occur - Lag Time (Hours)	3.57	0.70
Ratio of Hydrograph Time Interval to Lag Time	0.1401	0.7143

SUBAREA 1

t (hr)	Q (cfs)	t (hr)	Q (cfs)	t (hr)	Q (cfs)
0	0	16.0	200	32.5	73
0.5	1183	16.5	200	33.0	52
1.0	1607	17.0	200	33.5	27
1.5	2549	17.5	183	34.0	27
2.0	3762	18.0	179	34.5	27
2.5	4001	18.5	179	35.0	27
3.0	2728	19.0	179	35.5	27
3.5	2073	19.5	163	36.0	27
4.0	1641	20.0	157	36.5	27
4.5	1195	20.5	157	37.0	27
5.0	1019	21.0	157	37.5	27
5.5	982	21.5	155	38.0	27
6.0	826	22.0	132	38,5	27
6.5	760	22.5	132	39.0	27
7.0	688	23.0	132	39.5	27
7.5	637	23.5	132	40.0	27
8.0	618	24.0	132	40.5	27
8.5	509	24.5	114	41.0	27
9.0	476	25.0	101	41.5	27
9.5	457	25.5	101	42.0	27
10.0	425	26.5	101	42.5	27
10.5	398	27.0	101	43.0	27
11.0	364	27.5	101	43.5	27
11.5	353	28.0	91	44.0	27
12.0	340	28.5	73	44.5	27
12.5	321	29.0	73	45.0	27
13.0	275	29.5	73	45.5	27
13.5	275	30.0	73	46.0	27
14.0	243	30.5	73	46.5	22
14.5	226	31.0	73		
15.0	226	31.5	73		
15.5	215	32.0	73		

=36,378 Acre-Feet

SUBAREA 2

t (hr)	Q (cfs)
0	0
0.5	2752
1.0	1757
1.5	798
2.0	508
2.5	360
3.0	256
3.5	203
4.0	176
4.5	150
5.0	123
5.5	104
6.0	77
6.5	72
7.0	28
7.5	28
8.0	28
8.5	28
9.0	28
9.5	7

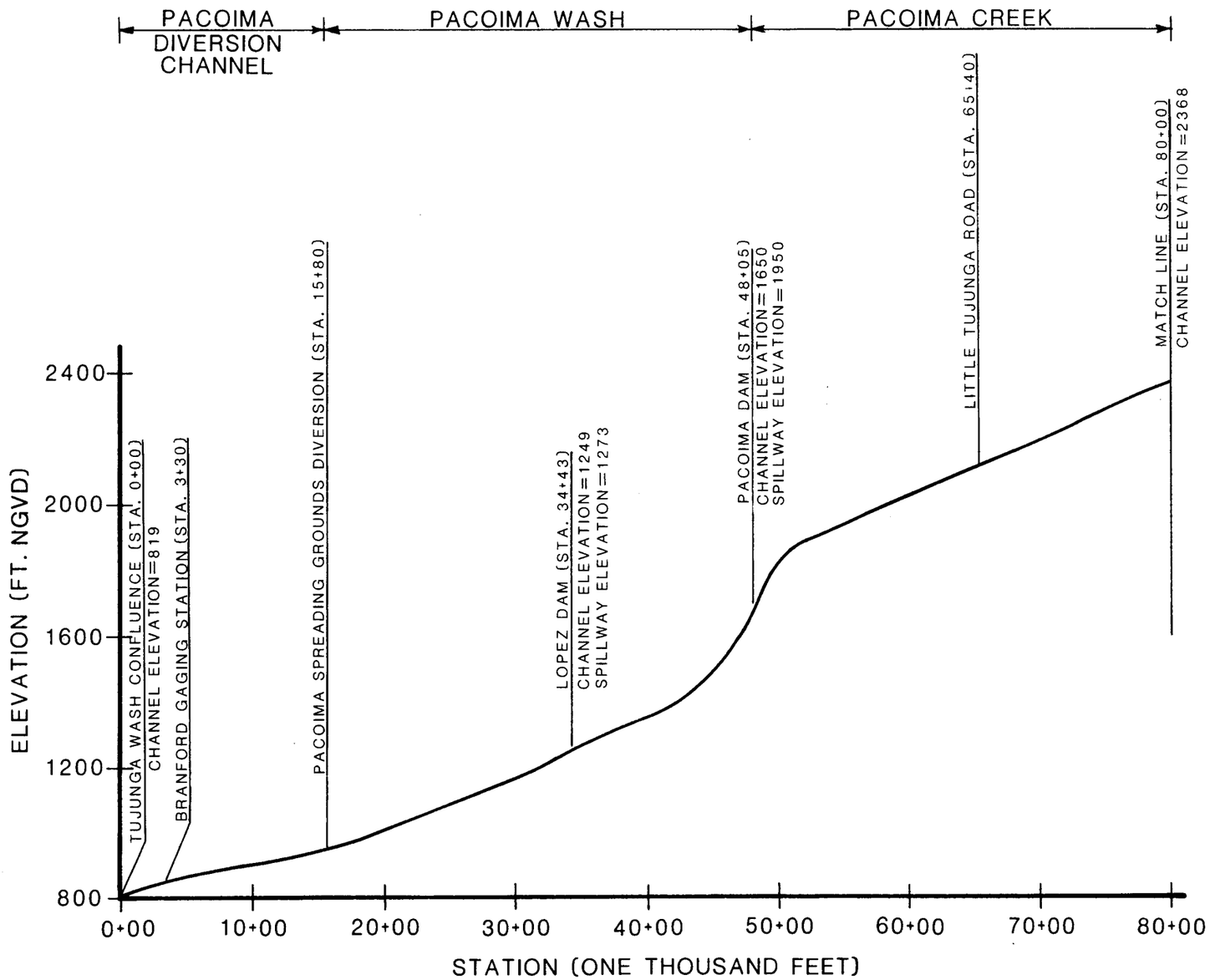
=7,482 Acre-Feet

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

BASIN UNIT HYDROGRAPH

SUBAREA 1 = DRAINAGE AREA ABOVE PACOIMA DAM
SUBAREA 2 = DRAINAGE AREA BETWEEN LOPEZ DAM AND PACOIMA DAM

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



NOTE: Channel elevations taken from U.S.G.S. Quadrangle maps (Van Nuys, San Fernando, Sunland, Agua Dulce, Condor Peak, and Acton.)

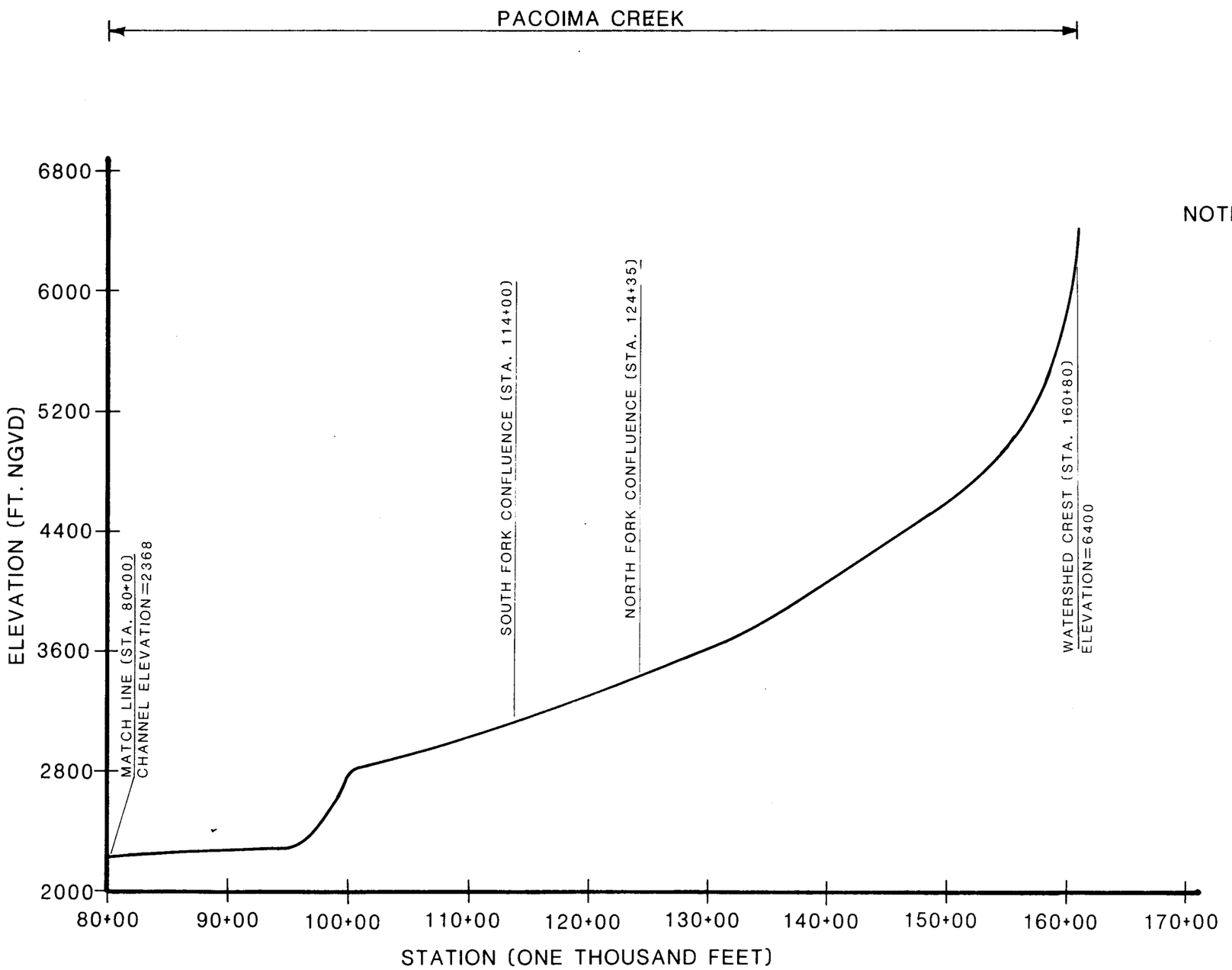
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA CHANNEL PROFILE

(STA. 0+00 - STA. 80+00)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 4-6



NOTE: Channel elevations taken from U.S.G.S. Quadrangle maps (Van Nuys, San Fernando, Sunland, Agua Dulce, Condor Park, and Acton.)

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA CHANNEL PROFILE

(STA. 80+00 - STA. 160+80)

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

DISCHARGE IN CUBIC FEET PER SECOND										
Gage Height (feet)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
.0	0	0.10	0.20	0.30	0.40	0.50	0.60	0.70	0.80	0.90
.1	1.00	1.35	1.70	2.05	2.40	2.75	3.10	3.45	3.80	4.15
.2	4.50	5.17	5.84	6.51	7.18	7.85	8.52	9.19	9.86	10.53
.3	11.2	12.3	13.4	14.4	15.5	16.6	17.7	18.8	19.8	20.9
.4	22.0	24.0	26.0	28.0	30.0	32.0	34.0	36.0	38.0	40.0
.5	42.0	44.8	47.6	50.4	53.2	56.0	58.8	61.6	64.4	67.2
.6	70.0	73.6	77.2	80.8	84.4	88.0	91.6	95.2	98.8	102.4
.7	106.0	110.2	114.4	118.6	122.8	127.0	131.2	135.4	139.6	143.8
.8	148.0	152.7	157.4	162.1	166.8	171.5	176.2	180.9	185.6	190.3
.9	195.0	200.1	205.2	210.3	215.4	220.5	225.6	230.7	235.8	240.9
1.0	246.0	251.5	257.0	262.5	268.0	273.5	279.0	284.5	290.0	295.5
1.1	301.0	306.7	312.4	318.1	323.8	329.5	335.2	340.9	346.6	352.3
1.2	358.0	364.0	370.0	376.0	382.0	388.0	394.0	400.0	406.0	412.0
1.3	418.0	424.4	430.8	437.2	443.6	450.0	456.4	462.8	469.2	475.6
1.4	482.0	488.4	494.8	501.2	507.6	514.0	520.4	526.8	533.2	539.6
1.5	546.0	552.9	559.8	566.7	573.6	580.5	587.4	594.3	601.2	608.1
1.6	615.0	622.3	629.6	636.9	644.2	651.5	658.8	666.1	673.4	680.7
1.7	688.0	695.5	703.0	710.5	718.0	725.5	733.0	740.5	748.0	755.5
1.8	763.0	770.7	778.4	786.1	793.8	801.5	809.2	816.9	824.6	832.3
1.9	840.0	848.0	856.0	864.0	872.0	880.0	888.0	896.0	904.0	912.0
2.0	920.0	928.5	937.0	945.5	954.0	962.5	971.0	979.5	988.0	996.5
2.1	1005.0	1014.0	1023.0	1032.0	1041.0	1050.0	1059.0	1068.0	1077.0	1086.0
2.2	1095.0	1105.0	1114.0	1124.0	1133.0	1143.0	1152.0	1162.0	1171.0	1181.0
2.3	1190.0	1200.0	1210.0	1220.0	1230.0	1240.0	1250.0	1260.0	1270.0	1280.0
2.4	1290.0	1300.0	1310.0	1320.0	1330.0	1340.0	1350.0	1360.0	1370.0	1380.0
2.5	1390.0	1400.0	1410.0	1420.0	1430.0	1440.0	1450.0	1460.0	1470.0	1480.0
2.6	1490.0	1500.0	1510.0	1520.0	1530.0	1540.0	1550.0	1560.0	1570.0	1580.0
2.7	1590.0	1601.0	1611.0	1622.0	1632.0	1643.0	1653.0	1664.0	1674.0	1685.0
2.8	1695.0	1706.0	1717.0	1728.0	1739.0	1750.0	1761.0	1772.0	1783.0	1794.0
2.9	1805.0	1817.0	1828.0	1840.0	1851.0	1863.0	1874.0	1886.0	1897.0	1909.0
3.0	1920.0	1932.0	1943.0	1955.0	1966.0	1978.0	1989.0	2001.0	2012.0	2024.0
3.1	2035.0	2047.0	2058.0	2070.0	2081.0	2093.0	2104.0	2116.0	2127.0	2139.0
3.2	2150.0	2162.0	2174.0	2186.0	2198.0	2210.0	2222.0	2234.0	2246.0	2258.0
3.3	2270.0	2283.0	2295.0	2308.0	2320.0	2333.0	2345.0	2358.0	2370.0	2383.0
3.4	2395.0	2408.0	2420.0	2433.0	2445.0	2458.0	2470.0	2483.0	2495.0	2508.0
3.5	2520.0	2533.0	2546.0	2559.0	2572.0	2585.0	2598.0	2611.0	2624.0	2637.0
3.6	2650.0	2663.0	2676.0	2689.0	2702.0	2715.0	2728.0	2741.0	2754.0	2767.0
3.7	2780.0	2793.0	2806.0	2819.0	2832.0	2845.0	2858.0	2871.0	2884.0	2897.0
3.8	2910.0	2923.0	2936.0	2949.0	2962.0	2975.0	2988.0	3001.0	3014.0	3027.0
3.9	3040.0	3054.0	3067.0	3081.0	3094.0	3108.0	3122.0	3135.0	3149.0	3162.0
4.0	3176.0	3190.0	3203.0	3217.0	3230.0	3244.0	3257.0	3271.0	3284.0	3298.0
4.1	3311.0	3325.0	3338.0	3352.0	3365.0	3379.0	3392.0	3406.0	3419.0	3433.0
4.2	3446.0	3460.0	3474.0	3488.0	3502.0	3516.0	3530.0	3544.0	3558.0	3572.0
4.3	3586.0	3600.0	3614.0	3628.0	3642.0	3656.0	3670.0	3684.0	3698.0	3712.0
4.4	3726.0	3741.0	3756.0	3771.0	3786.0	3801.0	3816.0	3831.0	3846.0	3861.0
4.5	3876.0	3891.0	3906.0	3921.0	3936.0	3951.0	3966.0	3981.0	3996.0	4011.0
4.6	4026.0	4042.0	4058.0	4074.0	4090.0	4106.0	4122.0	4138.0	4154.0	4170.0
4.7	4186.0	4202.0	4218.0	4234.0	4250.0	4266.0	4282.0	4298.0	4314.0	4330.0
4.8	4346.0	4364.0	4381.0	4399.0	4417.0	4434.0	4452.0	4470.0	4488.0	4505.0
4.9	4523.0	4541.0	4558.0	4576.0	4594.0	4611.0	4629.0	4647.0	4665.0	4682.0
5.0	4700.0									

Note: Rating Table provided by LACDPW.
Pacoima Diversion at Branford Street,
F305-R, Rating Curve 54I, March, 1954.

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA DIVERSION CHANNEL AT BRANFORD STREET

RATING TABLE

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

CHAIN OF COMMAND FOR RESERVOIR OPERATIONS DECISIONS

Corps of Engineers
Los Angeles District

Title	Office Phone Number:
District Engineer	(213) 894-5300 FTS 798-5300

Water Control Decisions

Title	Phone:
Chief, Engineering Division	(213) 894-5470 FTS 798-5470
Chief, Hydrology & Hydraulics Branch	(213) 894-5520 FTS 798-5520
Chief, Hydrologic Engineering Section	(213) 894-4753 FTS 798-4753
Chief, Reservoir Regulation Unit	(213) 894-4756 FTS 798-4756

Gate Operations

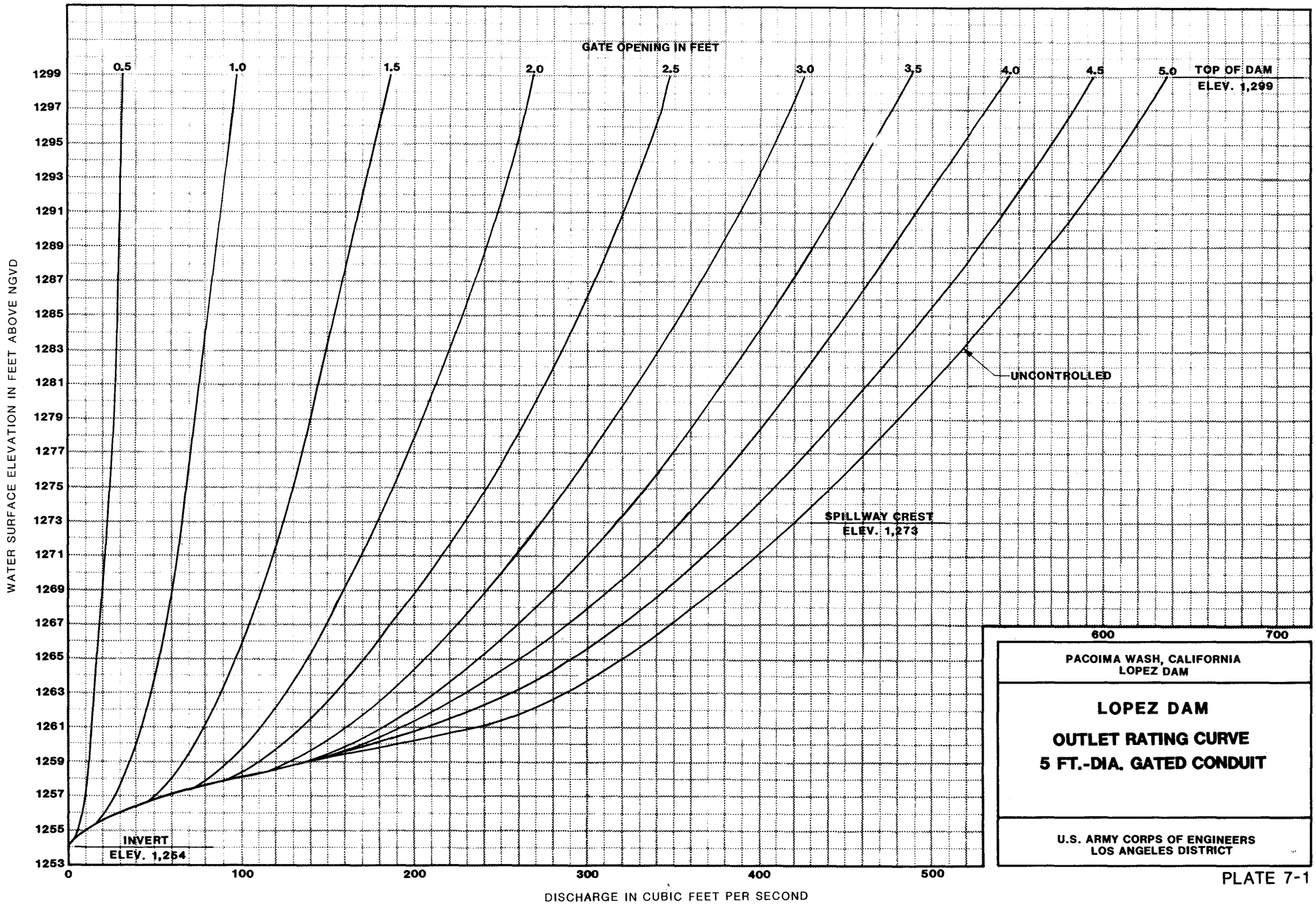
Title	Phone:
Chief, Construction-Operations Division	(213) 894-5600 FTS 798-5600
Chief, Operations Branch	(213) 894-5620 FTS 798-5620
Chief, Operations and Maintenance Section	(213) 283-2757
Dam Tender Foreman	(213) 283-2757
Lopez Dam Tender at Hansen Dam	(818) 767-3810

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

CORPS OF ENGINEERS
ORGANIZATION CHART AND
IMPORTANT PHONE NUMBERS
FOR RESERVIOR OPERATIONS

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 5-2



PACOIMA WASH, CALIFORNIA
LOPEZ DAM

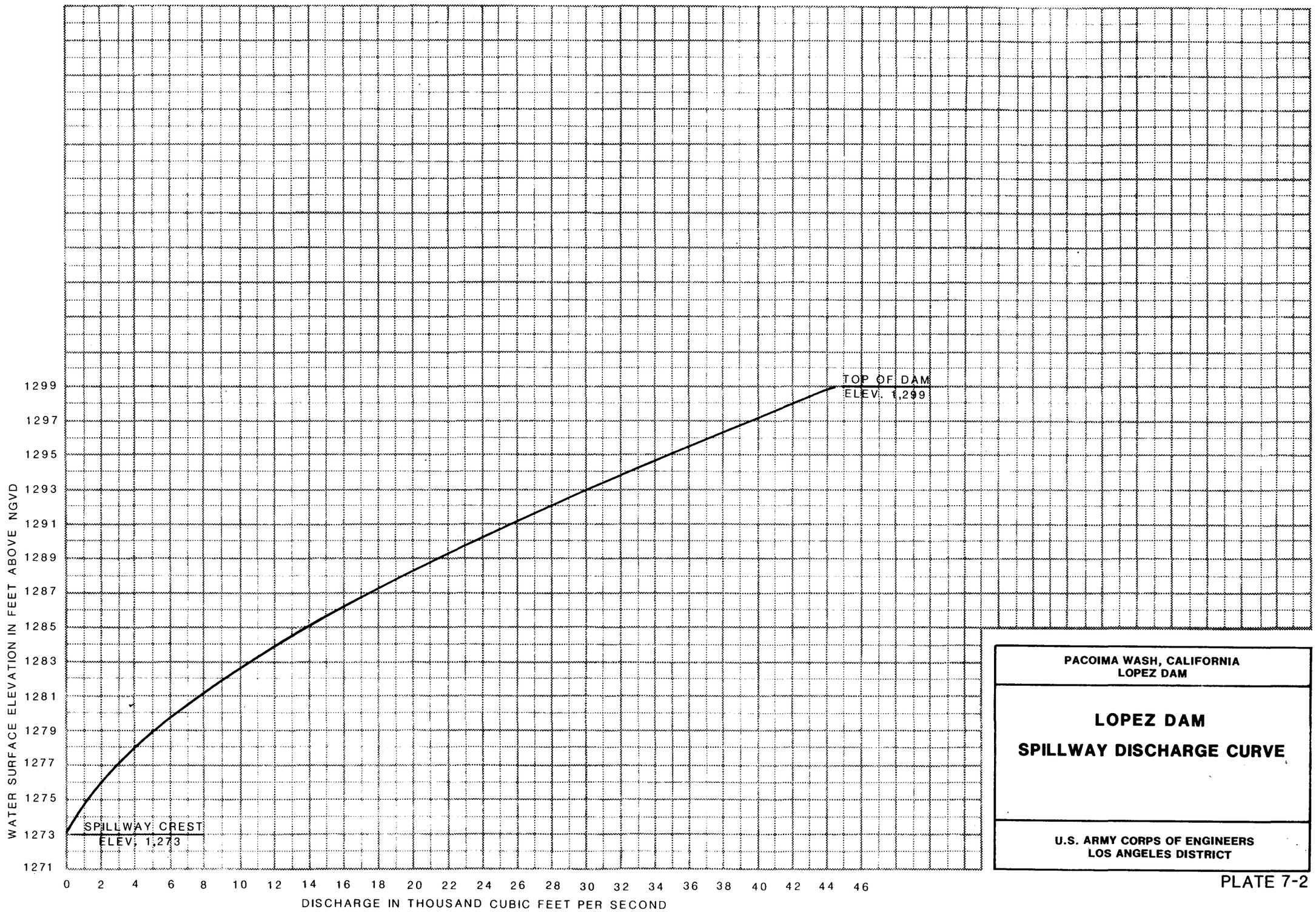
LOPEZ DAM

OUTLET RATING CURVE

5 FT.-DIA. GATED CONDUIT

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 7-1



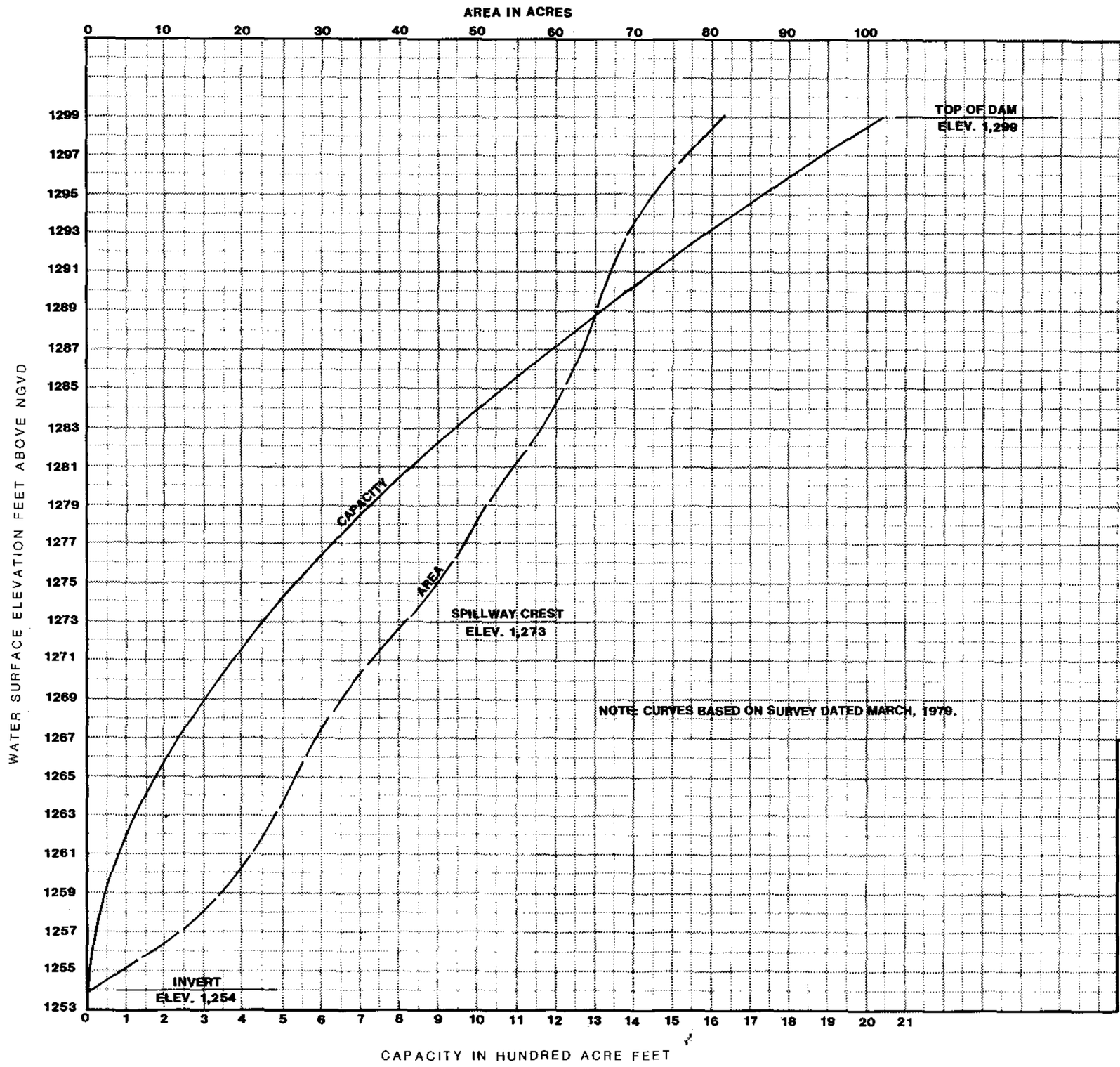
PACOIMA WASH, CALIFORNIA
LOPEZ DAM

LOPEZ DAM

SPILLWAY DISCHARGE CURVE

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 7-2

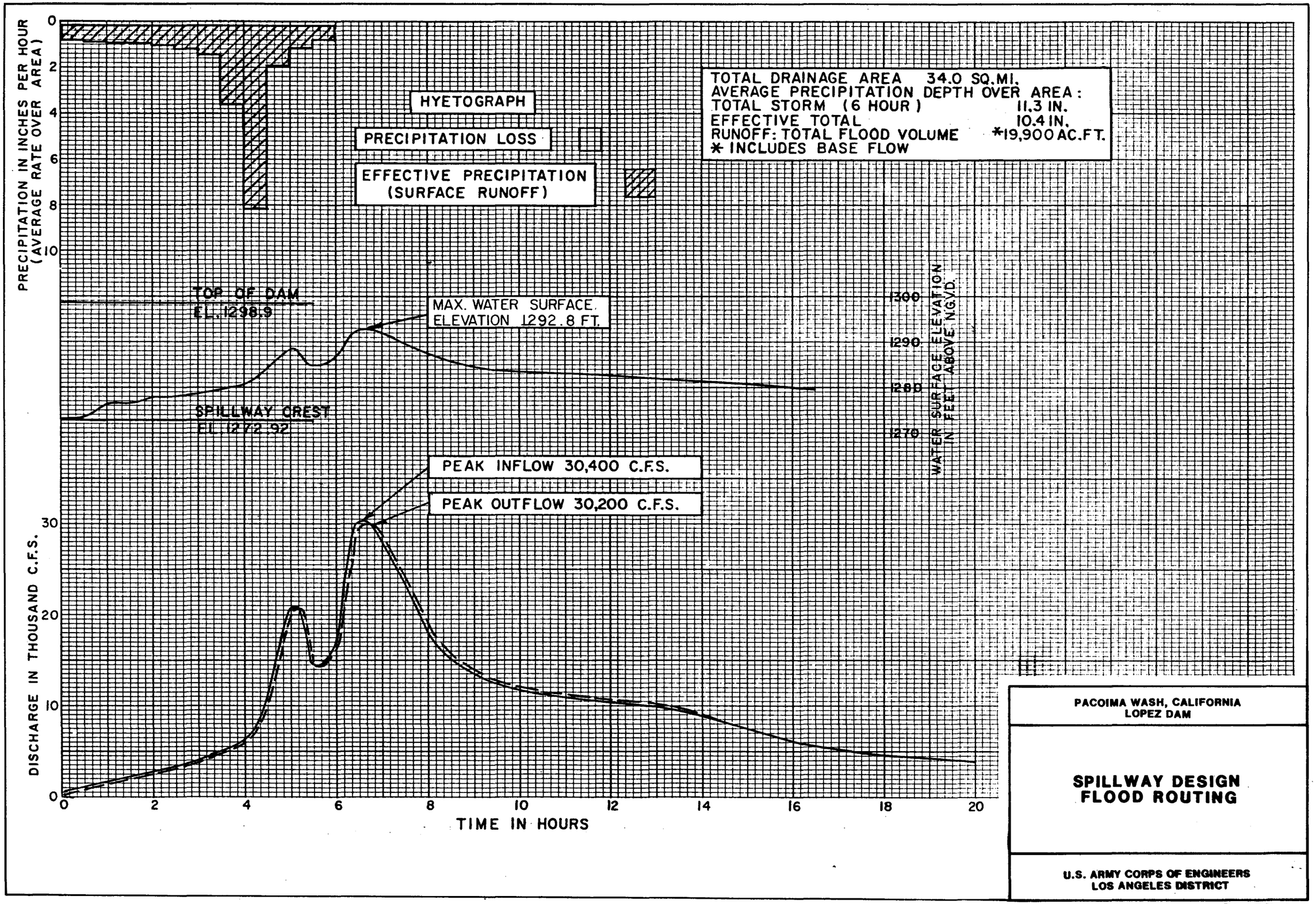


PACOIMA WASH, CALIFORNIA
LOPEZ DAM

LOPEZ DAM
AREA - CAPACITY CURVES

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

PLATE 7-3

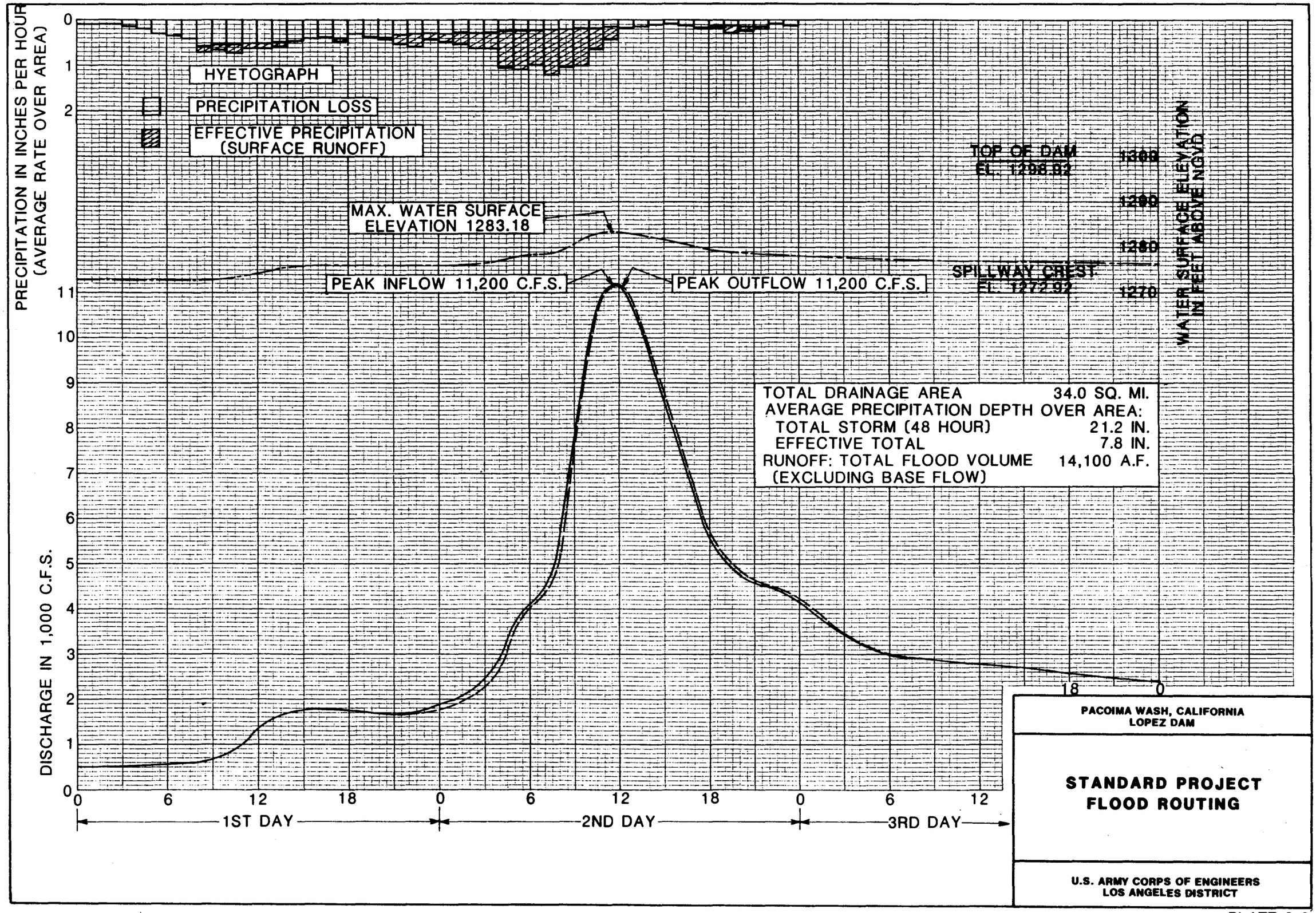


PACOIMA WASH, CALIFORNIA
LOPEZ DAM

SPILLWAY DESIGN FLOOD ROUTING

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

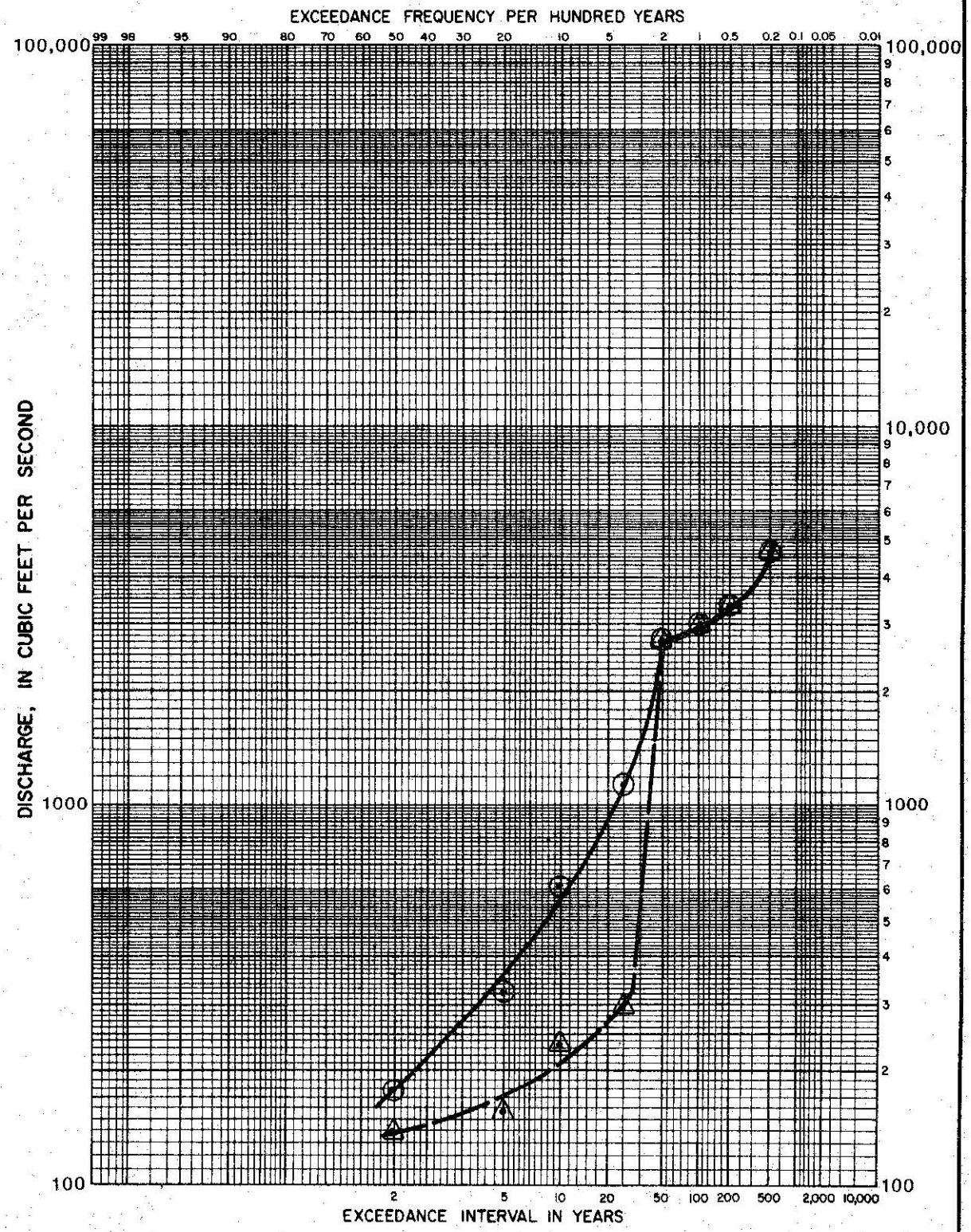
PLATE 8-1



PACOIMA WASH, CALIFORNIA
LOPEZ DAM

STANDARD PROJECT FLOOD ROUTING

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



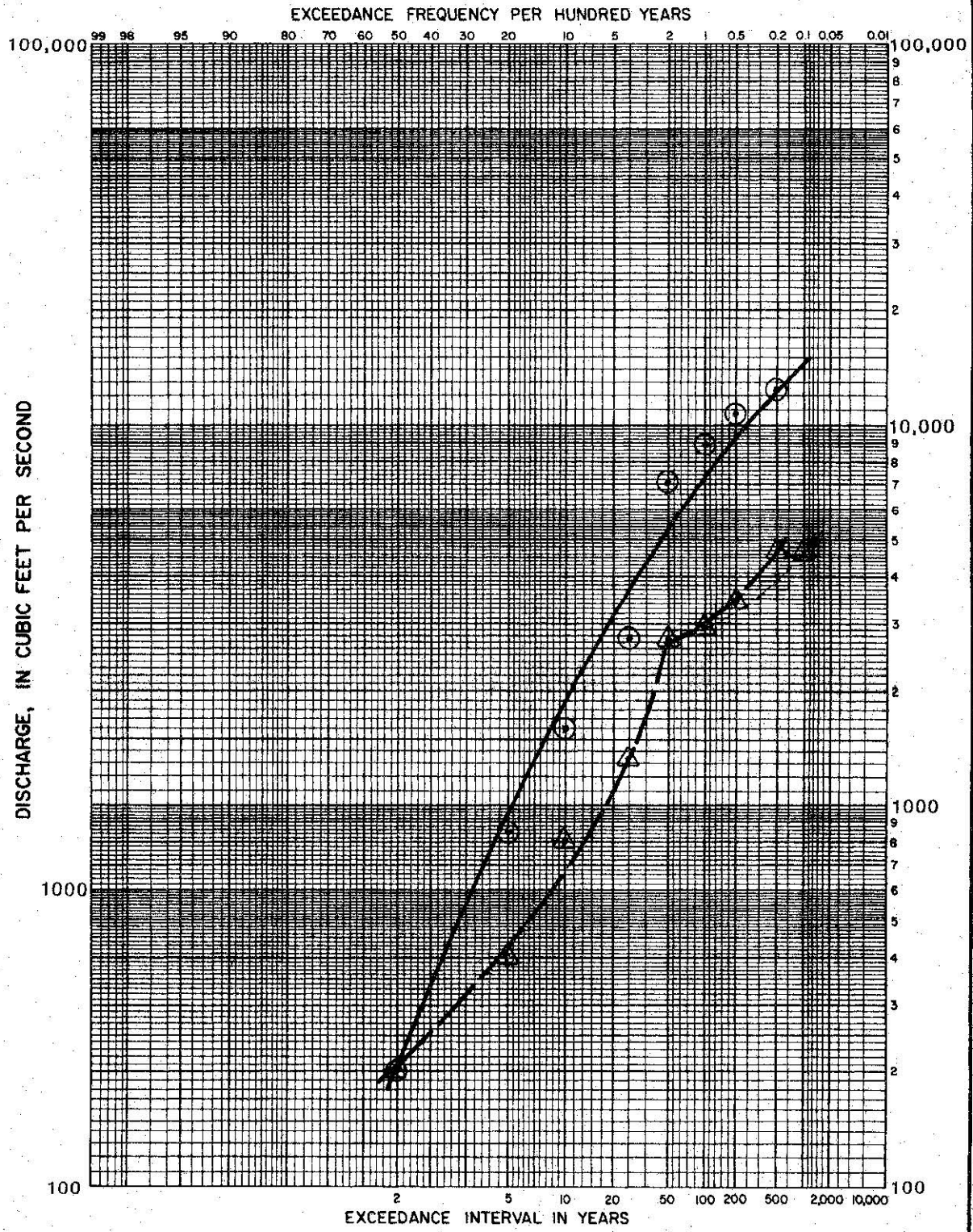
INFLOW

OUTFLOW

Data values obtained from the December, 1984 Los Angeles County Drainage Area review study performed by the Hydraulic Engineering Section, Los Angeles District, U.S. Army Corps of Engineers.

DISCHARGE FREQUENCY CURVES FOR LOPEZ DAM

U S ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
TO ACCOMPANY REPORT DATED:



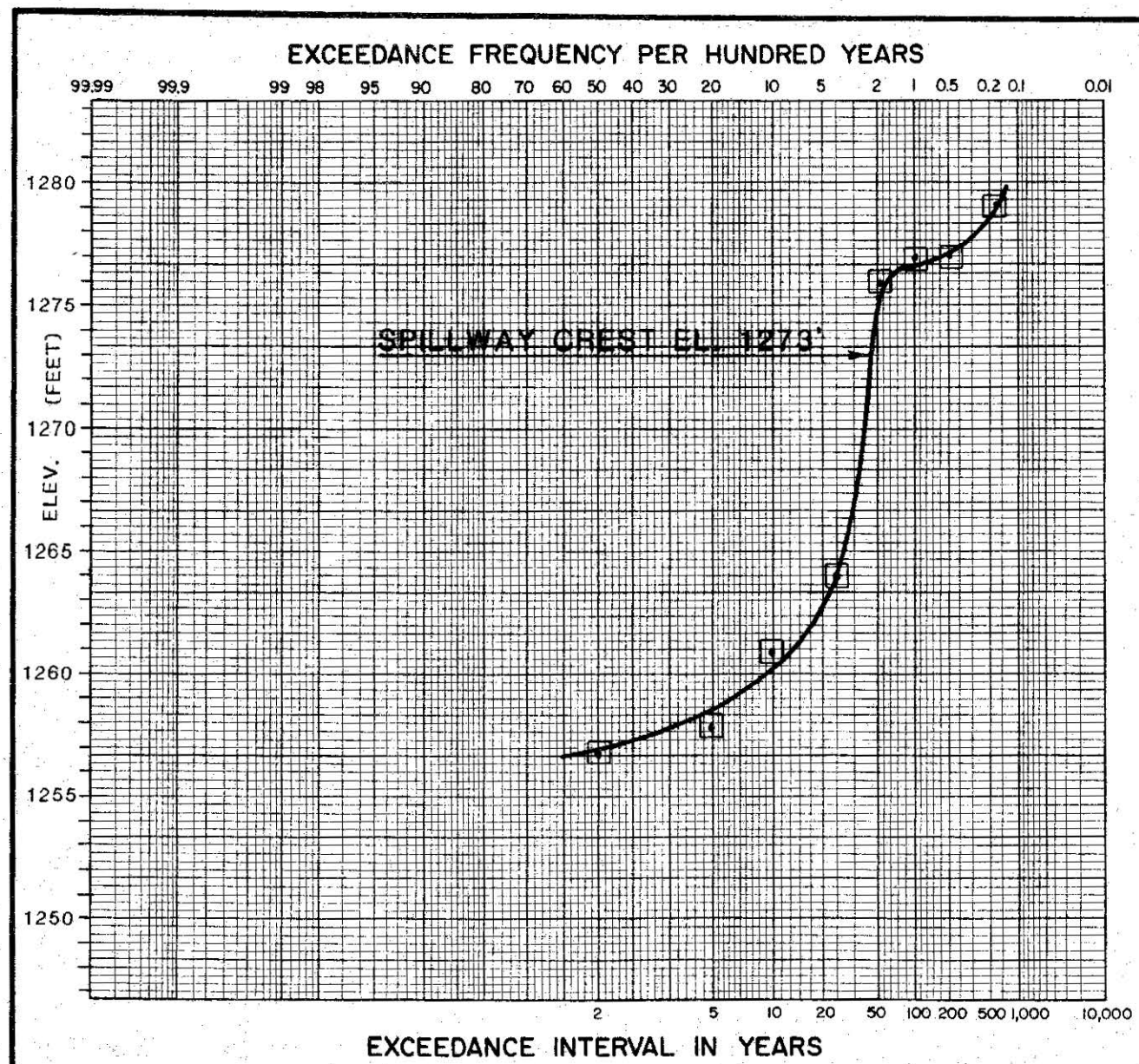
INFLOW

OUTFLOW

Data values obtained from the December, 1984 Los Angeles County Drainage Area review study performed by the Hydraulic Engineering Section, Los Angeles District, U.S. Army Corps of Engineers.

DISCHARGE FREQUENCY CURVE FOR PACOIMA DAM

U S ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
TO ACCOMPANY REPORT DATED:

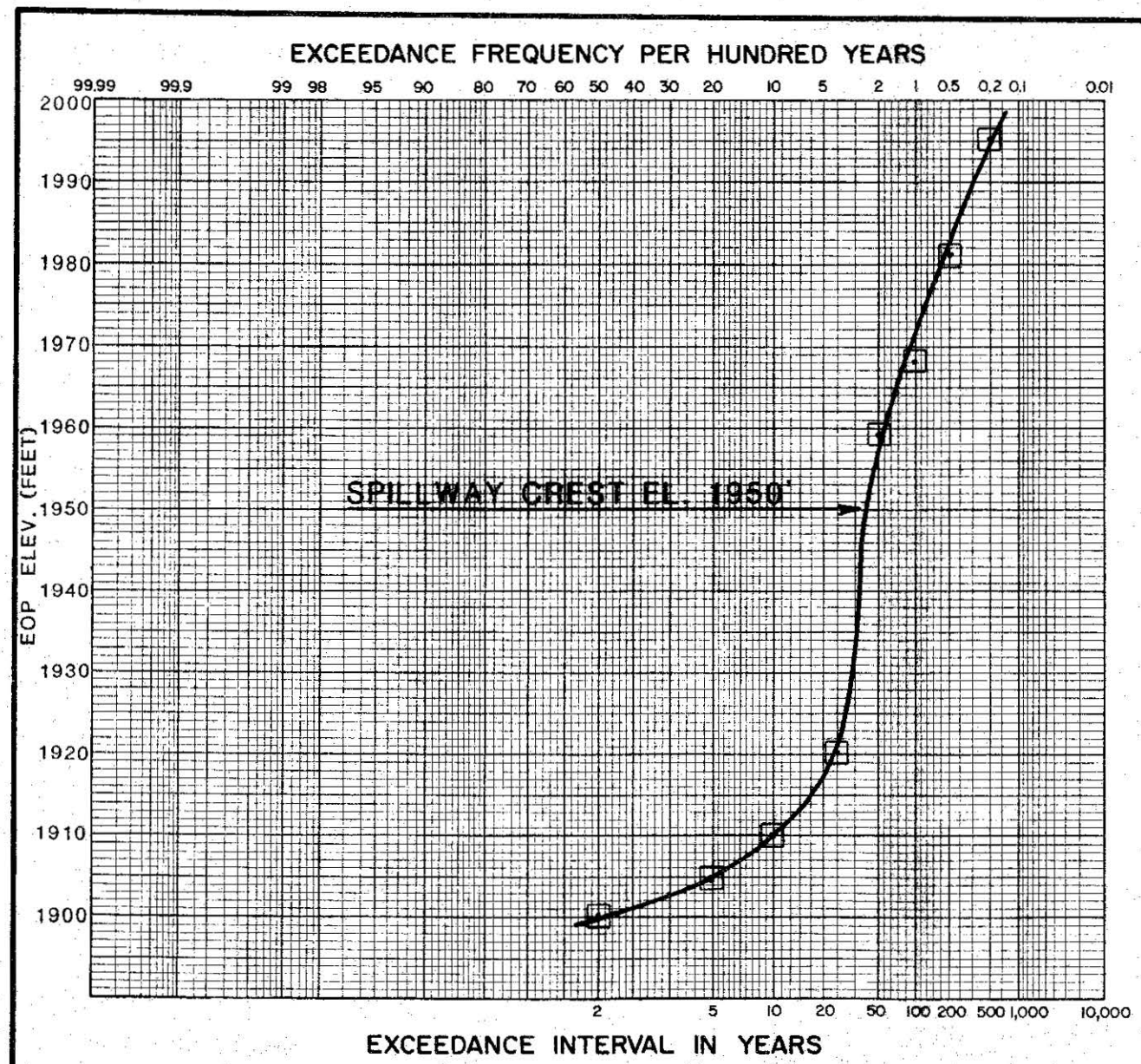


Data values obtained from the December, 1984 Los Angeles County Drainage Area review study performed by the Hydraulic Engineering Section, Los Angeles District, U.S. Army Corps of Engineers.

FILLING FREQUENCY

LOPEZ DAM

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
TO ACCOMPANY REPORT DATED:



⊡ Data values obtained from the December, 1984 Los Angeles County Drainage Area review study performed by the Hydraulic Engineering Section, Los Angeles District, U.S. Army Corps of Engineers.

FILLING FREQUENCY
PACOIMA DAM

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
TO ACCOMPANY REPORT DATED:

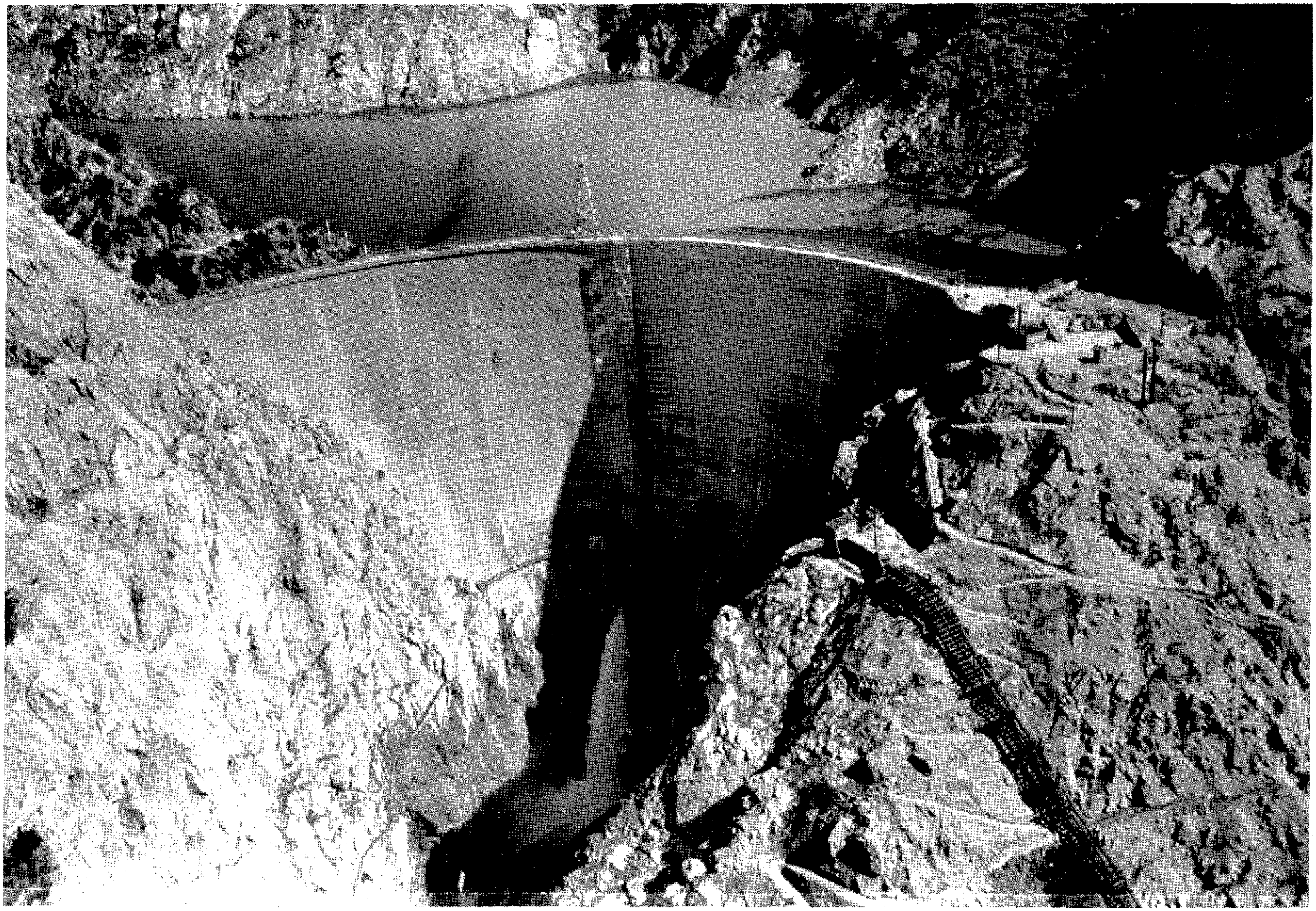
WATER CONTROL MANUAL
LOPEZ DAM

EXHIBIT A
PERTINENT DATA
PACOIMA DAM AND RESERVOIR

EXHIBIT A

PERTINENT DATA
PACOIMA DAM AND RESERVOIR

Item	Contents	Page
1	Photograph of Pacoima Dam	A-1
2	Pertinent Data Sheet	A-2
3	Photograph of Pacoima Outlet Works	A-3
4	Pacoima Dam Cross Section	A-4
5	Emergency Telephone List	A-5
6	Pacoima Dam and Reservoir Operation Plan	A-6
7	Reservoir Elevation-Storage Table	A-8
8	Reservoir Elevation-Area Table	A-16
9	Valve No. 2 Rating Table	A-22
10	Valve No. 3 Rating Table	A-25
11	Valve No. 4 Rating Table	A-28
12	Valve No. A2 Discharge Curve	A-31
13	Spillway Discharge Curve	A-32
14	Pacoima Creek Flume Below Pacoima Dam Rating Table	A-33



PACOIMA DAM

PACOIMA DAM
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

PERTINENT DATA SHEET

GENERAL

NAME - PACOIMA DAM
LOCATION - PACOIMA CANYON 4 MILES N.E. OF SAN FERNANDO
STREAM - PACOIMA CREEK
PURPOSE - FLOOD CONTROL AND CONSERVATION
TYPE - CONCRETE, CONSTANT ANGLE ARCH GRAVITY ABUTMENTS

BOND ISSUE - 1924
DRAINAGE AREA - 28.2 SQ. MI. FROM ELEV. 1950 TO ELEV. 6503 ABOVE MEAN SEA LEVEL

CONSTRUCTION:

BEGAN - MARCH 1925
COMPLETED - FEBRUARY 1929
COST $2,466,738.28
COST PER A.F. F.C. 206.85
COST PER A.F. CONSERV. 407.09
COST BASED ON ORIGINAL CAPACITIES

CONSTRUCTED BY - BENT BROS.
DESIGNER - CONSTANT ANGLE ARCH CO.
RESIDENT ENGINEER - K.J. HARRISON
COMPUTATIONS - B.F. JAKOBSEN
K.J. HARRISON

DIMENSIONS:

CREST HT. ABOVE ORIGINAL STREAMBED 365.0 FT.
CREST HT. ABOVE FOUNDATION 372.0 FT.
CREST LENGTH 640.0 FT.
CREST WIDTH 10.4 FT.
HEIGHT OF PARAPET WALL 0.75 FT.
BASE THICKNESS 100.0 FT.

TOTAL VOLUME OF EXCAVATION 105,927 C.Y.
TOTAL VOLUME ON CONCRETE 226,140 C.Y.
CHARACTER OF FOUNDATION - GRANITE

OUTLETS:

	NO.	TYPE	SIZE	RISER OR INLET SILL ELEV.	OUTLET ELEV	MAX. DISCH. AT SPILLWAY ELEV. CFS
	FLOOD OPERATION VALUES					
(2)	2	HOLLOW JET	30"	1850.2	1700.0	350
	2A	GATE VALVE	30"		1700.0	---
(3)	3	HOLLOW JET	30"	1850.0	1750.0	319
	3A	GATE VALVE	30"		1750.0	---
(3)	4	HOLLOW JET	30"	1850.5	1800.0	281
	4A	GATE VALVE	30"		1800.0	---
	SERVICE VALVES					
	A1	GATE VALVE	18"	1669.7	1694.0	---
	A1A	GATE VALVE	8"	1669.7	1694.0	---
	A1B	GATE VALVE	8"	1669.7	1694.0	---
	A1C	GATE VALVE	18"	1669.7	1694.0	---
(4)	A2	HOLLOW JET	10"	1825.0	1703.0	33
(1)	S.G.	SLUICE GATE	5' x 5'	1739.9	1739.9	1712.0

SPILLWAY NO.	TYPE	SILL ELEV.	NO. 1 SPILLWAY ORIG. CAP. A.F.	MAX. DISCHARGE AT ASSUMED H.W.L. CFS
1	TUNNEL	1950.00	(6060.0)	10,780 (COMBINED)
2	TUNNEL	1989.95		

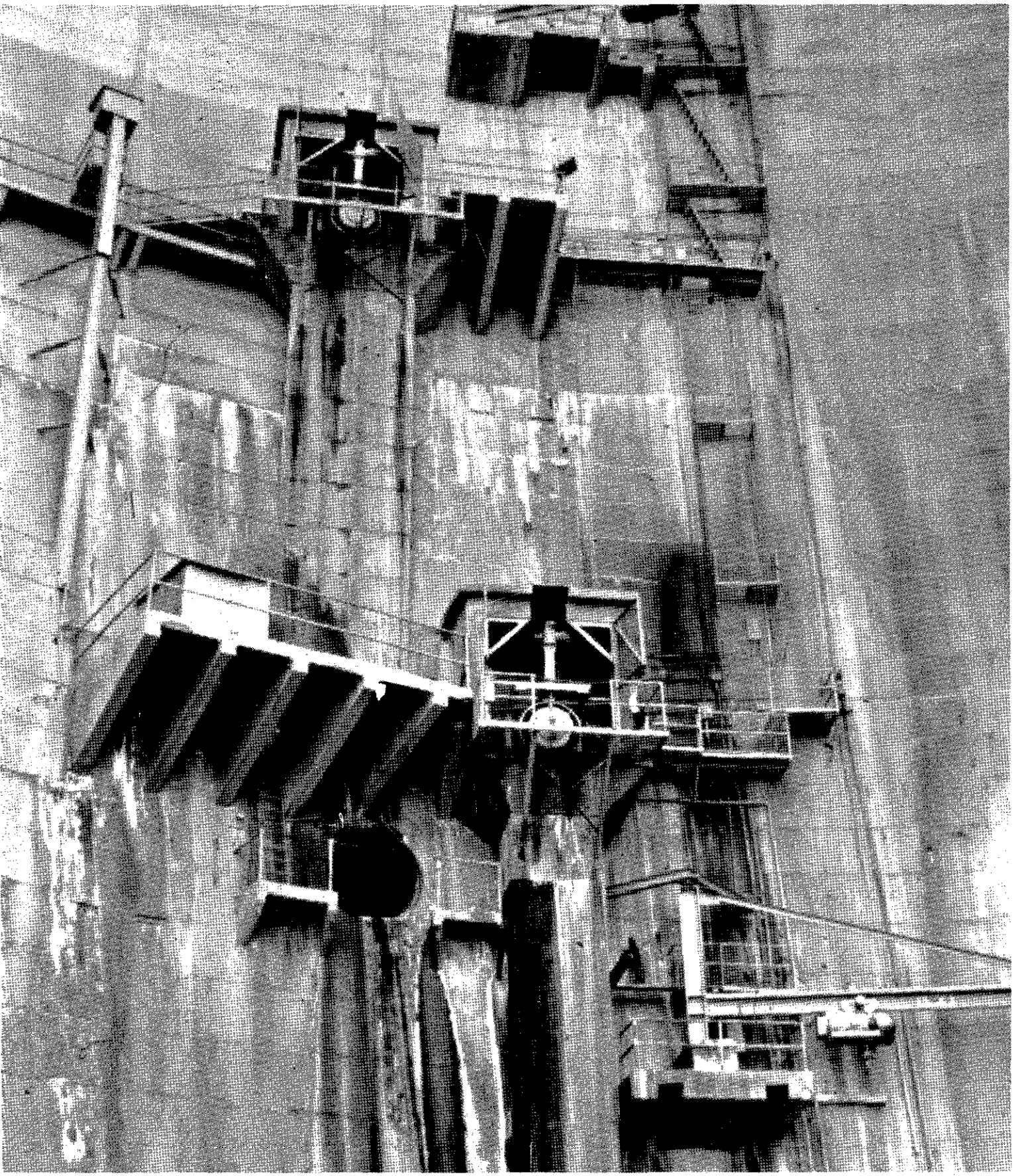
ELEVATIONS:

	ELEV.
ORIGINAL STREAMBED	1650.00
LOWEST EXCAVATION	1642.60
CREST	2015.00
TOP OF PARAPET	2015.75
ASSUMED H.W.L.	2025.00

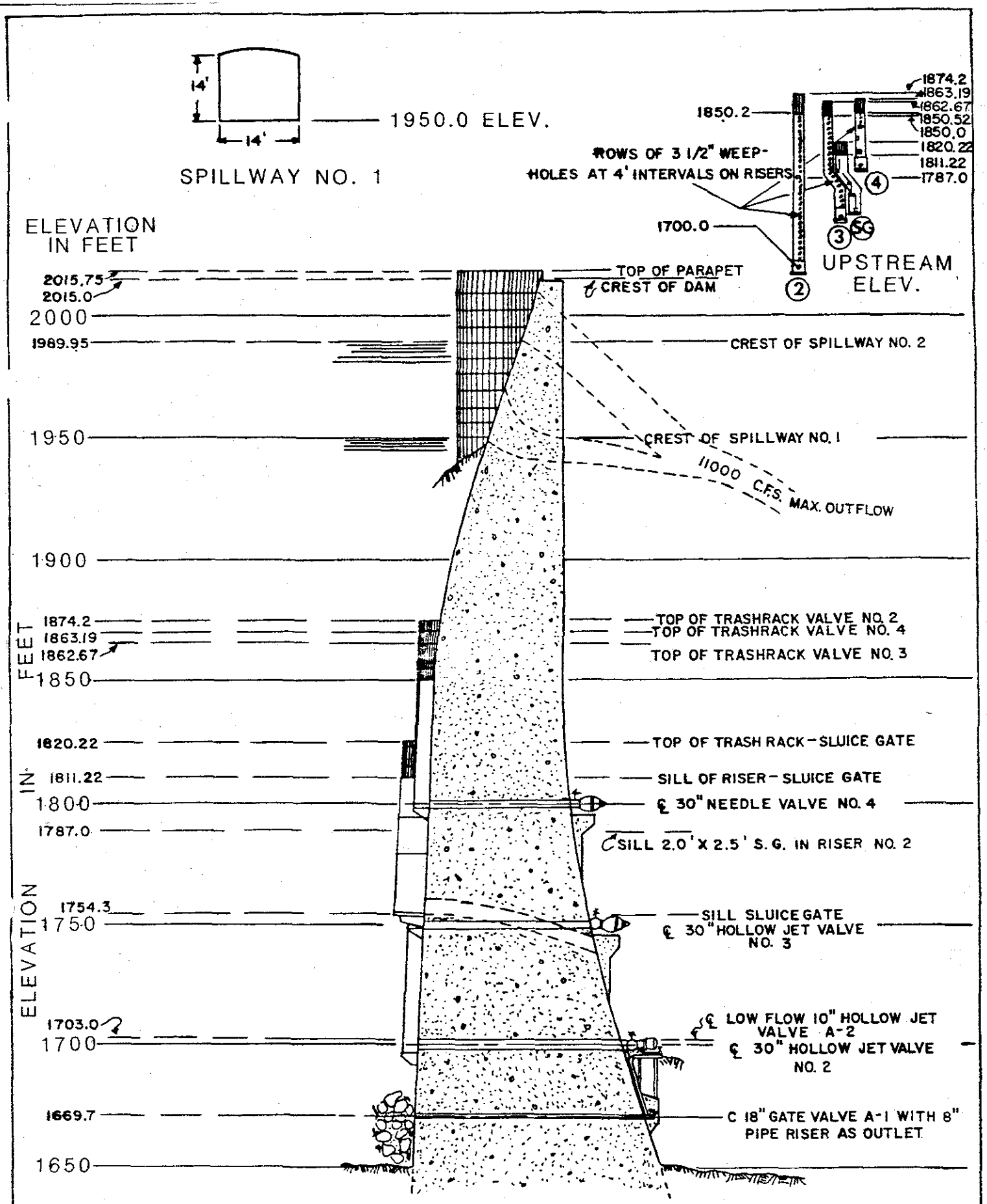
REMARKS:

(1) CONSTRUCTED 1947. NEW TRASH RACK INSTALLED OCTOBER 1960. RISER INSTALLED NOVEMBER 1971. RISER REMOVED AUG. 1983.
(2) RISER CONSTRUCTED DECEMBER 1947. MODIFIED IN 1964. EXTENDED IN OCTOBER 1969.
(3) GUNITE RISERS CONSTRUCTED JANUARY 1939. RISER NO. 3 EXTENDED NOVEMBER 1971.
(4) HOLLOW JET INSTALLED JANUARY 1956.
LATEST STATE APPROVAL JUNE 8, 1977. WATER MAY BE IMPOUNDED TO ELEVATION 1950 FEET.
1950.035 USGS = 1950.0 SPILLWAY DATUM. SPILLWAY DATUM SHOWN.

REVISED AUGUST 1984



PACOIMA DAM OUTLET WORKS



PACOIMA DAM CROSS SECTION

6/17/77 C.W.V.

PACOIMA DAM

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

EMERGENCY TELEPHONE LIST

District Operations Center (M-F, 8:00 am - 4:30 pm)	(213)	226-4191
District 24-Hour Number	(213)	226-4308

Department of Public Works

M E M O R A N D U M

TO: Mr. Orville E. McCollom January 31, 1985

FROM: N. C. Datywler
Hydraulic Division

File No. 64.121
Pacoima Dam and Reservoir
Operation Plan

Recommendation

Approve the following operating plan for Pacoima Dam. It is recommended that this operating plan take effect upon completion of the current spillway tunnel extension project.

Background

Due to sluicing of Pacoima Reservoir in 1983 and the current spillway tunnel extension project, several new operating schemes for the dam and reservoir were studied. The proposed operating plan is outlined below.

Operating Plan -

Holding Pool

Minimum holding pool is Elevation 1880.0 feet.

Rising Reservoir

Storm inflow will be ponded to Elevation 1920.0 feet. Above 1920.0 feet, outflow will approximate inflow to maximum outlet capacity (874 cfs at Elevation 1920.0 feet).

Once spillway flow is achieved (Elevation 1950.0 feet), the valves will be closed in increments so that the combined outflow from the valves and spillway will produce a uniform outflow hydrograph. All valves will be closed above Elevation 1954.0 feet. At no time will the combination of total valve plus spillway outflow be greater than inflow to the reservoir.

Falling Reservoir

When possible, releases greater than inflow will be maintained until the reservoir water surface has receded to Elevation 1927.0 feet. At that time, outflow may be reduced to a conservable rate or inflow, whichever is greater. At the discretion of the operation engineer, reservoir outflow may be reduced to inflow at elevations greater than 1927.0 feet to increase water conservation benefits.

Water Conservation Pool

Nonstorm spreading releases greater than inflow should be initiated when Elevation 1927.0 feet is achieved.

Discussion

The 10-, 25-, 50-year and capital event runoff frequency inflow hydrographs were routed through the dam with the goal of increasing water conservation benefits, preventing spillway flows for events with less than a 10-year frequency, and keeping the reservoir debris cone upstream a satisfactory distance. Alternate discharge schedules, which begin releases at lower elevations, do not significantly decrease the peak outflows for events greater than a 10-year frequency.

Runoff Frequency	Resultant W.S. Proposed Plan	Maximum Release
10	1950.4	969
25	1962.5	1761
50	1976.3	2230
Capital	2009.0	10,342

A 1,500 acre-foot water conservation pool is provided for between Elevation 1880.0 feet and 1927.0 feet. If need be, the reservoir can be drawn from 1927.0 feet to Elevation 1920.0 feet in approximately four hours using all valves with no inflow.

The Sedimentation Section of Hydraulic Division concurs with the elevation selected for minimum holding pool (Elevation 1880.0 feet) with regards to sedimentation. They expect no difficulties in valve operations due to sediment for at least several years with the absence of very large debris-producing storms.

Brett L. Forrester
Operations Section
Extension 4191

BLF:bmc

cc: Operation and Maintenance (2) (Noyes, Remillard)
Water Conservation
SP&DIG
Hydraulic (2) (Mitchell, Files)
General Files

PROGRAM F0611P
PACOIMA
RESERVOIR STORAGE TABULATION (ACRE-FEET)
STORAGE TABLE NO. 23
SURVEY OF 8- 4-83

G.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1748.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1749.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1750.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1751.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1752.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1753.	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1754.	0.0	0.00	0.01	0.01	0.02	0.02	0.03	0.03	0.04	0.04	0.00
1755.	0.05	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.14	0.01
1756.	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.01
1757.	0.25	0.27	0.28	0.30	0.31	0.32	0.34	0.35	0.37	0.38	0.01
1758.	0.40	0.43	0.45	0.47	0.50	0.52	0.55	0.57	0.60	0.62	0.02
1759.	0.65	0.69	0.72	0.75	0.79	0.82	0.86	0.89	0.93	0.96	0.03
1760.	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.28	1.32	1.36	0.04
1761.	1.40	1.44	1.49	1.53	1.58	1.62	1.67	1.71	1.76	1.80	0.04
1762.	1.85	1.90	1.96	2.01	2.07	2.12	2.18	2.23	2.29	2.34	0.05
1763.	2.40	2.46	2.53	2.59	2.66	2.72	2.79	2.85	2.92	2.98	0.06
1764.	3.05	3.12	3.20	3.27	3.35	3.42	3.50	3.57	3.65	3.72	0.07
1765.	3.80	3.88	3.97	4.05	4.14	4.22	4.31	4.39	4.48	4.56	0.08
1766.	4.65	4.74	4.84	4.93	5.03	5.12	5.22	5.31	5.41	5.50	0.09
1767.	5.60	5.70	5.81	5.91	6.02	6.12	6.23	6.33	6.44	6.54	0.11
1768.	6.65	6.76	6.88	6.99	7.11	7.22	7.34	7.45	7.57	7.68	0.11
1769.	7.80	7.92	8.05	8.17	8.30	8.42	8.55	8.67	8.80	8.92	0.13
1770.	9.05	9.18	9.31	9.44	9.57	9.70	9.83	9.96	10.1	10.2	0.13
1771.	10.3	10.5	10.6	10.8	10.9	11.0	11.2	11.3	11.4	11.6	0.13
1772.	11.7	11.8	12.0	12.1	12.3	12.4	12.6	12.7	12.9	13.0	0.14
1773.	13.1	13.3	13.5	13.6	13.8	13.9	14.1	14.2	14.4	14.5	0.15
1774.	14.7	14.9	15.0	15.2	15.3	15.5	15.7	15.8	16.0	16.1	0.16
1775.	16.3	16.5	16.6	16.8	17.0	17.1	17.3	17.5	17.6	17.8	0.16
1776.	17.9	18.1	18.3	18.5	18.6	18.8	19.0	19.2	19.3	19.5	0.17
1777.	19.7	19.9	20.1	20.3	20.4	20.6	20.8	21.0	21.2	21.4	0.18
1778.	21.5	21.7	21.9	22.1	22.3	22.5	22.7	22.9	23.1	23.3	0.19

G.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1779.	23.5	23.7	23.9	24.1	24.3	24.5	24.7	24.9	25.1	25.3	0.20
1780.	25.5	25.8	26.0	26.2	26.4	26.6	26.8	27.1	27.3	27.5	0.21
1781.	27.7	27.9	28.1	28.4	28.6	28.8	29.0	29.3	29.5	29.7	0.22
1782.	29.9	30.2	30.4	30.7	30.9	31.1	31.4	31.6	31.8	32.1	0.23
1783.	32.3	32.5	32.8	33.0	33.3	33.5	33.7	34.0	34.2	34.5	0.24
1784.	34.7	34.9	35.2	35.4	35.7	35.9	36.2	36.4	36.7	36.9	0.24
1785.	37.1	37.4	37.7	37.9	38.2	38.4	38.7	38.9	39.2	39.4	0.25
1786.	39.7	40.0	40.2	40.5	40.8	41.0	41.3	41.6	41.8	42.1	0.26
1787.	42.3	42.6	42.9	43.2	43.4	43.7	44.0	44.2	44.5	44.8	0.27
1788.	45.0	45.3	45.6	45.9	46.1	46.4	46.7	47.0	47.2	47.5	0.27
1789.	47.8	48.1	48.4	48.7	48.9	49.2	49.5	49.8	50.1	50.4	0.28
1790.	50.6	50.9	51.2	51.5	51.8	52.1	52.4	52.7	53.0	53.3	0.29
1791.	53.6	53.9	54.2	54.5	54.8	55.1	55.5	55.8	56.1	56.4	0.31
1792.	56.7	57.0	57.3	57.7	58.0	58.3	58.6	59.0	59.3	59.6	0.32
1793.	59.9	60.3	60.6	61.0	61.3	61.6	62.0	62.3	62.6	63.0	0.33
1794.	63.3	63.6	64.0	64.3	64.7	65.0	65.4	65.7	66.1	66.4	0.35
1795.	66.8	67.2	67.5	67.9	68.3	68.6	69.0	69.4	69.7	70.1	0.36
1796.	70.4	70.8	71.2	71.6	71.9	72.3	72.7	73.1	73.4	73.8	0.38
1797.	74.2	74.6	75.0	75.4	75.7	76.1	76.5	76.9	77.3	77.7	0.38
1798.	78.0	78.4	78.8	79.2	79.6	80.0	80.4	80.8	81.2	81.6	0.40
1799.	82.0	82.5	82.9	83.3	83.7	84.1	84.5	85.0	85.4	85.8	0.41
1800.	86.2	86.6	87.0	87.5	87.9	88.3	88.7	89.2	89.6	90.0	0.42
1801.	90.4	90.9	91.3	91.8	92.2	92.6	93.1	93.5	93.9	94.4	0.43
1802.	94.8	95.2	95.7	96.1	96.6	97.0	97.5	97.9	98.4	98.8	0.44
1803.	99.2	99.7	100.2	100.6	101.1	101.5	102.0	102.4	102.9	103.3	0.45
1804.	103.8	104.3	104.7	105.2	105.7	106.1	106.6	107.1	107.5	108.0	0.46
1805.	108.4	108.9	109.4	109.9	110.4	110.8	111.3	111.8	112.3	112.8	0.48
1806.	113.2	113.7	114.2	114.7	115.2	115.7	116.2	116.7	117.2	117.7	0.49
1807.	118.2	118.7	119.2	119.7	120.2	120.7	121.2	121.7	122.2	122.7	0.50
1808.	123.2	123.8	124.3	124.8	125.3	125.8	126.3	126.9	127.4	127.9	0.51
1809.	128.4	128.9	129.5	130.0	130.5	131.0	131.6	132.1	132.6	133.2	0.53
1810.	133.7	134.2	134.8	135.3	135.9	136.4	137.0	137.5	138.1	138.6	0.54
1811.	139.1	139.7	140.3	140.8	141.4	141.9	142.5	143.1	143.6	144.2	0.56
1812.	144.7	145.3	145.9	146.5	147.0	147.6	148.2	148.8	149.3	149.9	0.57
1813.	150.5	151.1	151.7	152.3	152.9	153.4	154.0	154.6	155.2	155.8	0.59
1814.	156.4	157.0	157.6	158.2	158.8	159.4	160.0	160.6	161.2	161.8	0.60

G.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1815.	162.4	163.1	163.7	164.3	164.9	165.5	166.2	166.8	167.4	168.0	0.62
1816.	168.6	169.3	169.9	170.6	171.2	171.8	172.5	173.1	173.7	174.4	0.63
1817.	175.0	175.6	176.3	176.9	177.6	178.2	178.9	179.5	180.2	180.8	0.65
1818.	181.5	182.2	182.8	183.5	184.2	184.8	185.5	186.2	186.9	187.5	0.67
1819.	188.2	188.9	189.6	190.3	191.0	191.6	192.3	193.0	193.7	194.4	0.69
1820.	195.1	195.8	196.5	197.2	197.9	198.6	199.4	200.1	200.8	201.5	0.71
1821.	202.2	202.9	203.7	204.4	205.1	205.9	206.6	207.3	208.1	208.8	0.73
1822.	209.5	210.3	211.1	211.8	212.6	213.3	214.1	214.9	215.6	216.4	0.76
1823.	217.1	217.9	218.7	219.5	220.3	221.1	221.9	222.6	223.4	224.2	0.78
1824.	225.0	225.8	226.6	227.4	228.3	229.1	229.9	230.7	231.5	232.3	0.81
1825.	233.1	234.0	234.8	235.7	236.5	237.4	238.2	239.1	239.9	240.8	0.84
1826.	241.6	242.5	243.3	244.2	245.1	245.9	246.8	247.7	248.6	249.4	0.87
1827.	250.3	251.2	252.1	253.0	253.9	254.8	255.7	256.6	257.5	258.4	0.89
1828.	259.2	260.2	261.1	262.0	262.9	263.8	264.8	265.7	266.6	267.5	0.92
1829.	268.4	269.4	270.3	271.3	272.2	273.2	274.1	275.1	276.0	277.0	0.94
1830.	277.9	278.9	279.8	280.8	281.8	282.8	283.7	284.7	285.7	286.7	0.97
1831.	287.6	288.7	289.7	290.7	291.7	292.7	293.7	294.7	295.7	296.7	1.00
1832.	297.7	298.7	299.8	300.8	301.9	302.9	303.9	305.0	306.0	307.1	1.04
1833.	308.1	309.2	310.2	311.3	312.4	313.5	314.5	315.6	316.7	317.8	1.07
1834.	318.8	320.0	321.1	322.2	323.3	324.4	325.5	326.6	327.7	328.8	1.11
1835.	329.9	331.1	332.2	333.4	334.5	335.7	336.8	338.0	339.1	340.3	1.15
1836.	341.4	342.6	343.8	345.0	346.2	347.4	348.6	349.8	351.0	352.2	1.19
1837.	353.3	354.6	355.8	357.0	358.3	359.5	360.7	362.0	363.2	364.4	1.23
1838.	365.6	366.9	368.2	369.4	370.7	372.0	373.2	374.5	375.8	377.0	1.26
1839.	378.3	379.6	380.9	382.2	383.5	384.8	386.1	387.4	388.7	390.0	1.30
1840.	391.3	392.6	394.0	395.3	396.6	398.0	399.3	400.6	402.0	403.3	1.33
1841.	404.6	406.0	407.4	408.7	410.1	411.5	412.8	414.2	415.6	416.9	1.36
1842.	418.3	419.7	421.1	422.5	423.9	425.3	426.7	428.1	429.5	430.9	1.39
1843.	432.2	433.7	435.1	436.5	437.9	439.3	440.8	442.2	443.6	445.0	1.42
1844.	446.4	447.9	449.3	450.8	452.2	453.6	455.1	456.5	458.0	459.4	1.44
1845.	460.8	462.3	463.8	465.2	466.7	468.1	469.6	471.1	472.5	474.0	1.46
1846.	475.4	476.9	478.4	479.9	481.4	482.8	484.3	485.8	487.3	488.8	1.48
1847.	490.2	491.7	493.2	494.7	496.2	497.7	499.2	500.7	502.2	503.7	1.49
1848.	505.2	506.7	508.2	509.7	511.2	512.7	514.2	515.7	517.2	518.7	1.50
1849.	520.2	521.8	523.3	524.8	526.3	527.8	529.4	530.9	532.4	533.9	1.52
1850.	535.4	537.0	538.5	540.1	541.6	543.1	544.7	546.2	547.8	549.3	1.54

G.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1851.	550.8	552.4	554.0	555.5	557.1	558.6	560.2	561.8	563.3	564.9	1.56
1852.	566.4	568.0	569.6	571.2	572.8	574.3	575.9	577.5	579.1	580.7	1.58
1853.	582.2	583.8	585.4	587.0	588.6	590.2	591.8	593.4	595.0	596.6	1.60
1854.	598.2	599.9	601.5	603.1	604.7	606.3	608.0	609.6	611.2	612.8	1.62
1855.	614.4	616.1	617.7	619.4	621.0	622.6	624.3	625.9	627.6	629.2	1.64
1856.	630.8	632.5	634.2	635.8	637.5	639.1	640.8	642.5	644.1	645.8	1.66
1857.	647.4	649.1	650.8	652.5	654.2	655.8	657.5	659.2	660.9	662.6	1.68
1858.	664.2	665.9	667.6	669.3	671.0	672.7	674.4	676.1	677.8	679.5	1.69
1859.	681.2	682.9	684.6	686.3	688.0	689.7	691.5	693.2	694.9	696.6	1.71
1860.	698.3	700.0	701.8	703.5	705.2	706.9	708.7	710.4	712.1	713.9	1.73
1861.	715.6	717.3	719.1	720.8	722.6	724.3	726.1	727.8	729.6	731.3	1.75
1862.	733.1	734.9	736.6	738.4	740.2	741.9	743.7	745.5	747.3	749.0	1.77
1863.	750.8	752.6	754.4	756.2	758.0	759.7	761.5	763.3	765.1	766.9	1.79
1864.	768.7	770.5	772.3	774.1	776.0	777.8	779.6	781.4	783.2	785.0	1.81
1865.	786.8	788.7	790.5	792.4	794.2	796.0	797.9	799.7	801.6	803.4	1.84
1866.	805.2	807.1	809.0	810.8	812.7	814.6	816.4	818.3	820.2	822.0	1.86
1867.	823.9	825.8	827.7	829.6	831.5	833.3	835.2	837.1	839.0	840.9	1.89
1868.	842.8	844.7	846.6	848.5	850.5	852.4	854.3	856.2	858.1	860.0	1.91
1869.	861.9	863.9	865.8	867.8	869.7	871.6	873.6	875.5	877.5	879.4	1.94
1870.	881.3	883.3	885.3	887.2	889.2	891.2	893.1	895.1	897.1	899.0	1.96
1871.	901.0	903.0	905.0	907.0	909.0	910.9	912.9	914.9	916.9	918.9	1.99
1872.	920.9	922.9	924.9	926.9	929.0	931.0	933.0	935.0	937.0	939.0	2.01
1873.	941.0	943.1	945.1	947.2	949.2	951.3	953.3	955.4	957.4	959.4	2.04
1874.	961.5	963.6	965.6	967.7	969.8	971.9	973.9	976.0	978.1	980.2	2.07
1875.	982.2	984.4	986.5	988.6	990.7	992.8	994.9	997.0	999.1	1001.2	2.11
1876.	1003.	1005.	1008.	1010.	1012.	1014.	1016.	1018.	1021.	1023.	2.14
1877.	1025.	1027.	1029.	1031.	1034.	1036.	1038.	1040.	1042.	1044.	2.18
1878.	1047.	1049.	1051.	1053.	1055.	1058.	1060.	1062.	1064.	1067.	2.21
1879.	1069.	1071.	1073.	1075.	1078.	1080.	1082.	1084.	1087.	1089.	2.24
1880.	1091.	1093.	1096.	1098.	1100.	1102.	1105.	1107.	1109.	1111.	2.26
1881.	1114.	1116.	1118.	1121.	1123.	1125.	1127.	1130.	1132.	1134.	2.27
1882.	1136.	1139.	1141.	1143.	1146.	1148.	1150.	1152.	1155.	1157.	2.28
1883.	1159.	1162.	1164.	1166.	1169.	1171.	1173.	1175.	1178.	1180.	2.30
1884.	1182.	1185.	1187.	1189.	1192.	1194.	1196.	1199.	1201.	1203.	2.32
1885.	1206.	1208.	1210.	1213.	1215.	1217.	1220.	1222.	1225.	1227.	2.36
1886.	1229.	1232.	1234.	1236.	1239.	1241.	1244.	1246.	1249.	1251.	2.41

G.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1887.	1253.	1256.	1258.	1261.	1263.	1266.	1268.	1271.	1273.	1276.	2.47
1888.	1278.	1281.	1283.	1286.	1288.	1291.	1293.	1296.	1298.	1301.	2.54
1889.	1304.	1306.	1309.	1311.	1314.	1317.	1319.	1322.	1324.	1327.	2.60
1890.	1330.	1332.	1335.	1338.	1340.	1343.	1345.	1348.	1351.	1353.	2.65
1891.	1356.	1359.	1362.	1364.	1367.	1370.	1372.	1375.	1378.	1380.	2.70
1892.	1383.	1386.	1389.	1391.	1394.	1397.	1400.	1402.	1405.	1408.	2.75
1893.	1411.	1413.	1416.	1419.	1422.	1425.	1427.	1430.	1433.	1436.	2.78
1894.	1438.	1441.	1444.	1447.	1450.	1453.	1455.	1458.	1461.	1464.	2.82
1895.	1467.	1470.	1472.	1475.	1478.	1481.	1484.	1487.	1490.	1492.	2.86
1896.	1495.	1498.	1501.	1504.	1507.	1510.	1513.	1516.	1518.	1521.	2.90
1897.	1524.	1527.	1530.	1533.	1536.	1539.	1542.	1545.	1548.	1551.	2.94
1898.	1554.	1557.	1560.	1563.	1566.	1569.	1572.	1575.	1578.	1581.	2.98
1899.	1583.	1587.	1590.	1593.	1596.	1599.	1602.	1605.	1608.	1611.	3.02
1900.	1614.	1617.	1620.	1623.	1626.	1629.	1632.	1635.	1638.	1641.	3.07
1901.	1644.	1648.	1651.	1654.	1657.	1660.	1663.	1666.	1669.	1672.	3.11
1902.	1676.	1679.	1682.	1685.	1688.	1691.	1695.	1698.	1701.	1704.	3.16
1903.	1707.	1710.	1714.	1717.	1720.	1723.	1726.	1730.	1733.	1736.	3.20
1904.	1739.	1742.	1746.	1749.	1752.	1755.	1759.	1762.	1765.	1768.	3.25
1905.	1772.	1775.	1778.	1782.	1785.	1788.	1792.	1795.	1798.	1801.	3.30
1906.	1805.	1808.	1811.	1815.	1818.	1822.	1825.	1828.	1832.	1835.	3.35
1907.	1838.	1842.	1845.	1849.	1852.	1855.	1859.	1862.	1866.	1869.	3.40
1908.	1872.	1876.	1879.	1883.	1886.	1890.	1893.	1897.	1900.	1903.	3.45
1909.	1907.	1910.	1914.	1917.	1921.	1924.	1928.	1931.	1935.	1938.	3.50
1910.	1942.	1945.	1949.	1953.	1956.	1960.	1963.	1967.	1970.	1974.	3.55
1911.	1977.	1981.	1985.	1988.	1992.	1995.	1999.	2003.	2006.	2010.	3.60
1912.	2013.	2017.	2021.	2024.	2028.	2032.	2035.	2039.	2043.	2046.	3.64
1913.	2050.	2054.	2057.	2061.	2065.	2068.	2072.	2076.	2080.	2083.	3.69
1914.	2087.	2091.	2094.	2098.	2102.	2106.	2109.	2113.	2117.	2121.	3.74
1915.	2124.	2128.	2132.	2136.	2140.	2143.	2147.	2151.	2155.	2158.	3.79
1916.	2162.	2166.	2170.	2174.	2178.	2182.	2185.	2189.	2193.	2197.	3.85
1917.	2201.	2205.	2209.	2213.	2216.	2220.	2224.	2228.	2232.	2236.	3.91
1918.	2240.	2244.	2248.	2252.	2256.	2260.	2264.	2268.	2272.	2276.	3.98
1919.	2280.	2284.	2288.	2292.	2296.	2300.	2304.	2308.	2312.	2316.	4.04
1920.	2320.	2324.	2328.	2332.	2337.	2341.	2345.	2349.	2353.	2357.	4.10
1921.	2361.	2365.	2369.	2374.	2378.	2382.	2386.	2390.	2394.	2399.	4.16
1922.	2403.	2407.	2411.	2415.	2420.	2424.	2428.	2432.	2436.	2441.	4.21

G.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1923.	2445.	2449.	2453.	2458.	2462.	2466.	2470.	2475.	2479.	2483.	4.26
1924.	2488.	2492.	2496.	2500.	2505.	2509.	2513.	2518.	2522.	2526.	4.31
1925.	2531.	2535.	2539.	2544.	2548.	2552.	2557.	2561.	2566.	2570.	4.36
1926.	2574.	2579.	2583.	2587.	2592.	2596.	2601.	2605.	2609.	2614.	4.40
1927.	2618.	2623.	2627.	2632.	2636.	2640.	2645.	2649.	2654.	2658.	4.44
1928.	2663.	2667.	2672.	2676.	2681.	2685.	2690.	2694.	2698.	2703.	4.47
1929.	2707.	2712.	2716.	2721.	2725.	2730.	2734.	2739.	2744.	2748.	4.51
1930.	2753.	2757.	2762.	2766.	2771.	2775.	2780.	2784.	2789.	2794.	4.55
1931.	2798.	2803.	2807.	2812.	2816.	2821.	2826.	2830.	2835.	2839.	4.60
1932.	2844.	2849.	2853.	2858.	2863.	2867.	2872.	2877.	2881.	2886.	4.64
1933.	2891.	2895.	2900.	2905.	2909.	2914.	2919.	2923.	2928.	2933.	4.69
1934.	2937.	2942.	2947.	2952.	2956.	2961.	2966.	2971.	2975.	2980.	4.75
1935.	2985.	2990.	2995.	2999.	3004.	3009.	3014.	3019.	3023.	3028.	4.81
1936.	3033.	3038.	3043.	3048.	3053.	3057.	3062.	3067.	3072.	3077.	4.88
1937.	3082.	3087.	3092.	3097.	3102.	3107.	3111.	3116.	3121.	3126.	4.94
1938.	3131.	3136.	3141.	3146.	3151.	3156.	3161.	3166.	3171.	3176.	5.00
1939.	3181.	3186.	3191.	3196.	3202.	3207.	3212.	3217.	3222.	3227.	5.07
1940.	3232.	3237.	3242.	3247.	3253.	3258.	3263.	3268.	3273.	3278.	5.13
1941.	3283.	3288.	3294.	3299.	3304.	3309.	3314.	3320.	3325.	3330.	5.19
1942.	3335.	3340.	3346.	3351.	3356.	3361.	3367.	3372.	3377.	3382.	5.25
1943.	3388.	3393.	3398.	3404.	3409.	3414.	3420.	3425.	3430.	3436.	5.32
1944.	3441.	3446.	3452.	3457.	3463.	3468.	3473.	3479.	3484.	3490.	5.39
1945.	3495.	3500.	3506.	3511.	3517.	3522.	3528.	3533.	3539.	3544.	5.47
1946.	3550.	3555.	3561.	3566.	3572.	3577.	3583.	3589.	3594.	3600.	5.55
1947.	3605.	3611.	3616.	3622.	3628.	3633.	3639.	3645.	3650.	3656.	5.64
1948.	3662.	3667.	3673.	3679.	3685.	3690.	3696.	3702.	3708.	3713.	5.73
1949.	3719.	3725.	3731.	3736.	3742.	3748.	3754.	3760.	3766.	3771.	5.81
1950.	3777.	3783.	3789.	3795.	3801.	3807.	3812.	3818.	3824.	3830.	5.88
1951.	3836.	3842.	3848.	3854.	3860.	3866.	3872.	3878.	3884.	3890.	5.95
1952.	3895.	3901.	3908.	3914.	3920.	3926.	3932.	3938.	3944.	3950.	6.01
1953.	3956.	3962.	3968.	3974.	3980.	3986.	3992.	3998.	4004.	4010.	6.06
1954.	4016.	4022.	4028.	4035.	4041.	4047.	4053.	4059.	4065.	4071.	6.13
1955.	4077.	4084.	4090.	4096.	4102.	4108.	4115.	4121.	4127.	4133.	6.19
1956.	4139.	4146.	4152.	4158.	4164.	4171.	4177.	4183.	4189.	4196.	6.26
1957.	4202.	4208.	4215.	4221.	4227.	4234.	4240.	4246.	4253.	4259.	6.33
1958.	4265.	4272.	4278.	4284.	4291.	4297.	4304.	4310.	4316.	4323.	6.39

G.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1959.	4329.	4336.	4342.	4349.	4355.	4361.	4368.	4374.	4381.	4387.	6.44
1960.	4394.	4400.	4407.	4413.	4420.	4426.	4433.	4439.	4446.	4452.	6.48
1961.	4458.	4465.	4471.	4478.	4484.	4491.	4498.	4504.	4511.	4517.	6.50
1962.	4524.	4530.	4537.	4543.	4550.	4556.	4563.	4569.	4576.	4582.	6.51
1963.	4589.	4595.	4602.	4608.	4615.	4621.	4628.	4634.	4641.	4647.	6.52
1964.	4654.	4660.	4667.	4674.	4680.	4687.	4693.	4700.	4706.	4713.	6.54
1965.	4719.	4726.	4732.	4739.	4746.	4752.	4759.	4765.	4772.	4778.	6.56
1966.	4785.	4792.	4798.	4805.	4811.	4818.	4825.	4831.	4838.	4844.	6.60
1967.	4851.	4858.	4864.	4871.	4878.	4884.	4891.	4897.	4904.	4911.	6.64
1968.	4917.	4924.	4931.	4937.	4944.	4951.	4958.	4964.	4971.	4978.	6.69
1969.	4984.	4991.	4998.	5004.	5011.	5018.	5025.	5031.	5038.	5045.	6.72
1970.	5052.	5058.	5065.	5072.	5079.	5085.	5092.	5099.	5106.	5112.	6.74
1971.	5119.	5126.	5133.	5139.	5146.	5153.	5160.	5166.	5173.	5180.	6.75
1972.	5187.	5193.	5200.	5207.	5214.	5220.	5227.	5234.	5241.	5248.	6.77
1973.	5254.	5261.	5268.	5275.	5282.	5288.	5295.	5302.	5309.	5316.	6.81
1974.	5322.	5329.	5336.	5343.	5350.	5357.	5364.	5371.	5378.	5384.	6.89
1975.	5391.	5398.	5405.	5412.	5419.	5426.	5433.	5440.	5447.	5454.	7.01
1976.	5462.	5469.	5476.	5483.	5490.	5497.	5505.	5512.	5519.	5526.	7.19
1977.	5533.	5541.	5548.	5556.	5563.	5570.	5578.	5585.	5593.	5600.	7.39
1978.	5607.	5615.	5623.	5630.	5638.	5645.	5653.	5661.	5668.	5676.	7.60
1979.	5683.	5691.	5699.	5707.	5714.	5722.	5730.	5738.	5746.	5753.	7.78
1980.	5761.	5769.	5777.	5785.	5793.	5801.	5809.	5817.	5825.	5833.	7.94
1981.	5841.	5849.	5857.	5865.	5873.	5881.	5889.	5897.	5905.	5913.	8.05
1982.	5921.	5929.	5937.	5946.	5954.	5962.	5970.	5978.	5986.	5994.	8.13
1983.	6002.	6011.	6019.	6027.	6035.	6043.	6052.	6060.	6068.	6076.	8.19
1984.	6084.	6093.	6101.	6109.	6117.	6126.	6134.	6142.	6150.	6159.	8.24
1985.	6167.	6175.	6183.	6192.	6200.	6208.	6217.	6225.	6233.	6242.	8.30
1986.	6250.	6258.	6267.	6275.	6283.	6292.	6300.	6308.	6317.	6325.	8.36
1987.	6334.	6342.	6350.	6359.	6367.	6376.	6384.	6393.	6401.	6409.	8.43
1988.	6418.	6426.	6435.	6443.	6452.	6460.	6469.	6477.	6486.	6494.	8.51
1989.	6503.	6512.	6520.	6529.	6537.	6546.	6554.	6563.	6572.	6580.	8.58
1990.	6589.	6597.	6606.	6615.	6623.	6632.	6641.	6649.	6658.	6667.	8.66
1991.	6675.	6684.	6693.	6702.	6710.	6719.	6728.	6737.	6745.	6754.	8.73
1992.	6763.	6772.	6780.	6789.	6798.	6807.	6816.	6824.	6833.	6842.	8.80
1993.	6851.	6860.	6869.	6877.	6886.	6895.	6904.	6913.	6922.	6931.	8.88
1994.	6940.	6949.	6957.	6966.	6975.	6984.	6993.	7002.	7011.	7020.	8.94

C.H.	.0	.1	.2	.3	.4	.5	.6	.7	.8	.9	DIFF.
1995.	7029.	7038.	7047.	7056.	7065.	7074.	7083.	7092.	7101.	7110.	9.01
1996.	7119.	7128.	7137.	7146.	7156.	7165.	7174.	7183.	7192.	7201.	9.08
1997.	7210.	7219.	7228.	7237.	7247.	7256.	7265.	7274.	7283.	7292.	9.16
1998.	7302.	7311.	7320.	7329.	7339.	7348.	7357.	7366.	7375.	7385.	9.23
1999.	7394.	7403.	7413.	7422.	7431.	7441.	7450.	7459.	7468.	7478.	9.31
2000.	7487.	7496.	7506.	7515.	7525.	7534.	7543.	7553.	7562.	7572.	9.39
2001.	7581.	7590.	7600.	7609.	7619.	7628.	7638.	7647.	7657.	7666.	9.47
2002.	7676.	7685.	7695.	7704.	7714.	7723.	7733.	7742.	7752.	7762.	9.55
2003.	7771.	7781.	7790.	7800.	7810.	7819.	7829.	7839.	7848.	7858.	9.63
2004.	7867.	7877.	7887.	7897.	7906.	7916.	7926.	7935.	7945.	7955.	9.71
2005.	7965.	7974.	7984.	7994.	8004.	8014.	8023.	8033.	8043.	8053.	9.79
2006.	8062.	8072.	8082.	8092.	8102.	8112.	8122.	8132.	8141.	8151.	9.86
2007.	8161.	8171.	8181.	8191.	8201.	8211.	8221.	8231.	8241.	8251.	9.94
2008.	8261.	8271.	8281.	8291.	8301.	8311.	8321.	8331.	8341.	8351.	10.02
2009.	8361.	8371.	8381.	8391.	8401.	8411.	8421.	8431.	8441.	8452.	10.10
2010.	8462.	8472.	8482.	8492.	8502.	8513.	8523.	8533.	8543.	8553.	10.18
2011.	8564.	8574.	8584.	8594.	8605.	8615.	8625.	8635.	8646.	8656.	10.28
2012.	8666.	8677.	8687.	8697.	8708.	8718.	8729.	8739.	8749.	8760.	10.38
2013.	8770.	8781.	8791.	8802.	8812.	8823.	8833.	8844.	8854.	8865.	10.48
2014.	8875.	8886.	8896.	8907.	8917.	8928.	8939.	8949.	8960.	8970.	10.59
2015.	8981.										0.0

SPILLWAY ELEVATION = 1950.0
CREST ELEVATION = 2015.0
ASSUMED HIGH WATER LINE = 2015.0

JS
9-12-83

INTERPOLATED ELEVATION-AREA TABULATION FOR PACOIMA DAM
BASED ON 64-T31 DATED 08/04/83 SCALE 1"= 10.0 FT, 1 SQ.IN= 1.000 UNITS

INTERPOLATED RESULTS

POINT NUMBER ******	ELEVATION (FEET) *********	AREA (ACRES) *******
1	1748.00	0.0
2	1749.00	0.02
3	1750.00	0.03
4	1751.00	0.04
5	1752.00	0.04
6	1753.00	0.04
7	1754.00	0.04
8	1755.00	0.06
9	1756.00	0.09
10	1757.00	0.14
11	1758.00	0.20
12	1759.00	0.28
13	1760.00	0.36
14	1761.00	0.44
15	1762.00	0.53
16	1763.00	0.63
17	1764.00	0.72
18	1765.00	0.82
19	1766.00	0.91
20	1767.00	1.01
21	1768.00	1.10
22	1769.00	1.19
23	1770.00	1.27
24	1771.00	1.35
25	1772.00	1.42
26	1773.00	1.49
27	1774.00	1.57
28	1775.00	1.65
29	1776.00	1.73
30	1777.00	1.82
31	1778.00	1.91
32	1779.00	2.00
33	1780.00	2.09
34	1781.00	2.18
35	1782.00	2.27
36	1783.00	2.35
37	1784.00	2.43
38	1785.00	2.51
39	1786.00	2.59
40	1787.00	2.67
41	1788.00	2.75
42	1789.00	2.83
43	1790.00	2.93
44	1791.00	3.05
45	1792.00	3.17
46	1793.00	3.31
47	1794.00	3.44
48	1795.00	3.58
49	1796.00	3.71
50	1797.00	3.83
51	1798.00	3.95

BY JS 09/12/83

INTERPOLATED ELEVATION-AREA TABULATION FOR PACOIMA DAM
BASED ON 64-T31 DATED 08/04/83 SCALE 1"= 10.0 FT. 1 SQ.IN= 1.000 UNITS

INTERPOLATED RESULTS

POINT NUMBER	ELEVATION (FEET)	AREA (ACRES)
******	*********	*******
52	1799.00	4.06
53	1800.00	4.17
54	1801.00	4.28
55	1802.00	4.39
56	1803.00	4.50
57	1804.00	4.62
58	1805.00	4.73
59	1806.00	4.85
60	1807.00	4.98
61	1808.00	5.11
62	1809.00	5.25
63	1810.00	5.39
64	1811.00	5.54
65	1812.00	5.69
66	1813.00	5.84
67	1814.00	6.00
68	1815.00	6.15
69	1816.00	6.30
70	1817.00	6.45
71	1818.00	6.61
72	1819.00	6.79
73	1820.00	6.99
74	1821.00	7.22
75	1822.00	7.48
76	1823.00	7.75
77	1824.00	8.02
78	1825.00	8.29
79	1826.00	8.56
80	1827.00	8.81
81	1828.00	9.07
82	1829.00	9.33
83	1830.00	9.61
84	1831.00	9.90
85	1832.00	10.22
86	1833.00	10.55
87	1834.00	10.91
88	1835.00	11.28
89	1836.00	11.67
90	1837.00	12.06
91	1838.00	12.46
92	1839.00	12.84
93	1840.00	13.21
94	1841.00	13.54
95	1842.00	13.84
96	1843.00	14.11
97	1844.00	14.34
98	1845.00	14.54
99	1846.00	14.71
100	1847.00	14.86
101	1848.00	15.00
102	1849.00	15.14

BY JS 09/12/83

INTERPOLATED ELEVATION-AREA TABULATION FOR PACOIMA DAM
BASED ON 64-T31 DATED 08/04/83 SCALE 1"= 10.0 FT, 1 SQ.IN= 1.000 UNITS

INTERPOLATED RESULTS

POINT NUMBER ******	ELEVATION (FEET) *********	AREA (ACRES) *******
103	1850.00	15.30
104	1851.00	15.48
105	1852.00	15.69
106	1853.00	15.90
107	1854.00	16.12
108	1855.00	16.32
109	1856.00	16.52
110	1857.00	16.70
111	1858.00	16.87
112	1859.00	17.05
113	1860.00	17.22
114	1861.00	17.41
115	1862.00	17.60
116	1863.00	17.81
117	1864.00	18.03
118	1865.00	18.26
119	1866.00	18.51
120	1867.00	18.76
121	1868.00	19.03
122	1869.00	19.29
123	1870.00	19.54
124	1871.00	19.79
125	1872.00	20.04
126	1873.00	20.30
127	1874.00	20.59
128	1875.00	20.90
129	1876.00	21.26
130	1877.00	21.63
131	1878.00	21.98
132	1879.00	22.29
133	1880.00	22.54
134	1881.00	22.69
135	1882.00	22.80
136	1883.00	22.92
137	1884.00	23.10
138	1885.00	23.40
139	1886.00	23.86
140	1887.00	24.43
141	1888.00	25.07
142	1889.00	25.72
143	1890.00	26.32
144	1891.00	26.83
145	1892.00	27.27
146	1893.00	27.66
147	1894.00	28.02
148	1895.00	28.39
149	1896.00	28.78
150	1897.00	29.19
151	1898.00	29.61
152	1899.00	30.05
153	1900.00	30.49

BY JS 09/12/83

INTERPOLATED ELEVATION-AREA TABULATION FOR PACOIMA DAM
BASED ON 64-T31 DATED 08/04/83 SCALE 1"= 10.0 FT, 1 SQ.IN= 1.000 UNITS

INTERPOLATED RESULTS

POINT NUMBER	ELEVATION (FEET)	AREA (ACRES)
******	*********	*******
154	1901.00	30.92
155	1902.00	31.35
156	1903.00	31.80
157	1904.00	32.26
158	1905.00	32.74
159	1906.00	33.26
160	1907.00	33.78
161	1908.00	34.31
162	1909.00	34.83
163	1910.00	35.33
164	1911.00	35.80
165	1912.00	36.25
166	1913.00	36.70
167	1914.00	37.17
168	1915.00	37.68
169	1916.00	38.24
170	1917.00	38.84
171	1918.00	39.44
172	1919.00	40.09
173	1920.00	40.71
174	1921.00	41.31
175	1922.00	41.87
176	1923.00	42.41
177	1924.00	42.90
178	1925.00	43.36
179	1926.00	43.78
180	1927.00	44.17
181	1928.00	44.55
182	1929.00	44.93
183	1930.00	45.33
184	1931.00	45.76
185	1932.00	46.22
186	1933.00	46.71
187	1934.00	47.24
188	1935.00	47.81
189	1936.00	48.42
190	1937.00	49.06
191	1938.00	49.71
192	1939.00	50.36
193	1940.00	51.00
194	1941.00	51.63
195	1942.00	52.25
196	1943.00	52.89
197	1944.00	53.57
198	1945.00	54.32
199	1946.00	55.15
200	1947.00	56.02
201	1948.00	56.91
202	1949.00	57.75
203	1950.00	58.53
204	1951.00	59.20

BY JS 09/12/83

INTERPOLATED ELEVATION-AREA TABULATION FOR PACOIMA DAM
BASED ON 64-T31 DATED 08/04/83 SCALE 1"= 10.0 FT, 1 SQ.IN= 1.000 UNITS

INTERPOLATED RESULTS

POINT NUMBER ******	ELEVATION (FEET) *********	AREA (ACRES) *******
205	1952.00	59.80
206	1953.00	60.36
207	1954.00	60.93
208	1955.00	61.55
209	1956.00	62.24
210	1957.00	62.96
211	1958.00	63.64
212	1959.00	64.24
213	1960.00	64.69
214	1961.00	64.96
215	1962.00	65.10
216	1963.00	65.18
217	1964.00	65.28
218	1965.00	65.46
219	1966.00	65.80
220	1967.00	66.22
221	1968.00	66.67
222	1969.00	67.08
223	1970.00	67.37
224	1971.00	67.51
225	1972.00	67.63
226	1973.00	67.88
227	1974.00	68.42
228	1975.00	69.41
229	1976.00	70.95
230	1977.00	72.87
231	1978.00	74.96
232	1979.00	76.99
233	1980.00	78.74
234	1981.00	80.05
235	1982.00	80.98
236	1983.00	81.66
237	1984.00	82.19
238	1985.00	82.71
239	1986.00	83.31
240	1987.00	83.99
241	1988.00	84.73
242	1989.00	85.49
243	1990.00	86.25
244	1991.00	86.99
245	1992.00	87.72
246	1993.00	88.43
247	1994.00	89.13
248	1995.00	89.83
249	1996.00	90.53
250	1997.00	91.23
251	1998.00	91.95
252	1999.00	92.69
253	2000.00	93.46
254	2001.00	94.25
255	2002.00	95.07

BY JS 09/12/83

INTERPOLATED ELEVATION-AREA TABULATION FOR PACOIMA DAM
BASED ON 64-T31 DATED 08/04/83 SCALE 1"= 10.0 FT, 1 SQ.IN= 1.000 UNITS

INTERPOLATED RESULTS

POINT NUMBER	ELEVATION (FEET)	AREA (ACRES)
256	2003.00	95.89
257	2004.00	96.70
258	2005.00	97.50
259	2006.00	98.26
260	2007.00	99.02
261	2008.00	99.78
262	2009.00	100.58
263	2010.00	101.42
264	2011.00	102.34
265	2012.00	103.31
266	2013.00	104.32
267	2014.00	105.37
268	2015.00	106.43

BY JS 09/12/83

PACOIMA DAM VALVE # 2 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) E,ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1851.00	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.	18.
1852.00	19.	39.	58.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.	68.
1853.00	19.	39.	58.	77.	95.	113.	131.	141.	141.	141.	141.	141.	141.	141.	141.	141.	141.	141.	141.	141.
1854.00	20.	39.	58.	77.	96.	114.	131.	148.	164.	180.	191.	202.	214.	224.	224.	224.	224.	224.	224.	224.
1855.00	20.	39.	58.	77.	96.	114.	132.	149.	165.	181.	192.	203.	215.	226.	236.	243.	256.	262.	269.	275.
1856.00	20.	39.	59.	78.	96.	114.	132.	149.	165.	181.	192.	203.	216.	227.	237.	244.	255.	263.	270.	276.
1857.00	20.	39.	59.	78.	97.	115.	132.	150.	166.	182.	193.	204.	216.	228.	237.	245.	255.	264.	271.	277.
1858.00	20.	39.	59.	78.	97.	115.	133.	150.	166.	182.	196.	205.	217.	229.	238.	245.	256.	265.	271.	278.
1859.00	20.	40.	59.	78.	97.	116.	133.	150.	167.	183.	194.	205.	218.	229.	239.	246.	257.	266.	272.	279.
1860.00	20.	40.	59.	79.	97.	116.	134.	151.	168.	183.	195.	206.	218.	230.	240.	247.	258.	266.	273.	280.
1861.00	20.	40.	60.	79.	98.	116.	134.	151.	168.	184.	195.	207.	219.	231.	240.	248.	259.	267.	274.	281.
1862.00	20.	40.	60.	79.	98.	117.	135.	152.	169.	185.	196.	207.	220.	231.	241.	248.	260.	268.	275.	281.
1863.00	20.	40.	60.	79.	98.	117.	135.	152.	169.	185.	197.	208.	220.	232.	242.	249.	260.	269.	276.	282.
1864.00	20.	40.	60.	80.	99.	117.	135.	153.	170.	186.	197.	208.	221.	233.	243.	250.	261.	270.	277.	283.
1865.00	20.	40.	60.	80.	99.	118.	136.	153.	170.	186.	198.	209.	222.	234.	243.	251.	262.	271.	277.	284.
1866.00	20.	40.	60.	80.	99.	118.	136.	154.	171.	187.	198.	210.	222.	234.	244.	251.	263.	271.	278.	285.
1867.00	20.	41.	61.	80.	100.	118.	137.	154.	171.	187.	199.	210.	223.	235.	245.	252.	263.	272.	279.	286.
1868.00	20.	41.	61.	81.	100.	119.	137.	155.	172.	188.	200.	211.	224.	236.	246.	253.	264.	273.	280.	287.
1869.00	20.	41.	61.	81.	100.	119.	137.	155.	172.	189.	200.	212.	224.	236.	246.	254.	265.	274.	281.	288.
1870.00	21.	41.	61.	81.	100.	119.	138.	156.	173.	189.	201.	212.	225.	237.	247.	254.	266.	275.	282.	288.
1871.00	21.	41.	61.	81.	101.	120.	138.	156.	173.	190.	201.	213.	226.	238.	248.	255.	267.	275.	282.	289.
1872.00	21.	41.	62.	82.	101.	120.	139.	157.	174.	190.	202.	213.	226.	239.	249.	256.	267.	276.	283.	290.
1873.00	21.	41.	62.	82.	101.	121.	139.	157.	174.	191.	203.	214.	227.	239.	249.	257.	268.	277.	284.	291.
1874.00	21.	41.	62.	82.	102.	121.	139.	157.	175.	191.	203.	215.	228.	240.	250.	257.	269.	278.	285.	292.
1875.00	21.	42.	62.	82.	102.	121.	140.	158.	175.	192.	204.	215.	228.	241.	251.	258.	270.	279.	286.	293.
1876.00	21.	42.	62.	82.	102.	122.	140.	158.	176.	192.	204.	216.	229.	241.	251.	259.	270.	279.	287.	293.
1877.00	21.	42.	62.	83.	103.	122.	141.	159.	176.	193.	205.	217.	230.	242.	252.	260.	271.	280.	287.	294.
1878.00	21.	42.	63.	83.	103.	122.	141.	159.	177.	193.	206.	217.	230.	243.	253.	260.	272.	281.	288.	295.
1879.00	21.	42.	63.	83.	103.	123.	141.	160.	177.	194.	206.	218.	231.	243.	254.	261.	273.	282.	289.	296.
1880.00	21.	42.	63.	83.	103.	123.	142.	160.	178.	195.	207.	218.	231.	244.	254.	262.	276.	283.	290.	297.
1881.00	21.	42.	63.	84.	104.	123.	142.	161.	178.	195.	207.	219.	232.	245.	255.	263.	274.	283.	291.	298.
1882.00	21.	42.	63.	84.	104.	124.	143.	161.	179.	196.	208.	220.	233.	245.	256.	263.	275.	284.	291.	298.
1883.00	21.	42.	63.	84.	104.	124.	143.	161.	179.	196.	208.	220.	233.	246.	256.	264.	276.	285.	292.	299.
1884.00	21.	43.	64.	84.	105.	124.	143.	162.	180.	197.	209.	221.	234.	247.	257.	265.	277.	286.	293.	300.
1885.00	21.	43.	64.	85.	105.	125.	144.	162.	180.	197.	210.	221.	235.	247.	258.	265.	277.	286.	294.	301.
1886.00	21.	43.	64.	85.	105.	125.	144.	163.	181.	198.	210.	222.	235.	248.	258.	266.	278.	287.	295.	302.
1887.00	22.	43.	64.	85.	105.	125.	145.	163.	181.	198.	211.	223.	236.	249.	259.	267.	279.	288.	295.	302.
1888.00	22.	43.	64.	85.	106.	126.	145.	164.	182.	199.	211.	223.	237.	249.	260.	268.	280.	289.	296.	303.
1889.00	22.	43.	64.	85.	106.	126.	145.	164.	182.	199.	212.	224.	237.	250.	261.	268.	280.	290.	297.	304.

PACOIMA DAM VALVE # 2 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) F.ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1889.00	22.	43.	64.	85.	106.	126.	145.	164.	182.	199.	212.	224.	237.	250.	261.	268.	280.	290.	297.	304.
1890.00	22.	43.	65.	86.	106.	126.	146.	165.	183.	200.	212.	224.	238.	251.	261.	269.	281.	290.	298.	305.
1891.00	22.	43.	65.	86.	107.	127.	146.	165.	183.	200.	213.	225.	238.	251.	262.	270.	282.	291.	298.	306.
1892.00	22.	44.	65.	86.	107.	127.	147.	165.	184.	201.	213.	226.	239.	252.	263.	270.	283.	292.	299.	306.
1893.00	22.	44.	65.	86.	107.	127.	147.	166.	184.	201.	214.	226.	240.	253.	263.	271.	283.	293.	300.	307.
1894.00	22.	44.	65.	87.	107.	128.	147.	166.	184.	202.	215.	227.	240.	253.	264.	272.	284.	293.	301.	308.
1895.00	22.	44.	65.	87.	108.	128.	148.	167.	185.	202.	215.	227.	241.	254.	265.	273.	285.	294.	302.	309.
1896.00	22.	44.	66.	87.	108.	128.	148.	167.	185.	203.	216.	228.	242.	255.	265.	273.	285.	295.	302.	310.
1897.00	22.	44.	66.	87.	108.	129.	148.	168.	186.	204.	216.	228.	242.	255.	266.	274.	286.	296.	303.	310.
1898.00	22.	44.	66.	87.	108.	129.	149.	168.	186.	204.	217.	229.	243.	256.	267.	275.	287.	296.	304.	311.
1899.00	22.	44.	66.	88.	109.	129.	149.	168.	187.	205.	217.	230.	243.	257.	267.	275.	288.	297.	305.	312.
1900.00	22.	44.	66.	88.	109.	130.	150.	169.	187.	205.	218.	230.	244.	257.	268.	276.	288.	298.	305.	313.
1901.00	22.	45.	66.	88.	109.	130.	150.	169.	188.	206.	218.	231.	245.	258.	269.	277.	289.	299.	306.	314.
1902.00	22.	45.	67.	88.	110.	130.	150.	170.	188.	206.	219.	231.	245.	258.	269.	277.	290.	299.	307.	314.
1903.00	22.	45.	67.	89.	110.	131.	151.	170.	189.	207.	219.	232.	246.	259.	270.	278.	290.	300.	308.	315.
1904.00	22.	45.	67.	89.	110.	131.	151.	170.	189.	207.	220.	232.	246.	260.	271.	279.	291.	301.	308.	316.
1905.00	23.	45.	67.	89.	110.	131.	151.	171.	190.	208.	221.	233.	247.	260.	271.	279.	292.	302.	309.	317.
1906.00	23.	45.	67.	89.	111.	132.	152.	171.	190.	208.	221.	234.	248.	261.	272.	280.	293.	302.	310.	317.
1907.00	23.	45.	67.	89.	111.	132.	152.	172.	191.	209.	222.	234.	248.	262.	273.	281.	293.	303.	311.	318.
1908.00	23.	45.	68.	90.	111.	132.	152.	172.	191.	209.	222.	235.	249.	262.	273.	281.	294.	304.	311.	319.
1909.00	23.	45.	68.	90.	111.	132.	153.	173.	191.	210.	223.	235.	249.	263.	274.	282.	295.	304.	312.	320.
1910.00	23.	46.	68.	90.	112.	133.	153.	173.	192.	210.	223.	236.	250.	264.	275.	283.	295.	305.	313.	320.
1911.00	23.	46.	68.	90.	112.	133.	154.	173.	192.	211.	224.	236.	251.	264.	275.	284.	296.	306.	314.	321.
1912.00	23.	46.	68.	90.	112.	133.	154.	174.	193.	211.	224.	237.	251.	265.	276.	284.	297.	307.	314.	322.
1913.00	23.	46.	68.	91.	112.	134.	154.	174.	193.	212.	225.	238.	252.	265.	277.	285.	298.	307.	315.	323.
1914.00	23.	46.	69.	91.	113.	134.	155.	175.	194.	212.	225.	238.	252.	266.	277.	286.	298.	308.	316.	324.
1915.00	23.	46.	69.	91.	113.	134.	155.	175.	194.	213.	226.	239.	253.	267.	278.	286.	299.	309.	317.	324.
1916.00	23.	46.	69.	91.	113.	135.	155.	175.	195.	213.	226.	239.	254.	267.	279.	287.	300.	310.	317.	325.
1917.00	23.	46.	69.	92.	114.	135.	156.	176.	195.	214.	227.	240.	254.	268.	279.	288.	300.	310.	318.	326.
1918.00	23.	46.	69.	92.	114.	135.	156.	176.	196.	214.	227.	240.	255.	269.	280.	288.	301.	311.	319.	327.
1919.00	23.	46.	69.	92.	114.	136.	156.	177.	196.	215.	228.	241.	255.	269.	280.	289.	302.	312.	320.	327.
1920.00	23.	47.	70.	92.	114.	136.	157.	177.	196.	215.	229.	241.	256.	270.	281.	289.	302.	312.	320.	328.
1921.00	23.	47.	70.	92.	115.	136.	157.	177.	197.	216.	229.	242.	257.	270.	282.	290.	303.	313.	321.	329.
1922.00	23.	47.	70.	93.	115.	137.	158.	178.	197.	216.	230.	243.	257.	271.	282.	291.	304.	314.	322.	330.
1923.00	24.	47.	70.	93.	115.	137.	158.	178.	198.	217.	230.	243.	258.	272.	283.	291.	304.	315.	323.	330.
1924.00	24.	47.	70.	93.	115.	137.	158.	179.	198.	217.	231.	244.	258.	272.	284.	292.	305.	315.	323.	331.

Pacoima Dam Valve #2 Rating Table - 30" Hollow Jet Valve

PACOIMA DAM VALVE # 2 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) F.ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1924.00	24.	47.	70.	93.	115.	137.	158.	179.	198.	217.	231.	244.	258.	272.	284.	292.	305.	315.	323.	331.
1925.00	24.	47.	70.	93.	116.	137.	159.	179.	199.	218.	231.	244.	259.	273.	284.	293.	306.	316.	324.	332.
1926.00	24.	47.	71.	93.	116.	138.	159.	179.	199.	218.	232.	245.	259.	273.	285.	293.	307.	317.	325.	332.
1927.00	24.	47.	71.	94.	116.	138.	159.	180.	200.	218.	232.	245.	260.	274.	286.	294.	307.	317.	325.	333.
1928.00	24.	47.	71.	94.	116.	138.	160.	180.	200.	219.	233.	246.	261.	275.	286.	295.	308.	318.	326.	334.
1929.00	24.	48.	71.	94.	117.	139.	160.	181.	200.	219.	233.	246.	261.	275.	287.	295.	309.	319.	327.	335.
1930.00	24.	48.	71.	94.	117.	139.	160.	181.	201.	220.	234.	247.	262.	276.	287.	296.	309.	319.	328.	335.
1931.00	24.	48.	71.	94.	117.	139.	161.	181.	201.	220.	234.	247.	262.	276.	288.	297.	310.	320.	328.	336.
1932.00	24.	48.	71.	95.	117.	140.	161.	182.	202.	221.	235.	248.	263.	277.	289.	297.	311.	321.	329.	337.
1933.00	24.	48.	72.	95.	118.	140.	161.	182.	202.	221.	235.	248.	263.	278.	289.	298.	311.	321.	330.	338.
1934.00	24.	48.	72.	95.	118.	140.	162.	183.	203.	222.	236.	249.	264.	278.	290.	299.	312.	322.	330.	338.
1935.00	24.	48.	72.	95.	118.	140.	162.	183.	203.	222.	236.	250.	265.	279.	291.	299.	313.	323.	331.	339.
1936.00	24.	48.	72.	95.	118.	141.	162.	183.	203.	223.	237.	250.	265.	279.	291.	300.	313.	324.	332.	340.
1937.00	24.	48.	72.	96.	119.	141.	163.	184.	204.	223.	237.	251.	266.	280.	292.	300.	314.	324.	333.	340.
1938.00	24.	48.	72.	96.	119.	141.	163.	184.	204.	224.	238.	251.	266.	281.	292.	301.	315.	325.	333.	341.
1939.00	24.	49.	73.	96.	119.	142.	163.	185.	205.	224.	238.	252.	267.	281.	293.	302.	315.	326.	334.	342.
1940.00	24.	49.	73.	96.	119.	142.	164.	185.	205.	225.	239.	252.	267.	282.	294.	302.	316.	326.	335.	343.
1941.00	24.	49.	73.	96.	120.	142.	164.	185.	206.	225.	239.	253.	268.	282.	294.	303.	317.	327.	335.	343.
1942.00	24.	49.	73.	97.	120.	143.	164.	186.	206.	226.	240.	253.	268.	283.	295.	304.	317.	328.	336.	344.
1943.00	25.	49.	73.	97.	120.	143.	165.	186.	206.	226.	240.	254.	269.	284.	295.	306.	318.	328.	337.	345.
1944.00	25.	49.	73.	97.	120.	143.	165.	186.	207.	227.	241.	254.	270.	284.	296.	305.	318.	329.	337.	345.
1945.00	25.	49.	73.	97.	121.	143.	165.	187.	207.	227.	241.	255.	270.	285.	297.	306.	319.	330.	338.	346.
1946.00	25.	49.	74.	97.	121.	144.	166.	187.	208.	227.	242.	255.	271.	285.	297.	306.	320.	330.	339.	347.
1947.00	25.	49.	74.	98.	121.	144.	166.	188.	208.	228.	242.	256.	271.	286.	298.	307.	320.	331.	339.	348.
1948.00	25.	49.	74.	98.	121.	144.	167.	188.	209.	228.	243.	256.	272.	286.	298.	307.	321.	332.	340.	348.
1949.00	25.	50.	74.	98.	122.	145.	167.	188.	209.	229.	243.	257.	272.	287.	299.	308.	322.	332.	341.	349.
1950.00	25.	50.	74.	98.	122.	145.	167.	189.	209.	229.	244.	257.	273.	288.	300.	309.	322.	333.	342.	350.

Pacoima Dam Valve #3 Rating Table - 30" Hollow Jet Valve

PACOIMA DAM VALVE #3 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) F. ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1850.00	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1851.00	16.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.	25.
1852.00	16.	32.	47.	63.	78.	78.	78.	78.	78.	78.	78.	78.	78.	78.	78.	78.	78.	78.	78.	78.
1853.00	16.	32.	48.	63.	78.	93.	108.	122.	135.	148.	157.	157.	157.	157.	157.	157.	157.	157.	157.	157.
1854.00	16.	32.	48.	63.	79.	94.	108.	122.	136.	149.	159.	168.	178.	188.	196.	202.	212.	219.	225.	230.
1855.00	16.	32.	48.	64.	79.	94.	109.	123.	137.	150.	159.	169.	179.	189.	197.	203.	213.	220.	226.	231.
1856.00	16.	32.	48.	64.	80.	95.	109.	124.	137.	151.	160.	169.	180.	190.	198.	204.	214.	221.	227.	232.
1857.00	16.	33.	49.	64.	80.	95.	110.	124.	138.	151.	161.	170.	181.	191.	199.	205.	215.	222.	228.	233.
1858.00	16.	33.	49.	65.	80.	96.	110.	125.	139.	152.	162.	171.	182.	192.	200.	206.	216.	223.	229.	235.
1859.00	16.	33.	49.	65.	81.	96.	111.	125.	139.	153.	162.	172.	182.	192.	201.	207.	217.	224.	230.	236.
1860.00	17.	33.	49.	65.	81.	96.	111.	126.	140.	153.	163.	173.	183.	193.	202.	208.	218.	225.	231.	237.
1861.00	17.	33.	49.	66.	81.	97.	112.	126.	141.	154.	164.	173.	184.	194.	203.	209.	219.	226.	232.	238.
1862.00	17.	33.	50.	66.	82.	97.	112.	127.	141.	155.	165.	175.	185.	195.	204.	210.	219.	227.	233.	239.
1863.00	17.	33.	50.	66.	82.	98.	113.	128.	142.	155.	165.	175.	186.	196.	204.	211.	220.	228.	234.	240.
1864.00	17.	34.	50.	66.	82.	98.	113.	128.	142.	156.	166.	176.	186.	197.	205.	212.	221.	229.	235.	241.
1865.00	17.	34.	50.	67.	83.	99.	114.	129.	143.	157.	167.	176.	187.	198.	206.	213.	222.	230.	236.	242.
1866.00	17.	34.	51.	67.	83.	99.	114.	129.	144.	158.	168.	177.	188.	199.	207.	214.	223.	231.	237.	243.
1867.00	17.	34.	51.	67.	84.	99.	115.	130.	144.	158.	168.	178.	189.	199.	208.	216.	224.	232.	238.	244.
1868.00	17.	34.	51.	68.	84.	100.	115.	130.	145.	159.	169.	179.	190.	200.	209.	215.	225.	233.	239.	245.
1869.00	17.	34.	51.	68.	84.	100.	116.	131.	146.	160.	170.	180.	191.	201.	210.	216.	226.	234.	240.	246.
1870.00	17.	34.	51.	68.	85.	101.	116.	132.	146.	160.	170.	180.	191.	202.	211.	217.	227.	235.	241.	247.
1871.00	17.	35.	52.	68.	85.	101.	117.	132.	147.	161.	171.	181.	192.	203.	212.	218.	228.	236.	242.	248.
1872.00	17.	35.	52.	69.	85.	102.	117.	133.	147.	162.	172.	182.	193.	204.	212.	219.	229.	237.	243.	249.
1873.00	17.	35.	52.	69.	86.	102.	118.	133.	148.	162.	173.	182.	194.	204.	213.	220.	230.	238.	244.	250.
1874.00	18.	35.	52.	69.	86.	102.	118.	134.	149.	163.	173.	183.	194.	205.	214.	221.	231.	239.	245.	251.
1875.00	18.	35.	52.	70.	86.	103.	119.	134.	149.	164.	174.	184.	195.	206.	215.	222.	232.	240.	246.	252.
1876.00	18.	35.	53.	70.	87.	103.	119.	135.	150.	164.	175.	185.	196.	207.	216.	223.	233.	241.	247.	253.
1877.00	18.	35.	53.	70.	87.	104.	120.	135.	150.	165.	175.	185.	197.	208.	217.	223.	234.	242.	248.	254.
1878.00	18.	36.	53.	70.	87.	104.	120.	136.	151.	165.	176.	186.	198.	209.	218.	224.	235.	243.	249.	255.
1879.00	18.	36.	53.	71.	88.	104.	121.	136.	152.	166.	177.	187.	198.	209.	218.	225.	236.	244.	250.	256.
1880.00	18.	36.	54.	71.	88.	105.	121.	137.	152.	167.	177.	188.	199.	210.	219.	226.	236.	245.	251.	257.
1881.00	18.	36.	54.	71.	88.	105.	122.	137.	153.	167.	178.	188.	200.	211.	220.	227.	237.	245.	252.	258.
1882.00	18.	36.	54.	72.	89.	106.	122.	138.	153.	168.	179.	189.	201.	212.	221.	228.	238.	246.	253.	259.
1883.00	18.	36.	54.	72.	89.	106.	122.	138.	154.	169.	179.	190.	201.	213.	222.	229.	239.	247.	254.	260.
1884.00	18.	36.	54.	72.	89.	106.	123.	139.	154.	169.	180.	190.	202.	213.	223.	229.	240.	248.	255.	261.
1885.00	18.	37.	55.	72.	90.	107.	123.	139.	155.	170.	181.	191.	203.	214.	223.	230.	241.	249.	256.	262.
1886.00	18.	37.	55.	73.	90.	107.	124.	140.	156.	171.	181.	192.	204.	215.	224.	231.	242.	250.	257.	263.
1887.00	18.	37.	55.	73.	90.	108.	124.	141.	156.	171.	182.	193.	204.	216.	225.	232.	243.	251.	258.	264.
1888.00	19.	37.	55.	73.	91.	108.	125.	141.	157.	172.	183.	193.	205.	217.	226.	233.	244.	252.	259.	265.
1889.00	19.	37.	55.	73.	91.	108.	125.	142.	157.	172.	183.	194.	206.	217.	227.	234.	245.	253.	260.	266.

Pacoima Dam Valve #3 Rating Table - 30" Hollow Jet Valve

PACOIMA DAM VALVE #3 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) E. ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1889.00	19.	37.	55.	73.	91.	108.	125.	142.	157.	172.	183.	194.	206.	217.	227.	234.	245.	253.	260.	266.
1890.00	19.	37.	56.	74.	91.	109.	126.	142.	158.	173.	184.	195.	207.	218.	228.	235.	245.	254.	261.	267.
1891.00	19.	37.	56.	74.	92.	109.	126.	143.	158.	174.	185.	195.	207.	219.	228.	235.	246.	255.	261.	268.
1892.00	19.	37.	56.	74.	92.	110.	127.	143.	159.	174.	185.	196.	208.	220.	229.	236.	247.	256.	262.	269.
1893.00	19.	38.	56.	74.	92.	110.	127.	144.	160.	175.	186.	197.	209.	220.	230.	237.	248.	256.	263.	270.
1894.00	19.	38.	56.	75.	93.	110.	127.	144.	160.	176.	187.	197.	210.	221.	231.	238.	249.	257.	264.	271.
1895.00	19.	38.	57.	75.	93.	111.	128.	145.	161.	176.	187.	198.	210.	222.	232.	239.	250.	258.	265.	272.
1896.00	19.	38.	57.	75.	93.	111.	128.	145.	161.	177.	188.	199.	211.	223.	232.	240.	251.	259.	266.	273.
1897.00	19.	38.	57.	75.	94.	111.	129.	146.	162.	177.	189.	200.	212.	224.	233.	240.	251.	260.	267.	274.
1898.00	19.	38.	57.	76.	94.	112.	129.	146.	162.	178.	189.	200.	212.	224.	234.	241.	252.	261.	268.	275.
1899.00	19.	38.	57.	76.	94.	112.	130.	147.	163.	179.	190.	201.	213.	225.	235.	242.	253.	262.	269.	275.
1900.00	19.	38.	57.	76.	95.	113.	130.	147.	163.	179.	191.	202.	214.	226.	236.	243.	254.	263.	270.	276.
1901.00	19.	39.	58.	76.	95.	113.	131.	148.	164.	180.	191.	202.	215.	227.	236.	244.	255.	264.	271.	277.
1902.00	19.	39.	58.	77.	95.	113.	131.	148.	164.	180.	192.	203.	215.	227.	237.	244.	256.	264.	271.	278.
1903.00	19.	39.	58.	77.	96.	114.	131.	148.	165.	181.	192.	204.	216.	228.	238.	245.	257.	265.	272.	279.
1904.00	20.	39.	58.	77.	96.	114.	132.	149.	166.	181.	193.	204.	217.	229.	239.	246.	257.	266.	273.	280.
1905.00	20.	39.	58.	77.	96.	114.	132.	149.	166.	182.	194.	205.	217.	230.	239.	247.	258.	267.	274.	281.
1906.00	20.	39.	59.	78.	97.	115.	133.	150.	167.	183.	194.	206.	218.	230.	240.	248.	259.	268.	275.	282.
1907.00	20.	39.	59.	78.	97.	115.	133.	150.	167.	183.	195.	206.	219.	231.	241.	248.	260.	269.	276.	283.
1908.00	20.	39.	59.	78.	97.	116.	134.	151.	168.	184.	196.	207.	220.	232.	242.	249.	261.	270.	277.	284.
1909.00	20.	40.	59.	78.	97.	116.	134.	151.	168.	184.	196.	207.	220.	232.	243.	250.	262.	270.	278.	285.
1910.00	20.	40.	59.	79.	98.	116.	134.	152.	169.	185.	197.	208.	221.	233.	243.	251.	262.	271.	278.	285.
1911.00	20.	40.	60.	79.	98.	117.	135.	152.	169.	186.	197.	209.	222.	234.	244.	252.	263.	272.	279.	286.
1912.00	20.	40.	60.	79.	98.	117.	135.	153.	170.	186.	198.	209.	222.	235.	245.	252.	264.	273.	280.	287.
1913.00	20.	40.	60.	79.	99.	117.	136.	153.	170.	187.	199.	210.	223.	235.	246.	253.	265.	274.	281.	288.
1914.00	20.	40.	60.	80.	99.	118.	136.	154.	171.	187.	199.	211.	224.	236.	246.	254.	266.	275.	282.	289.
1915.00	20.	40.	60.	80.	99.	118.	136.	154.	171.	188.	200.	211.	224.	237.	247.	255.	266.	276.	283.	290.
1916.00	20.	40.	60.	80.	100.	118.	137.	155.	172.	188.	200.	212.	225.	238.	248.	255.	267.	276.	284.	291.
1917.00	20.	41.	61.	80.	100.	119.	137.	155.	172.	189.	201.	213.	226.	238.	249.	256.	268.	277.	285.	292.
1918.00	20.	41.	61.	81.	100.	119.	138.	156.	173.	190.	202.	213.	226.	239.	249.	257.	269.	278.	285.	292.
1919.00	20.	41.	61.	81.	100.	120.	138.	156.	173.	190.	202.	214.	227.	240.	250.	258.	270.	279.	286.	293.
1920.00	21.	41.	61.	81.	101.	120.	138.	157.	174.	191.	203.	215.	228.	240.	251.	258.	270.	280.	287.	294.
1921.00	21.	41.	61.	81.	101.	120.	139.	157.	174.	191.	203.	215.	228.	241.	252.	259.	271.	280.	288.	295.
1922.00	21.	41.	62.	82.	101.	121.	139.	157.	175.	192.	204.	216.	229.	242.	252.	260.	272.	281.	289.	296.
1923.00	21.	41.	62.	82.	102.	121.	140.	158.	175.	192.	205.	216.	230.	242.	253.	261.	273.	282.	290.	297.
1924.00	21.	41.	62.	82.	102.	121.	140.	158.	176.	193.	205.	217.	230.	243.	254.	262.	274.	283.	290.	298.

PACOIMA DAM VALVE #3 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) E. ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1924.00	21.	41.	62.	82.	102.	121.	140.	158.	176.	193.	205.	217.	230.	243.	254.	262.	274.	283.	290.	298.
1925.00	21.	42.	62.	82.	102.	122.	141.	159.	176.	193.	206.	218.	231.	244.	254.	262.	274.	284.	291.	299.
1926.00	21.	42.	62.	83.	103.	122.	141.	159.	177.	194.	206.	218.	232.	245.	255.	263.	275.	285.	292.	299.
1927.00	21.	42.	62.	83.	103.	122.	141.	160.	177.	195.	207.	219.	232.	245.	256.	264.	276.	285.	293.	300.
1928.00	21.	42.	63.	83.	103.	123.	142.	160.	178.	195.	208.	220.	233.	246.	257.	264.	277.	286.	294.	301.
1929.00	21.	42.	63.	83.	103.	123.	142.	161.	178.	196.	208.	220.	234.	247.	257.	265.	277.	287.	295.	302.
1930.00	21.	42.	63.	84.	104.	123.	142.	161.	179.	196.	209.	221.	234.	247.	258.	266.	278.	288.	295.	303.
1931.00	21.	42.	63.	84.	104.	124.	143.	162.	179.	197.	209.	221.	235.	248.	259.	267.	279.	289.	296.	304.
1932.00	21.	42.	63.	84.	104.	124.	143.	162.	180.	197.	210.	222.	236.	249.	259.	267.	280.	289.	297.	304.
1933.00	21.	43.	64.	84.	105.	124.	144.	162.	180.	198.	210.	223.	236.	249.	260.	268.	281.	290.	298.	305.
1934.00	21.	43.	64.	84.	105.	125.	144.	163.	181.	198.	211.	223.	237.	250.	261.	269.	281.	291.	299.	306.
1935.00	21.	43.	64.	85.	105.	125.	144.	163.	181.	199.	212.	224.	238.	251.	262.	270.	282.	292.	299.	307.
1936.00	21.	43.	64.	85.	105.	125.	145.	164.	182.	199.	212.	224.	238.	251.	262.	270.	283.	293.	300.	308.
1937.00	22.	43.	64.	85.	106.	126.	145.	164.	182.	200.	213.	225.	239.	252.	263.	271.	284.	293.	301.	309.
1938.00	22.	43.	64.	85.	106.	126.	146.	165.	183.	201.	213.	226.	239.	253.	264.	272.	284.	296.	302.	309.
1939.00	22.	43.	65.	86.	106.	126.	146.	165.	183.	201.	214.	226.	240.	253.	264.	273.	285.	295.	303.	310.
1940.00	22.	43.	65.	86.	106.	127.	146.	165.	184.	202.	214.	227.	241.	254.	265.	273.	286.	296.	303.	311.
1941.00	22.	43.	65.	86.	107.	127.	147.	166.	184.	202.	215.	227.	241.	255.	266.	274.	287.	296.	304.	312.
1942.00	22.	44.	65.	86.	107.	127.	147.	166.	185.	203.	216.	228.	242.	255.	267.	275.	287.	297.	305.	313.
1943.00	22.	44.	65.	86.	107.	128.	148.	167.	185.	203.	216.	229.	243.	256.	267.	275.	288.	298.	306.	313.
1944.00	22.	44.	65.	87.	108.	128.	148.	167.	186.	204.	217.	229.	243.	257.	268.	276.	289.	299.	307.	314.
1945.00	22.	44.	66.	87.	108.	128.	148.	168.	186.	204.	217.	230.	244.	257.	269.	277.	290.	300.	307.	315.
1946.00	22.	44.	66.	87.	108.	129.	149.	168.	187.	205.	218.	230.	245.	258.	269.	278.	290.	300.	308.	316.
1947.00	22.	44.	66.	87.	108.	129.	149.	168.	187.	205.	218.	231.	245.	259.	270.	278.	291.	301.	309.	317.
1948.00	22.	44.	66.	88.	109.	129.	149.	169.	188.	206.	219.	232.	246.	259.	271.	279.	292.	302.	310.	318.
1949.00	22.	44.	66.	88.	109.	130.	150.	169.	188.	206.	219.	232.	246.	260.	271.	280.	293.	303.	311.	318.
1950.00	22.	44.	66.	88.	109.	130.	150.	170.	189.	207.	220.	233.	247.	261.	272.	280.	293.	303.	311.	319.

Pacoima Dam Valve #4 Rating Table - 30" Hollow Jet Valve

PACOIMA DAM VALVE #4 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) E. ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1851.00	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
1852.00	11.	23.	34.	45.	52.	52.	52.	52.	52.	52.	52.	52.	52.	52.	52.	52.	52.	52.	52.	52.
1853.00	11.	23.	34.	45.	56.	67.	78.	88.	98.	107.	114.	117.	117.	117.	117.	117.	117.	117.	117.	117.
1854.00	12.	23.	35.	46.	57.	68.	78.	89.	99.	108.	115.	122.	130.	137.	143.	148.	155.	160.	165.	169.
1855.00	12.	23.	35.	46.	57.	68.	79.	89.	100.	109.	116.	123.	131.	138.	144.	149.	156.	162.	166.	170.
1856.00	12.	24.	35.	47.	58.	69.	80.	90.	100.	110.	117.	124.	132.	140.	146.	150.	158.	163.	168.	172.
1857.00	12.	24.	35.	47.	58.	70.	80.	91.	101.	111.	118.	125.	133.	141.	147.	152.	159.	165.	169.	173.
1858.00	12.	24.	36.	47.	59.	70.	81.	92.	102.	112.	119.	126.	134.	142.	148.	153.	160.	166.	170.	175.
1859.00	12.	24.	36.	48.	59.	71.	82.	93.	103.	113.	120.	128.	136.	143.	150.	154.	162.	167.	172.	176.
1860.00	12.	24.	36.	48.	60.	71.	83.	93.	104.	114.	121.	129.	137.	144.	151.	156.	163.	169.	173.	178.
1861.00	12.	25.	37.	49.	60.	72.	83.	94.	105.	115.	122.	130.	138.	146.	152.	157.	164.	170.	175.	179.
1862.00	12.	25.	37.	49.	61.	73.	84.	95.	106.	116.	123.	131.	139.	147.	153.	158.	166.	172.	176.	181.
1863.00	13.	25.	37.	49.	61.	73.	85.	96.	107.	117.	124.	132.	140.	148.	155.	159.	167.	173.	178.	182.
1864.00	13.	25.	38.	50.	62.	74.	85.	97.	107.	118.	125.	133.	141.	149.	156.	161.	168.	174.	179.	184.
1865.00	13.	25.	38.	50.	62.	74.	86.	97.	108.	119.	126.	134.	142.	150.	157.	162.	170.	176.	180.	185.
1866.00	13.	26.	38.	51.	63.	75.	87.	98.	109.	120.	127.	135.	143.	152.	158.	163.	171.	177.	182.	187.
1867.00	13.	26.	38.	51.	63.	75.	87.	99.	110.	121.	128.	136.	144.	153.	159.	164.	172.	178.	183.	188.
1868.00	13.	26.	39.	51.	64.	76.	88.	99.	111.	121.	129.	137.	146.	154.	161.	166.	174.	180.	185.	189.
1869.00	13.	26.	39.	52.	64.	77.	89.	100.	111.	122.	130.	138.	147.	155.	162.	167.	175.	181.	186.	191.
1870.00	13.	26.	39.	52.	65.	77.	89.	101.	112.	123.	131.	139.	148.	156.	163.	168.	176.	182.	187.	192.
1871.00	13.	26.	40.	53.	65.	78.	90.	102.	113.	124.	132.	140.	149.	157.	164.	169.	177.	184.	189.	194.
1872.00	13.	27.	40.	53.	66.	78.	90.	102.	114.	125.	133.	141.	150.	158.	165.	171.	179.	185.	190.	195.
1873.00	13.	27.	40.	53.	66.	79.	91.	103.	115.	126.	134.	142.	151.	159.	166.	172.	180.	186.	191.	196.
1874.00	14.	27.	40.	54.	67.	79.	92.	104.	115.	127.	135.	143.	152.	160.	168.	173.	181.	187.	193.	198.
1875.00	14.	27.	41.	54.	67.	80.	92.	104.	116.	128.	136.	144.	153.	162.	169.	174.	182.	189.	194.	199.
1876.00	14.	27.	41.	54.	67.	80.	93.	105.	117.	128.	137.	145.	154.	163.	170.	175.	183.	190.	195.	200.
1877.00	14.	28.	41.	55.	68.	81.	94.	106.	118.	129.	138.	146.	155.	164.	171.	176.	185.	191.	196.	202.
1878.00	14.	28.	41.	55.	68.	81.	94.	107.	119.	130.	139.	147.	156.	165.	172.	177.	186.	192.	198.	203.
1879.00	14.	28.	42.	55.	69.	82.	95.	107.	119.	131.	139.	148.	157.	166.	173.	179.	187.	194.	199.	204.
1880.00	14.	28.	42.	56.	69.	82.	95.	108.	120.	132.	140.	149.	158.	167.	174.	180.	188.	195.	200.	205.
1881.00	14.	28.	42.	56.	70.	83.	96.	109.	121.	133.	141.	149.	159.	168.	175.	181.	189.	196.	201.	207.
1882.00	14.	28.	43.	56.	70.	83.	97.	109.	122.	133.	142.	150.	160.	169.	176.	182.	191.	197.	203.	208.
1883.00	14.	29.	43.	57.	71.	84.	97.	110.	122.	134.	143.	151.	161.	170.	177.	183.	192.	199.	204.	209.
1884.00	14.	29.	43.	57.	71.	85.	98.	111.	123.	135.	144.	152.	162.	171.	179.	184.	193.	200.	205.	210.
1885.00	15.	29.	43.	57.	71.	85.	98.	111.	124.	136.	145.	153.	163.	172.	180.	185.	194.	201.	206.	212.
1886.00	15.	29.	44.	58.	72.	86.	99.	112.	124.	137.	145.	154.	164.	173.	181.	186.	195.	202.	208.	213.
1887.00	15.	29.	44.	58.	72.	86.	99.	113.	125.	137.	146.	155.	165.	174.	182.	187.	196.	203.	209.	214.
1888.00	15.	29.	44.	58.	73.	86.	100.	113.	126.	138.	147.	156.	166.	175.	183.	188.	197.	206.	210.	215.
1889.00	15.	30.	44.	59.	73.	87.	101.	114.	127.	139.	148.	157.	167.	176.	184.	190.	199.	206.	211.	217.

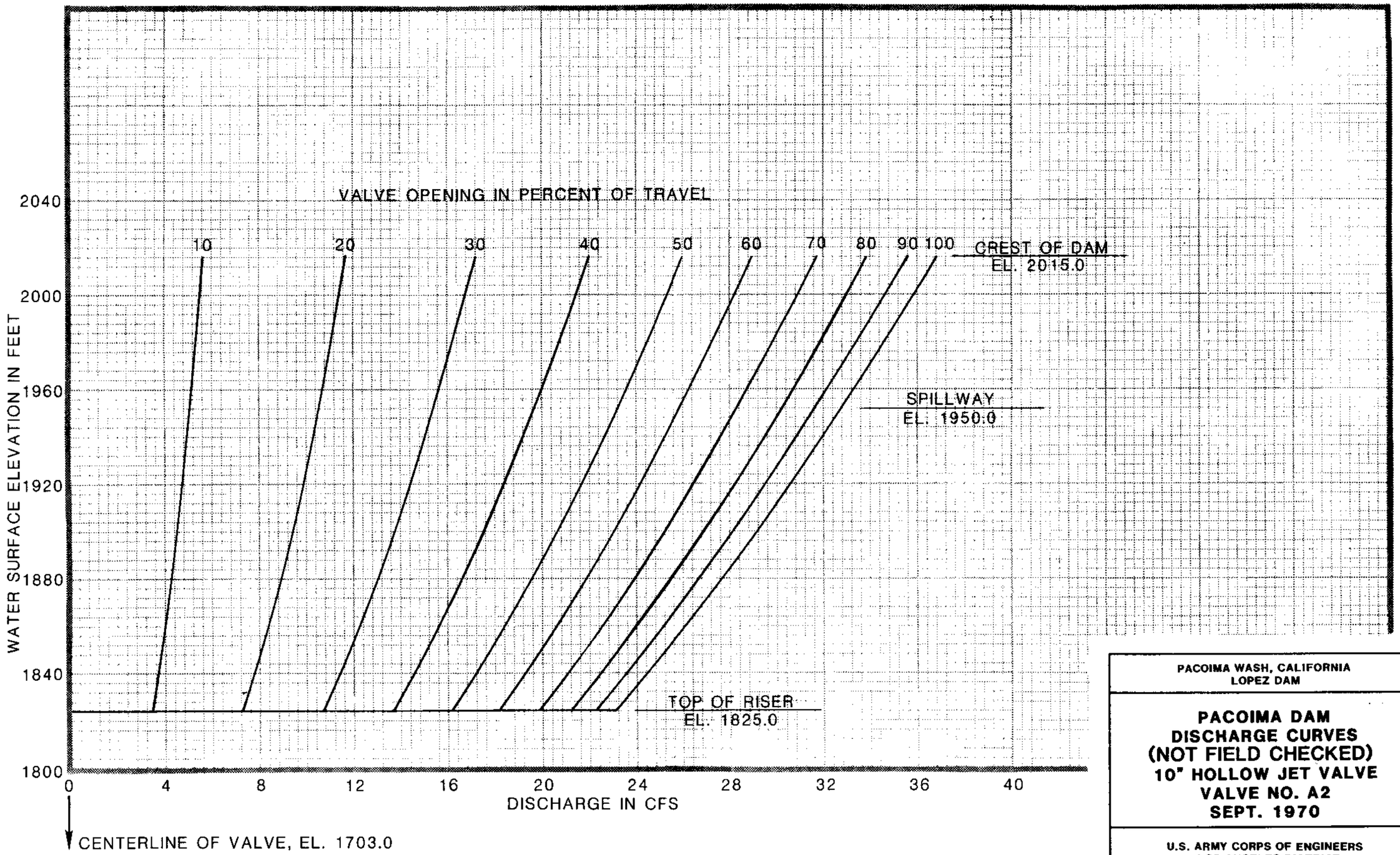
Pacoima Dam Valve #4 Rating Table - 30" Hollow Jet Valve

PACOIMA DAM VALVE #4 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) E. ALVES

RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1889.00	15.	30.	44.	59.	73.	87.	101.	114.	127.	139.	148.	157.	167.	176.	184.	190.	199.	206.	211.	217.
1890.00	15.	30.	45.	59.	73.	87.	101.	114.	127.	140.	149.	158.	167.	177.	185.	191.	200.	207.	212.	218.
1891.00	15.	30.	45.	59.	74.	88.	102.	115.	128.	141.	150.	158.	168.	178.	186.	192.	201.	208.	214.	219.
1892.00	15.	30.	45.	60.	74.	88.	102.	116.	129.	141.	150.	159.	169.	179.	187.	193.	202.	209.	215.	220.
1893.00	15.	30.	45.	60.	75.	89.	103.	116.	129.	142.	151.	160.	170.	180.	188.	194.	203.	210.	216.	221.
1894.00	15.	30.	46.	60.	75.	89.	103.	117.	130.	143.	152.	161.	171.	181.	189.	195.	204.	211.	217.	223.
1895.00	15.	31.	46.	61.	75.	90.	104.	118.	131.	144.	153.	162.	172.	182.	190.	196.	205.	212.	218.	224.
1896.00	15.	31.	46.	61.	76.	90.	104.	118.	132.	144.	154.	163.	173.	183.	191.	197.	206.	213.	219.	225.
1897.00	16.	31.	46.	61.	76.	91.	105.	119.	132.	145.	154.	164.	174.	184.	192.	198.	207.	215.	220.	226.
1898.00	16.	31.	47.	62.	77.	91.	106.	119.	133.	146.	155.	164.	175.	185.	193.	199.	208.	216.	222.	227.
1899.00	16.	31.	47.	62.	77.	92.	106.	120.	134.	147.	156.	165.	176.	186.	194.	200.	209.	217.	223.	228.
1900.00	16.	31.	47.	62.	77.	92.	107.	121.	134.	147.	157.	166.	176.	187.	195.	201.	210.	218.	224.	230.
1901.00	16.	32.	47.	63.	78.	93.	107.	121.	135.	148.	158.	167.	177.	187.	196.	202.	212.	219.	225.	231.
1902.00	16.	32.	47.	63.	78.	93.	108.	122.	136.	149.	158.	168.	178.	188.	197.	203.	213.	220.	226.	232.
1903.00	16.	32.	48.	63.	79.	94.	108.	122.	136.	150.	159.	169.	179.	189.	198.	204.	214.	221.	227.	233.
1904.00	16.	32.	48.	64.	79.	94.	109.	123.	137.	150.	160.	169.	180.	190.	199.	205.	215.	222.	228.	234.
1905.00	16.	32.	48.	64.	79.	94.	109.	124.	138.	151.	161.	170.	181.	191.	200.	206.	216.	223.	229.	235.
1906.00	16.	32.	48.	64.	80.	95.	110.	124.	138.	152.	161.	171.	182.	192.	201.	207.	217.	224.	230.	236.
1907.00	16.	33.	49.	64.	80.	95.	110.	125.	139.	152.	162.	172.	183.	193.	201.	208.	218.	225.	232.	238.
1908.00	16.	33.	49.	65.	80.	96.	111.	125.	139.	153.	163.	173.	183.	194.	202.	209.	219.	226.	233.	239.
1909.00	16.	33.	49.	65.	81.	96.	111.	126.	140.	154.	164.	173.	184.	195.	203.	210.	220.	227.	234.	240.
1910.00	17.	33.	49.	65.	81.	97.	112.	127.	141.	155.	164.	174.	185.	196.	204.	211.	221.	229.	235.	241.
1911.00	17.	33.	49.	66.	82.	97.	112.	127.	141.	155.	165.	175.	186.	197.	205.	212.	222.	230.	236.	242.
1912.00	17.	33.	50.	66.	82.	98.	113.	128.	142.	156.	166.	176.	187.	197.	206.	213.	223.	231.	237.	243.
1913.00	17.	33.	50.	66.	82.	98.	113.	128.	143.	157.	167.	177.	188.	198.	207.	214.	224.	232.	238.	244.
1914.00	17.	34.	50.	67.	83.	98.	114.	129.	143.	157.	167.	177.	188.	199.	208.	215.	225.	233.	239.	245.
1915.00	17.	34.	50.	67.	83.	99.	114.	129.	144.	158.	168.	178.	189.	200.	209.	215.	226.	234.	240.	246.
1916.00	17.	34.	51.	67.	83.	99.	115.	130.	145.	159.	169.	179.	190.	201.	210.	216.	227.	235.	241.	247.
1917.00	17.	34.	51.	67.	84.	100.	115.	130.	145.	159.	170.	180.	191.	202.	211.	217.	228.	236.	242.	248.
1918.00	17.	34.	51.	68.	84.	100.	116.	131.	146.	160.	170.	180.	192.	203.	212.	218.	229.	237.	243.	249.
1919.00	17.	34.	51.	68.	84.	101.	116.	132.	146.	161.	171.	181.	193.	203.	212.	219.	230.	238.	244.	251.
1920.00	17.	34.	51.	68.	85.	101.	117.	132.	147.	161.	172.	182.	193.	204.	213.	220.	231.	239.	245.	252.
1921.00	17.	35.	52.	69.	85.	101.	117.	133.	148.	162.	173.	183.	194.	205.	214.	221.	232.	240.	246.	253.
1922.00	17.	35.	52.	69.	86.	102.	118.	133.	148.	163.	173.	183.	195.	206.	215.	222.	232.	241.	247.	254.
1923.00	17.	35.	52.	69.	86.	102.	118.	134.	149.	163.	174.	184.	196.	207.	216.	223.	233.	242.	248.	255.
1924.00	18.	35.	52.	69.	86.	103.	119.	134.	149.	164.	175.	185.	197.	208.	217.	224.	234.	243.	249.	256.

PACOIMA DAM VALVE #4 RATING TABLE - 30" HOLLOW JET VALVE *** RATING TABLE EFFECTIVE JANUARY 1977 (01-07-77) E. ALVES

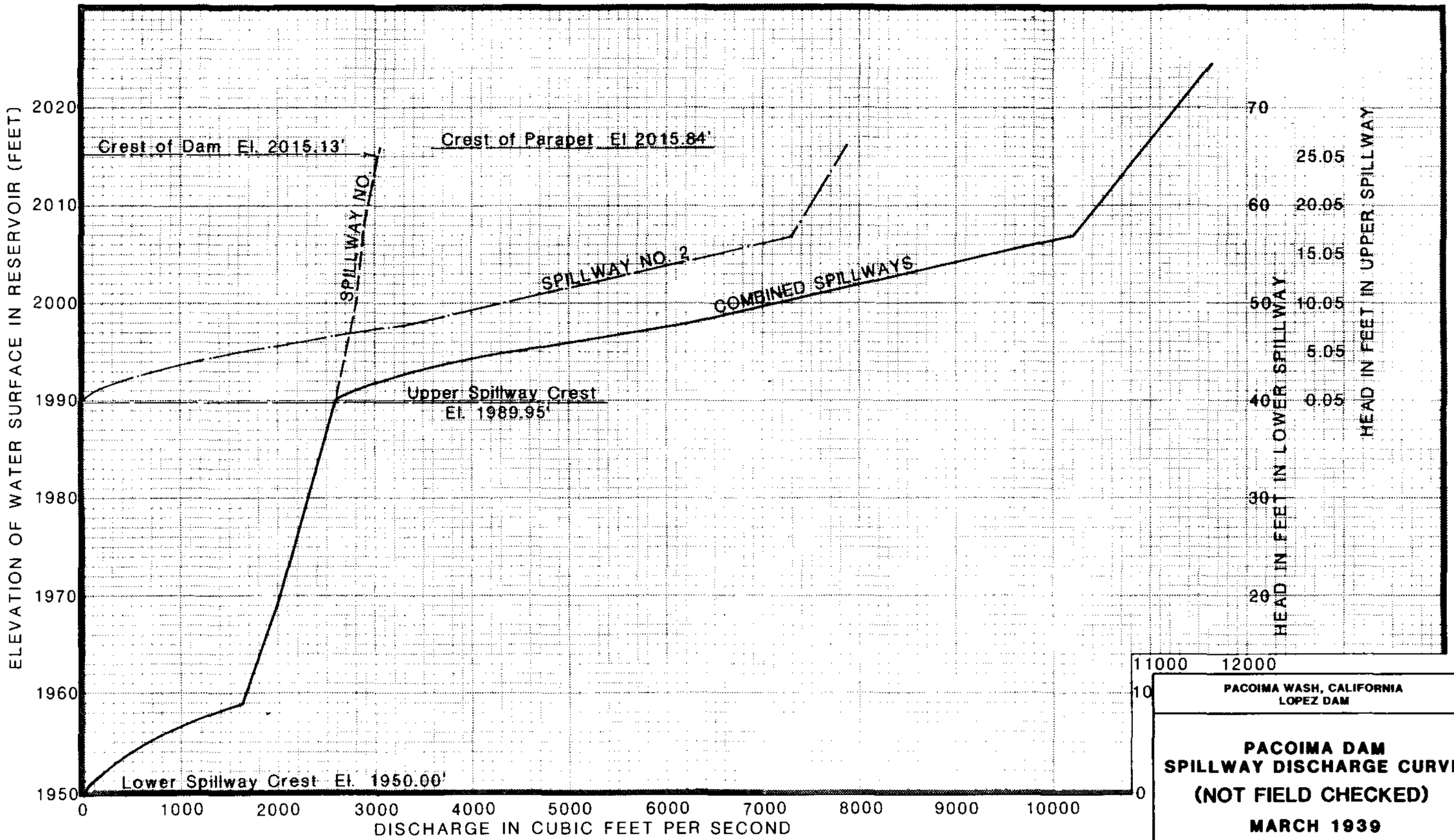
RESERVOIR ELEVATION (FEET)	TABULATED DISCHARGE (CFS) PERCENT VALVE OPENING 5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
1924.00	18.	35.	52.	69.	86.	103.	119.	134.	149.	164.	175.	185.	197.	208.	217.	224.	234.	243.	249.	256.
1925.00	18.	35.	53.	70.	87.	103.	119.	135.	150.	165.	175.	186.	197.	209.	218.	225.	235.	244.	250.	257.
1926.00	18.	35.	53.	70.	87.	103.	120.	135.	151.	165.	176.	186.	198.	209.	219.	226.	236.	245.	251.	258.
1927.00	18.	35.	53.	70.	87.	104.	120.	136.	151.	166.	177.	187.	199.	210.	220.	226.	237.	246.	252.	259.
1928.00	18.	36.	53.	71.	88.	104.	121.	136.	152.	167.	177.	188.	200.	211.	220.	227.	238.	247.	253.	260.
1929.00	18.	36.	53.	71.	88.	105.	121.	137.	152.	167.	178.	189.	200.	212.	221.	228.	239.	247.	254.	261.
1930.00	18.	36.	54.	71.	88.	105.	122.	138.	153.	168.	179.	189.	201.	213.	222.	229.	240.	248.	255.	262.
1931.00	18.	36.	54.	71.	89.	106.	122.	138.	154.	169.	180.	190.	202.	213.	223.	230.	241.	249.	256.	263.
1932.00	18.	36.	54.	72.	89.	106.	122.	139.	154.	169.	180.	191.	203.	214.	224.	231.	242.	250.	257.	264.
1933.00	18.	36.	54.	72.	89.	106.	123.	139.	155.	170.	181.	192.	204.	215.	225.	232.	243.	251.	258.	265.
1934.00	18.	36.	54.	72.	90.	107.	123.	140.	155.	171.	182.	192.	204.	216.	226.	233.	244.	252.	259.	266.
1935.00	18.	37.	55.	72.	90.	107.	124.	140.	156.	171.	182.	193.	205.	217.	226.	233.	245.	253.	260.	267.
1936.00	18.	37.	55.	73.	90.	108.	124.	141.	157.	172.	183.	194.	206.	218.	227.	234.	245.	254.	261.	268.
1937.00	18.	37.	55.	73.	91.	108.	125.	141.	157.	172.	184.	194.	207.	218.	228.	235.	246.	255.	262.	269.
1938.00	19.	37.	55.	73.	91.	108.	125.	142.	158.	173.	184.	195.	207.	219.	229.	236.	247.	256.	263.	270.
1939.00	19.	37.	55.	73.	91.	109.	126.	142.	158.	174.	185.	196.	208.	220.	230.	237.	248.	257.	264.	271.
1940.00	19.	37.	56.	74.	92.	109.	126.	143.	159.	174.	186.	197.	209.	221.	230.	238.	249.	258.	265.	272.
1941.00	19.	37.	56.	74.	92.	109.	127.	143.	159.	175.	186.	197.	210.	221.	231.	239.	250.	259.	266.	273.
1942.00	19.	37.	56.	74.	92.	110.	127.	144.	160.	176.	187.	198.	210.	222.	232.	239.	251.	260.	267.	274.
1943.00	19.	38.	56.	75.	93.	110.	127.	144.	160.	176.	188.	199.	211.	223.	233.	240.	252.	261.	268.	275.
1944.00	19.	38.	56.	75.	93.	111.	128.	145.	161.	177.	188.	199.	212.	224.	234.	241.	253.	261.	269.	276.
1945.00	19.	38.	57.	75.	93.	111.	128.	145.	162.	177.	189.	200.	213.	225.	235.	242.	253.	262.	270.	277.
1946.00	19.	38.	57.	75.	94.	111.	129.	146.	162.	178.	190.	201.	213.	225.	235.	243.	254.	263.	271.	277.
1947.00	19.	38.	57.	76.	94.	112.	129.	146.	163.	179.	190.	201.	214.	226.	236.	244.	255.	264.	271.	278.
1948.00	19.	38.	57.	76.	94.	112.	130.	147.	163.	179.	191.	202.	215.	227.	237.	244.	256.	265.	272.	279.
1949.00	19.	38.	57.	76.	95.	113.	130.	147.	164.	180.	191.	203.	215.	228.	238.	245.	257.	266.	273.	280.
1950.00	19.	38.	58.	76.	95.	113.	131.	148.	164.	180.	192.	203.	216.	228.	239.	246.	258.	267.	274.	281.



PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA DAM
DISCHARGE CURVES
(NOT FIELD CHECKED)
10" HOLLOW JET VALVE
VALVE NO. A2
SEPT. 1970

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT



Lower Spillway Crest El. 1950.00' = U.S.C. & G.S. El. 1949.98'
Camp Book 4, page 178

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA DAM
SPILLWAY DISCHARGE CURVE
(NOT FIELD CHECKED)
MARCH 1939

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

DISCHARGE IN CUBIC FEET PER SECOND

Gage Height (feet)	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
.0	0	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4
.1	6.0	6.7	7.4	8.1	8.8	9.5	10.2	10.9	11.6	12.3
.2	13.0	13.7	14.4	15.1	15.8	16.5	17.2	17.9	18.6	19.3
.3	20.0	20.8	21.6	22.4	23.2	24.0	24.8	25.6	26.4	27.2
.4	28.0	28.8	29.6	30.4	31.2	32.0	32.8	33.6	34.4	35.2
.5	36.0	36.8	37.7	38.5	39.4	40.2	41.1	41.9	42.8	43.6
.6	44.5	45.3	46.2	47.0	47.9	48.7	49.6	50.4	51.3	52.1
.7	53.0	53.9	54.8	55.7	56.6	57.5	58.4	59.3	60.2	61.1
.8	62.0	62.9	63.8	64.7	65.6	66.5	67.4	68.3	69.2	70.1
.9	71.0	71.9	72.9	73.8	74.8	75.7	76.7	77.6	78.6	79.5
1.0	80.5	81.4	82.4	83.3	84.3	85.2	86.2	87.1	88.1	89.0
1.1	90.0	91.0	92.0	93.0	94.0	95.0	96.0	97.0	98.0	99.0
1.2	100.0	101.0	102.0	103.0	104.0	105.0	106.0	107.0	108.0	109.0
1.3	110.0	111.0	112.0	113.0	114.0	115.0	116.0	117.0	118.0	119.0
1.4	120.0	121.0	122.0	123.0	124.0	125.0	126.0	127.0	128.0	129.0
1.5	130.0	131.1	132.2	133.3	134.4	135.5	136.6	137.7	138.8	139.9
1.6	141.0	142.1	143.2	144.3	145.4	146.5	147.6	148.7	149.8	150.9
1.7	152.0	153.0	154.0	155.0	156.0	157.0	158.0	159.0	160.0	161.0
1.8	162.0	163.1	164.2	165.3	166.4	167.5	168.6	169.7	170.8	171.9
1.9	173.0	174.1	175.2	176.3	177.4	178.5	179.6	180.7	181.8	182.9
2.0	184.0	185.3	186.6	187.9	189.2	190.5	191.8	193.1	194.4	195.7
2.1	197.0	198.3	199.6	200.9	202.2	203.5	204.8	206.1	207.4	208.7
2.2	210.0	211.3	212.6	213.9	215.2	216.5	217.8	219.1	220.4	221.7
2.3	223.0	224.4	225.8	227.2	228.6	230.0	231.4	232.8	234.2	235.6
2.4	237.0	238.5	240.0	241.5	243.0	244.5	246.0	247.5	249.0	250.5
2.5	252.0	253.6	255.2	256.8	258.4	260.0	261.6	263.2	264.8	266.4
2.6	268.0	269.7	271.4	273.1	274.8	276.5	278.2	279.9	281.6	283.3
2.7	285.0	286.7	288.4	290.1	291.8	293.5	295.2	296.9	298.6	300.3
2.8	302.0	303.7	305.4	307.1	308.8	310.5	312.2	313.9	315.6	317.3
2.9	319.0	320.7	322.4	324.1	325.8	327.5	329.2	330.9	332.6	334.3
3.0	336.0	337.8	339.6	341.4	343.2	345.0	346.8	348.6	350.4	352.2
3.1	354.0	355.8	357.6	359.4	361.2	363.0	364.8	366.6	368.4	370.2
3.2	372.0	373.9	375.8	377.7	379.6	381.5	383.4	385.3	387.2	389.1
3.3	391.0	392.9	394.8	396.7	398.6	400.5	402.4	404.3	406.2	408.1
3.4	410.0	412.0	414.0	416.0	418.0	420.0	422.0	424.0	426.0	428.0
3.5	430.0	432.0	434.0	436.0	438.0	440.0	442.0	444.0	446.0	448.0
3.6	450.0	452.0	454.0	456.0	458.0	460.0	462.0	464.0	466.0	468.0
3.7	470.0	472.0	474.0	476.0	478.0	480.0	482.0	484.0	486.0	488.0
3.8	490.0	492.1	494.2	496.3	498.4	500.5	502.6	504.7	506.8	508.9
3.9	511.0	513.1	515.2	517.3	519.4	521.5	523.6	525.7	527.8	529.9
4.0	532.0	534.2	536.4	538.6	540.8	543.0	545.2	547.4	549.6	551.8
4.1	554.0	556.3	558.6	560.9	563.2	565.5	567.8	570.1	572.4	574.7
4.2	577.0	579.3	581.6	583.9	586.2	588.5	590.8	593.1	595.4	597.7
4.3	600.0	602.3	604.6	606.9	609.2	611.5	613.8	616.1	618.4	620.7
4.4	623.0	625.3	627.6	629.9	632.2	634.5	636.8	639.1	641.1	643.7
4.5	646.0	648.3	650.6	652.9	655.2	657.5	659.8	662.1	664.4	666.7
4.6	669.0	671.4	673.8	676.2	678.6	681.0	683.4	685.8	688.2	690.6
4.7	693.0	695.4	697.8	700.2	702.6	705.0	707.4	709.8	712.2	714.6
4.8	717.0	719.4	721.8	724.2	726.6	729.0	731.4	733.8	736.2	738.6
4.9	741.0	743.4	745.8	748.2	750.6	753.0	755.4	757.8	760.2	762.6
5.0	765.0	767.4	769.8	772.2	774.6	777.0	779.4	781.8	784.2	786.6
5.1	789.0	791.4	793.8	796.2	798.6	801.0	803.4	805.8	808.2	810.6
5.2	813.0	815.4	817.8	820.2	822.6	825.0	827.4	829.8	832.2	834.6
5.3	837.0	839.5	842.0	844.5	847.0	849.5	852.0	854.5	857.0	859.5
5.4	862.0	864.5	867.0	869.5	872.0	874.5	877.0	879.5	882.0	884.5
5.5	887.0	889.5	892.0	894.5	897.0	899.5	902.0	904.5	907.0	909.5
5.6	912.0	914.6	917.2	919.8	922.4	925.0	927.6	930.2	932.8	935.4
5.7	938.0	940.6	943.2	945.8	948.4	951.0	953.6	956.2	958.8	961.4
5.8	964.0	966.6	969.2	971.8	974.4	977.0	979.6	982.2	984.8	987.4
5.9	990.0	992.6	995.2	997.8	1000.4	1003.0	1005.6	1008.2	1010.8	1013.4
6.0	1016.0	1018.6	1021.2	1023.8	1026.4	1029.0	1031.6	1034.2	1036.8	1039.4
6.1	1042.0	1044.6	1047.2	1049.8	1052.4	1055.0	1057.6	1060.2	1062.8	1065.4
6.2	1068.0	1070.6	1073.2	1075.8	1078.4	1081.0	1083.6	1086.2	1088.8	1091.4
6.3	1094.0	1096.6	1099.2	1101.8	1104.4	1107.0	1109.6	1112.2	1114.8	1117.4
6.4	1120.0	1122.6	1125.2	1127.8	1130.4	1133.0	1135.6	1138.2	1140.8	1143.4

Note: Rating Table provided by LACDPW.
Pacoima Creek Flume below Pacoima Dam,
Sta. No. F118B-R, Rating Curve 44I.
Does not include Spillway Flow

PACOIMA WASH, CALIFORNIA
LOPEZ DAM

PACOIMA CREEK FLUME BELOW PACOIMA DAM RATING TABLE

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

WATER CONTROL MANUAL
LOPEZ DAM

EXHIBIT B
PERTINENT DATA FOR OTHER RESERVOIRS AFFECTING LOS ANGELES RIVER

EXHIBIT B
PERTINENT DATA FOR OTHER
RESERVOIRS AFFECTING LOS ANGELES RIVER

Item	Contents	Page
1	Sepulveda Dam and Reservoir--Pertinent Data	B-1
2	Hansen Dam and Reservoir--Pertinent Data	B-3

SEPULVEDA DAM AND RESERVOIR
LOS ANGELES COUNTY, CALIFORNIA

PERTINENT DATA
May 1985

Stream system	Los Angeles River
Drainage area ... sq. miles	152
Reservoir:	
Elevation	
Top of spillway gates (in raised position) ... ft., NGVD	710
Flood control pool ... ft., NGVD	713.5
Spillway design surcharge level ... ft., NGVD	716.7
Top of dam ... ft., NGVD	725+
Spillway gates basin to automatically lower ... ft., NGVD	712.0
Spillway gates complete automatic lowering ... ft., NGVD	715.0
Area	
Spillway gates (in raised position) ... acres	1,335
Flood control pool ... acres	1,529
Spillway crest ... acres	765
Spillway design surcharge level ... acres	1,710
Top of dam ... acres	2,447
Capacity, gross	
Spillway gates (in raised position) ... acre-feet	17,425 (2.15*)
Flood control pool ... acre-feet	22,493 (2.77*)
Spillway crest ... acre-feet	6,857 (0.85*)
Spillway design surcharge level ... acre-feet	27,563 (3.40*)
Top of dam ... acre-feet	44,727 (5.52*)
Allowance for sediment (50-year) ... acre-feet	0
Dam:	
Type	Earthfill
Height above original streambed ... ft.	57
Top length ... ft.	15,440
Top width ... ft.	30
Freeboard ... ft.	7.4
Spillway:	
Type	Concrete ogee
Crest length ... ft.	399
Crest elevation ... ft., NGVD	700
Design surcharge ... ft.	17.6
Design discharge ... c.f.s.	108,900
Outlets:	
Uncontrolled	
Size	4 - 6'W x 6.5'H
Entrance invert elevation ... ft., NGVD	668
Controlled ... number	4
Size ... ft.	6'W x 9'H
Gate type	Vertical lift
Entrance invert elevation ... ft., NGVD	668

SEPULVEDA DAM AND RESERVOIR
LOS ANGELES COUNTY, CALIFORNIA

PERTINENT DATA (continued)
May 1985

Conduits - (Rectangular)	Number and Size
Ungated	4 - 6'W x 6.5'H
Gated	4 - 6'W x 9'H
Length ft.	40
Maximum capacity at spillway crest c.f.s.	16,500
Regulated capacity at spillway crest c.f.s.	16,500
Standard project flood:	
Duration (inflow) days	3
Total volume (including base flow) acre-feet	68,200 (8.41*)
Inflow peak c.f.s.	50,000
Probable maximum flood:	
Duration (inflow) days	4
Total volume acre-feet	163,200 (20.13*)
Inflow peak c.f.s.	114,000
Historic maximums:	
Maximum inflow c.f.s.	58,970
Date	2-16-80
Maximum release c.f.s.	15,100
Date	2-16-80
Maximum water surface elevation ft., NGVD	705.1
Date	2-16-80

* inches of runoff
+ December 1980 survey shows variation in elevation of top of dam from 723.7 feet northeast of Control House to 725.5 feet southwest of Control House.

HANSEN DAM AND RESERVOIR
LOS ANGELES COUNTY, CALIFORNIA

PERTINENT DATA
June 1984

Stream system	Tujunga Wash
Drainage area ... sq. miles	147.4
Reservoir:	
Elevation	
Debris pool ... ft., NGVD	1,010.5
Flood control pool (spillway crest) ... ft., NGVD	1,060
Spillway design surcharge level ... ft., NGVD	1,081.22
Top of dam ... ft., NGVD	1,087
Area	
Debris pool ... acres	142.4
Spillway crest ... acres	781.4
Spillway design surcharge level ... acres	1,061.5
Top of dam ... acres	1,136.0
Capacity, gross	
Debris pool ... acre-feet	1,329 (0.17*)
Spillway crest ... acre-feet	25,446.1 (3.24*)
Spillway design surcharge level ... acre-feet	44,990 (5.72*)
Top of dam ... acre-feet	51,360 (6.53*)
Allowance for sediment (50-year) ... acre-feet	10,500 (1.34*)
Allowance for sediment (100-year) ... acre-feet	21,000 (2.67*)
Dam:	
Type	Earthfill
Height above original streambed ... ft	97
Top length ... ft	10,475
Top width ... ft	30
Freeboard ... ft	5.8
Spillway:	Overflow conc
Type	Ungated ogee
Crest length ... ft	284
Design surcharge ... ft	21.22
Design discharge ... c.f.s	99,700
Outlets:	
Uncontrolled	
Number and size ... ft	2 - 8'W x 6'H
Entrance invert elevation ... ft., NGVD	1,011
Controlled	
Gate type	Vertical lift
Size ... ft	8 - 5'W x 8'H
Entrance invert elevation ... ft., NGVD	990
Conduits ... number	10
Size	2 - 8'W x 6'H 8 - 5'W x 8'H
Length ... ft	265
Maximum capacity at spillway crest ... c.f.s	22,000
Regulated capacity at spillway crest ... c.f.s	22,000

HANSEN DAM AND RESERVOIR
LOS ANGELES COUNTY, CALIFORNIA

PERTINENT DATA (continued)
June 1984

Standard project flood:	
Duration (inflow).....days..	4
Total volume.....acre-feet..	92,500 (11.77*)
Inflow peak.....c.f.s..	53,000
Probable maximum flood:	
Duration (inflow).....days..	1
Total volume.....acre-feet..	76,800 (9.77*)
Inflow peak.....c.f.s..	130,000
Historic maximums:	
Maximum release.....c.f.s..	12,371
Date.....	3-3-83
Maximum water surface elevation.....ft., NGVD..	1,039.70
Date.....	3-2-83

* inches of runoff

WATER CONTROL MANUAL
LOPEZ DAM

EXHIBIT C

LOPEZ DAM RESERVOIR

REGULATION SCHEDULE

AND

DAM OPERATOR INSTRUCTIONS

EXHIBIT C

LOPEZ DAM RESERVOIR REGULATION SCHEDULE

Step No.	When Reservoir Water Surface is Between Elevations (feet - NGVD)	Gate Setting (feet of opening)	Computed Outlet Discharge (cfs)	Spillway Discharge (cfs)
1	1,254-1,273	5.0	0-422	0
2	1,273-1,299	0	0	0-44,500

NOTES: Spillway Crest Elevation 1,273 ft, NGVD
Top of Dam Elevation 1,299 ft, NGVD
Follow Step 1 at all times when there is no spillway flow
Follow Step 2 at all times during spillway flow

DAM OPERATOR INSTRUCTIONS

1. Communication with the District Office is available.
   a. Notify the Reservoir Operations Center when a gate change will be required according to the schedule.
   b. Notify the Reservoir Operations Center if unable to set the gate as instructed.

2. Communication with the District Office is not available.
   a. Try to reestablish communication through the Los Angeles County Department of Public Works.
   b. Allow a period of one half hour to pass to reestablish communication with the District Office. If after one half hour communication is not reestablished, follow the gate operation schedule.