5062 North 19th Avenue
Phoenix, Arizona 85015
(602) 242-2999

CELLA BARR ASSOCIATES

"DRAFT SUBMITTAL PACKAGE"

December 15, 1989

Mr. David Greenwood
Michael Baker Jr., Inc.
1420 King Street, 6th Floor
Alexandria, Virginia 22314-2788

Re: **Physical Map Revision Request for the Gila River, from the East Boundary of the Gila Bend Indian Reservation (north of Gila Bend, Arizona) Upstream to Gillespie Dam in Maricopa County, Arizona Contract FCD No. 88-52**
CBA File No. 41389-01-30

Dear Mr. Greenwood:

This letter and accompanying information is a physical map revision request for a 19.9 mile reach of the Gila River in Maricopa County, Arizona. Cella Barr Associates (CBA) is under contract with the Flood Control District of Maricopa County (FCDMC) to prepare this map revision request in their behalf. This map revision request impacts floodplain boundaries depicted as approximate Zone A on Panels 3480, 3250, 2875 and 2850 of the current Flood Insurance Rate Maps for Maricopa County, Arizona and Incorporated Areas (Effective date: April 15, 1988) and provides base flood elevations and floodway delineations along the study reach. The upstream limit of this study (Gillespie Dam) coincides with the downstream limit of a contiguous map revision request for the Gila River filed recently by the consulting firm of Dames and Moore under contract with FCDMC.

Since only the limits of the regulatory floodplain and floodway are being requested to be established and/or revised, only 100-year discharges have been established as a part of this map revision request. These 100-year discharges were derived from the hydrology report entitled Gila River and Tributaries, prepared by the U.S. Army Corps of Engineers, Los Angeles District, May 1982. The proposed 100-year discharges to be used along the study reach and the recommended starting water surface elevation have been previously submitted for approval to Mr. Allen Johnson of FEMA by FCDMC. A copy of the submittal and supporting materials pertaining to these components of the study are included in Attachment No. 3.

New topographic mapping has been obtained for the study reach at 400 scale with a contour interval of 2 feet and has served as the basis for establishing ground elevations along modeled cross-sectional alignments. An existing bridge crossing of the Gila River at Old U.S. 80 near Gillespie Dam required field survey and measurement to determine "as-built" conditions. The accuracy of topographic mapping was also verified by field survey.

Channel and overbank roughness coefficients (Manning's "n") used in the hydraulic computations were based on field observations of the stream and floodplain areas and were established jointly by CBA and FCDMC. The channel "n" values ranged from 0.03 to 0.07 and the overbank "n" values ranged from 0.035 to 1.0. The higher "n" value of 0.07 was used in the channel areas having extensive salt cedar growth. In agricultural fields within the floodplain, an "n" value of 0.035 was used if the flow was roughly greater than 3.0 feet, an "n" value of 0.07 was used when depth of flooding was roughly 1.0 foot to 3.0 feet and an "n" value of 1.0 was used if flooding depth was less than 1.0 foot. These varying values were adopted as an attempt to more accurately reflect the expected hydraulic impact of crops on flow conveyance under varying depth conditions. The higher "n" value of 1.0 was also used for any areas in the overbanks that were considered to produce ineffective flow for other reasons.

The study reach of the Gila River is dotted with small agricultural levees and berms comprised of unconsolidated material, and we have concluded that these levees and berms have no substantial impact on flooding during the 100-year event.

Only one bridge crosses this reach of the Gila River, at Old U.S. 80 immediately downstream of Gillespie Dam. The bridge spans the entire width of the river at this location, but due to the high concentration of salt cedars immediately upstream and downstream of the bridge, it will be overtopped by weir flow during the 100-year flooding event.

Profile concurrence was met at the downstream limit of the study reach by transitioning into Zone A limits represented on existing official maps. This area is the backwater ponding area for downstream Painted Rock Dam constructed in 1958 by the U.S. Army Corps of Engineers, roughly 20.6 stream miles downstream of the study reach. The hydraulic properties of Painted Rock Dam are described in the previously mentioned submittal to Mr. Allen Johnson of FEMA. Water surface elevations at the downstream limit of the study reach are governed by the backwater ponding for roughly 2.0 to 2.5 miles upstream until the water surface profile breaks free of the ponding effects and commences with a water surface gradient profile.

The upstream limit of the study reach obtains profile concurrence at the first cross-section upstream of Gillespie Dam (Section 46.0) contained in the recently completed map revision request for the contiguous upstream reach by Dames and Moore (October 20, 1988). Gillespie Dam simply acts as a large concrete weir across the Gila River at the upstream study limit.

Zone designation within the 100-year floodplain is proposed to be "Zone AE", area of special flood hazard determined by detailed study, except for some limited areas that are proposed "Zone E", "Zone A" and "Zone X".

The proposed Zone E areas within the study reach are areas of special flood-related erosion hazard that consist of loose sand and silty materials (sand bars) ranging from roughly zero to 3 feet above base flood elevations. These Zone E areas are located within the proposed 100-year floodplain limits and are likely to erode and migrate during flood occurrences. A Zone E designation will serve to acknowledge the erosion potential and transient nature of these areas.

The Zone A designation is proposed for an area adjacent to the study floodplain between cross-sections 162.74 and 164.73. This area consists of agricultural fields, portions of which are below adjacent base flood elevations. Minor volumes of runoff are introduced into this agricultural area at its upstream limit, producing shallow flooding of minor, but undetermined depths as flow attempts to re-enter the primary floodplain for the Gila River. A zone break line was created along the "effective" floodplain limit for the Gila River to eliminate Zone A agricultural fields from the hydraulic evaluations due to their negligible conveyance.

Zone X designation was utilized to represent a "bedrock" island within the right overbank of the Gila River between cross-sections 152.80 and 152.90.

The following is a list of attachments being provided with this physical map revision request:

1. A signed copy of the form entitled "Request for Letter of Map Revision (218-65)" asserting the accuracy of the information submitted.

2. A copy of the form entitled "Community Endorsement for Letter of Map Revision" signed by the FCDMC asserting that the FCDMC has acknowledged and reviewed the revision request.

3. Copy of letter to Mr. Allen Johnson, FEMA, from FCDMC dated August 24, 1989 and letter to Mr. Pedro Calza, FCDMC, from CBA dated October 3, 1989, along with supporting material requesting approval of the proposed 100-year discharges and starting water surface elevation to be used in the map revision.

4. Reproducible mylar work maps for the study reach at 400 scale, indicating locations of cross-sections utilized in hydraulic analyses, flood zones, floodplain and floodway boundaries, base flood elevations, legend,

location map, section corners and elevation reference marks (ERMs). The information contained on these work maps has been included per contract requirements of FCDMC and FEMA requirements.

5. HEC-2 runs for the 100-year floodplain and floodway. Due to the length of the study reach, the HEC-2 analyses have been subdivided into 3 reaches.

6. Summary of 100-year discharges.

7. Water surface profiles for the 100-year flood discharge.

8. Floodway data table.

9. Table of Elevation Reference Marks (ERMs).

Please review this letter and accompanying information relevant to the solicited physical map revision for the Gila River. If you have any question or comments regarding this submittal, please contact John Conway or myself at (602) 242-2999.

Sincerely,

CELLA BARR ASSOCIATES

James H. Nelson, P.E.
Project Manager

cc: Mr. Ray Lenaburg, FEMA, Region IX Project Officer
Mr. Joe Tram, FCDMC
Mr. Pedro Calza, FCDMC
Mr. Russell Cruff, FCDMC
Mr. Jim Morris, Arizona Dept. of Water Resources
Mr. John Conway, CBA

JHN00406.30L/ef

ATTACHMENT NO. 1

A signed copy of the form entitled "Request for Letter of Map Revision (218-65)" asserting the accuracy of the information submitted.

Federal Emergency Management Agency

Washington, D.C. 20472

REQUEST FOR LETTER OF MAP REVISION (218-65)

This is to request that a determination be made as to whether or not a certain land area or structure is within a Special Flood Hazard Area.

All documents submitted in support of this appeal are correct to the best of my knowledge. I understand that any false statement may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

_____ _____

Date Signature of Applicant

ATTACHMENT NO. 2

A copy of the form entitled "Community Endorsement for Letter of Map Revision" signed by the FCDMC asserting that the FCDMC has acknowledged and reviewed the revision request.

Federal Emergency Management Agency

Washington, D.C. 20472

COMMUNITY ACKNOWLEDGEMENT OF REQUEST

FOR LETTER OF MAP REVISION

Community Name	Property

We hereby acknowledge receipt and review of this Letter of Map Revision request and have found that the project meets all of our community's applicable floodplain management regulations. We understand that this request is being forwarded to FEMA for a possible map revision.

Community Official's Signature	Date

Community Official's Title

ATTACHMENT NO. 3

Copy of letter to Mr. Allen Johnson, FEMA, from FCDMC dated August 24, 1989 and letter to Mr. Pedro Calza, FCDMC, from CBA dated October 3, 1989, along with supporting material requesting approval of the proposed 100-year discharges and starting water surface elevation to be used in the map revision.

FLOOD CONTROL DISTRICT of MARICOPA COUNTY 1959

FLOOD CONTROL DISTRICT
of
Maricopa County

3335 West Durango Street • Phoenix, Arizona 85009
Telephone (602) 262-1501

D. E. Sagramoso, P.E., Chief Engineer and General Manager

41389-01-30
To: JHN
JCC
File

AUG 24 1989

Mr. Allen Johnson
Federal Emergency Management Agency
Federal Insurance Administration
Office of Risk Management
500 C Street, SW
Washington, D.C. 20472

SUBJECT: Gila River Map Revision - Gillepie Dam to Gila Bend Indian Reservation, Maricopa County, Arizona
Proposed Discharges and Starting Water Surface Elevation
Flood Control District File No. FCD 88-52
CBA File No. 41389-01-30

Dear Mr. Johnson:

Attached is a copy of the June 27, 1989 letter to Michael Baker, Jr., Inc., from our study contractor, Cella Barr Associates (CBA), pertaining to a proposed map revision for the above referenced reach of the Gila River. Michael Baker, Jr., Inc., has indicated that the contents of this letter need to be submitted to FEMA directly by the Flood Control District of Maricopa County (FCDMC) in order for FEMA to respond to the issues discussed therein.

The FCDMC directed CBA in the subject matter of this letter and respectfully requests FEMA's concurrence with the proposed discharges and starting water surface elevation discussed in the letter for use in the study. If you have any questions, please contact Jim Nelson or John Conway of CBA at (602) 242-2999 or me at (602) 262-1501.

Thank you for your consideration.

Sincerely,

Pedro Calza

Pedro Calza
Hydrologist

Enclosure

Copy to: Jim Nelson, Cella Barr Associates
John Conway, Cella Barr Associates
David Greenwood, Michael Baker, Jr., Inc.

5062 North 19th Avenue
Phoenix, Arizona 85015
(602) 242-2999

CELLA BARR
ASSOCIATES

June 27, 1989

Mr. David Greenwood, Project Manager
Flood Insurance Studies
Michael Baker, Jr., Inc.
1420 King Street
Sixth Floor
Alexandria, VA 22314-2788

Re: Gila River Map Revision - Gillespie Dam to Gila Bend Indian Reservation, Maricopa County, Arizona
Proposed Discharges and Starting Water Surface Elevation
CBA File No. 41389-01-30

Dear Mr. Greenwood:

Cella Barr Associates has recently been retained by the Flood Control District of Maricopa County (FCDMC) to provide a Flood Insurance Re-Study (Map Revision) for the Gila River in Maricopa County, Arizona, commencing at the east boundary of the Gila Bend Indian Reservation north of Gila Bend, Arizona, and extending upstream to Gillespie Dam. The study reach is roughly 18.5 stream miles in length. This study is proposed to be submitted to the Federal Emergency Management Agency (FEMA) for review and subsequent incorporation into Maricopa County's Flood Insurance Rate Maps. The study will include delineations of the 100-year floodplain and floodway and associated tables and profiles.

We are currently in the early stages of this study and are providing you with advance information regarding the 100-year discharges and the starting water surface elevation that we are proposing to use as directed by FCDMC in an effort to obtain your concurrence prior to commencing with extensive hydraulic studies.

The 100-Year discharges proposed for this study are contained in a Hydrology Report entitled "Gila River and Tributaries," prepared by the U.S. Army Corps of Engineers, Los Angeles District, May, 1982. This report is the most comprehensive hydrologic analysis available, and the discharges presented therein have been used as a basis for floodplain delineations performed as Flood Insurance Studies and Re-Studies (Map Revisions) for upstream reaches of the Gila River. Selected pages from the report are attached, and the 100-year discharges proposed for use by CBA in the current study are as follows:

Location	100-year Discharge
Gillespie Dam	235,000 cfs
Midway from Gillespie Dam to Painted Rock Dam	230,000 cfs
Painted Rock Dam	220,000 cfs

We have been directed by FCDMC to utilize a starting water surface elevation of 661.00 feet for hydraulic evaluations, commencing at the east boundary of the Gila Bend Indian Reservation. This elevation corresponds with the spillway crest elevation for the downstream Painted Rock Dam, which impounds runoff upstream for several miles during a major flooding event. A plotting of the approximate floodplain boundary indicated as Zone A on the currently adopted FIRM maps onto corresponding U.S.G.S. quadrangle maps results in a floodplain boundary that closely matches the 661 contour. The 661 contour is also illustrated on the quadrangle maps as the backwater ponding limits upstream of Painted Rock Dam. Though HEC-2 modeling will begin at the Gila River Indian Reservation, the 100-year water surface elevations are likely to be governed by the assumed starting backwater ponding elevation of 661 feet for a mile or more upstream until the water surface elevation breaks free of the ponding effects and commences with a water surface gradient profile.

If there are any objections to the use of the above 100-year discharges or starting water surface elevation, please notify us as early as possible as we propose to incorporate these parameters into the hydraulic analysis. Please refer any questions or comments to John Conway or myself at (602) 242-2999. We have included a copy of pertinent sections of the U.S. Army Corps of Engineers' Hydrology Study, relevant U.S.G.S. quadrangle maps covering the study reach, a "Painted Rock Reservoir Floodplain Delineation Map" prepared by the FCDMC, and a study reach location map to assist you in your review of this submittal.

Thank you for your consideration.

Sincerely,

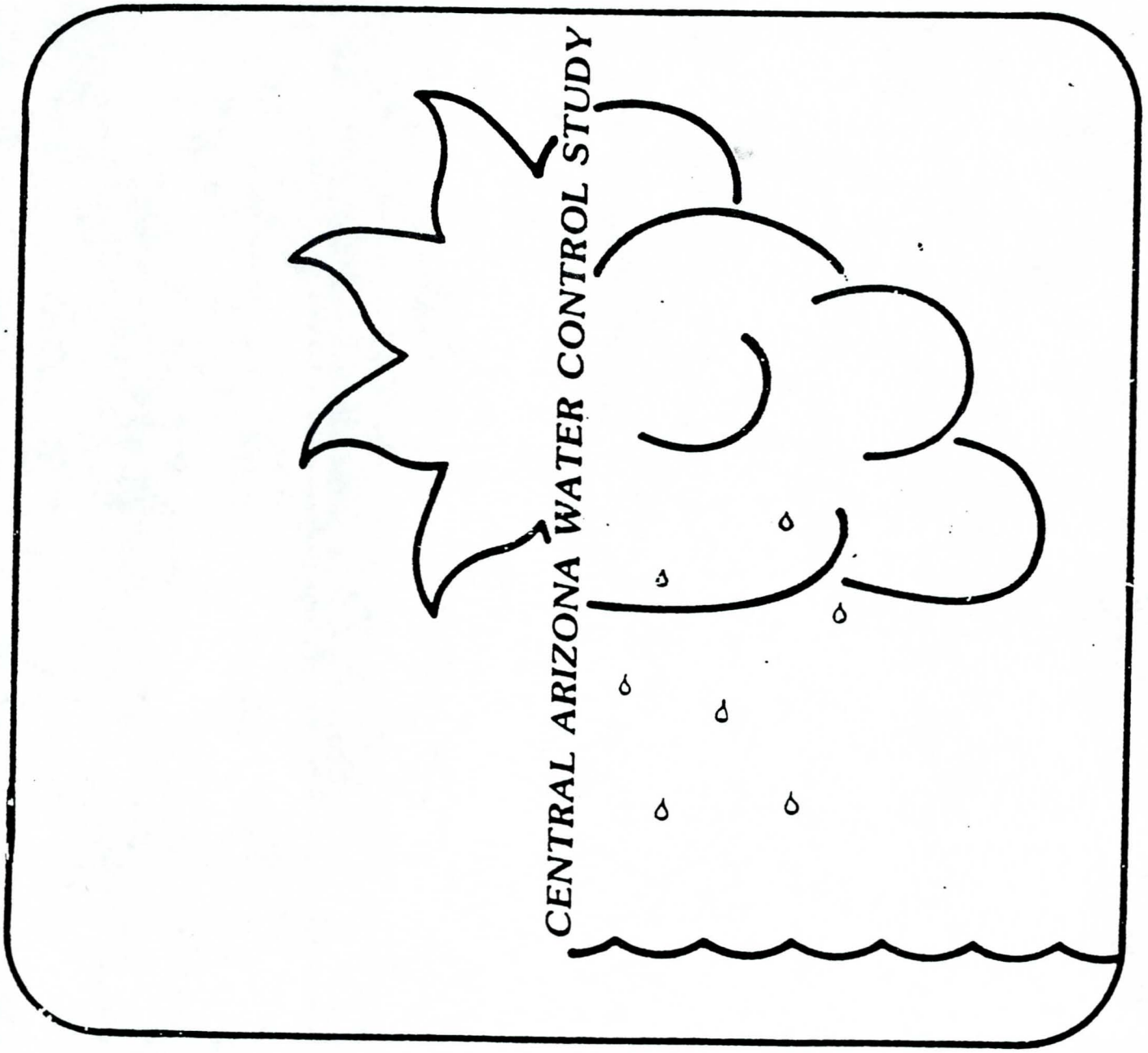
CELLA BARR ASSOCIATES

James H. Nelson, P.E.
Project Manager

cc: Mr. Joe Tram, FCDMC
Mr. Pedro Calza, FCDMC
Mr. John Conway, CBA

US Army Corps
of Engineers
Los Angeles District

Gila River & Tributaries



HYDROLOGY

May 1982

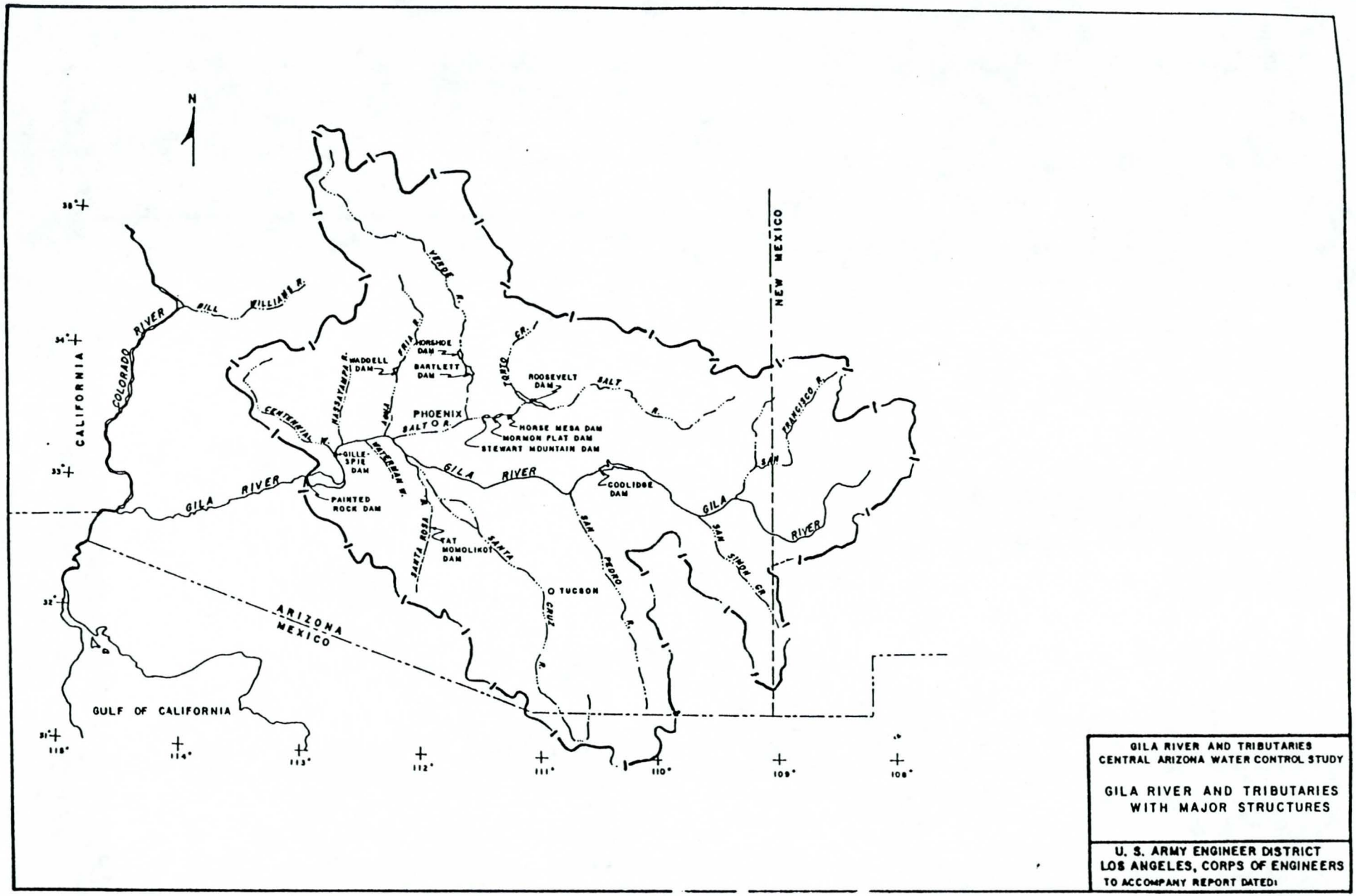
generation facilities and are kept at 90 percent full or higher, except during periods of extreme low flow. The nature of SPF and PMF, resulting in both cases from intense, general winter storms, includes antecedant runoff which would bring the other reservoirs into a "full" condition. Therefore, starting water surface elevations for SPF and PMF flood routings were at NWS (whether the reservoirs are nearly full or completely full has no effect on the peak). Estimated releases were made such that outflow was equal to inflow, the limit being the hydraulic capacity of the gated spillways. This type of reservoir operation maintains surcharge space for dam safety, if possible, and follows the 1979 SRP SRFOC (reference 1).

(2) Other reservoirs. The starting conditions and reservoir routing techniques for Coolidge and Waddell Dams were similar to those for SRP reservoirs, since they also operate primarily for water conservation. Coolidge Dam differs in spillway configuration because the gates are no longer operational and are frozen in closed position. The NWS at Coolidge Dam is actually established by concrete flashboards. During reservoir routing for the Painted Rock SPF, the flashboards were considered to fail. The failure was assumed to be complete, thus increasing the spillway capacity by lowering the crest and enlarging the spill area. The magnitude of the discharge at failure was only 25,000 cfs, compared to the peak spill of 92,000 cfs later in the flood; therefore, time of failure did not affect the peak.

b. Channel Routing. Modified Puls routing procedures were used to channel route frequency hydrographs as well as the SPF and PMF hydrographs. A summary of storage-discharge relationships for 1-hour and 6-hour time intervals, as required, is presented in tables 8 through 11 for each routing reach.

3-06. PERCOLATION LOSS. Not only are flood peaks in the Gila River system attenuated through effects of reservoir and channel routing, but they are also diminished volumetrically due to infiltration of streamflow into the river channel and overbank areas. This type of infiltration is apparent in several recent floods of varying peaks and volumes such as Dec 1965-Jan 1966, Feb-May 1973, March 1978, Dec 1978, Jan-April 1979, and February 1980. As evident from these floods, the rate of percolation is dependent on antecedent conditions, duration of flow, shape of hydrograph, and magnitude of peak and volume. An exponential type decay function similar to Horton's infiltration equation was hypothesized as a model to explain the percolation mechanism. This model predicts an ultimate or limiting infiltration rate based on a higher initial rate decaying over time (plate 10). A limiting infiltration rate of 0.2 cfs per wetted-acre of channel yielded good results based on studies of the aforementioned floods. The Hydrologic Engineering Center (HEC) also studied percolation in the Salt River near Phoenix (reference 5). Using a similar exponential decay function, an "average infiltration rate" of 1.3 in/hr was computed for flow in a one day period. The limiting value was 0.2 inches per hour. (1 inch per hour equals 1 cubic foot per second per wetted acre.) Since the results of both studies agreed, a percolation rate of 0.2 cfs per wetted acre for all normally "dry" channel reaches on the Salt, Agua Fria, and Gila Rivers was selected. The constant percolation rate was felt acceptable because the constant or limiting rate would be achieved prior to arrival of the peak, thus having no effect on the degree of attenuation.

Furthermore, the volumetric effect was minimal, since bank returns at the end of the flood tended to restore the water lost in the early stages of a real event. Percolation rates in cfs per acre-foot of channel and bank storage are shown for each normally dry reach in tables 9 through 11.



GILA RIVER AND TRIBUTARIES
CENTRAL ARIZONA WATER CONTROL STUDY

GILA RIVER AND TRIBUTARIES
WITH MAJOR STRUCTURES

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

PLATE 2

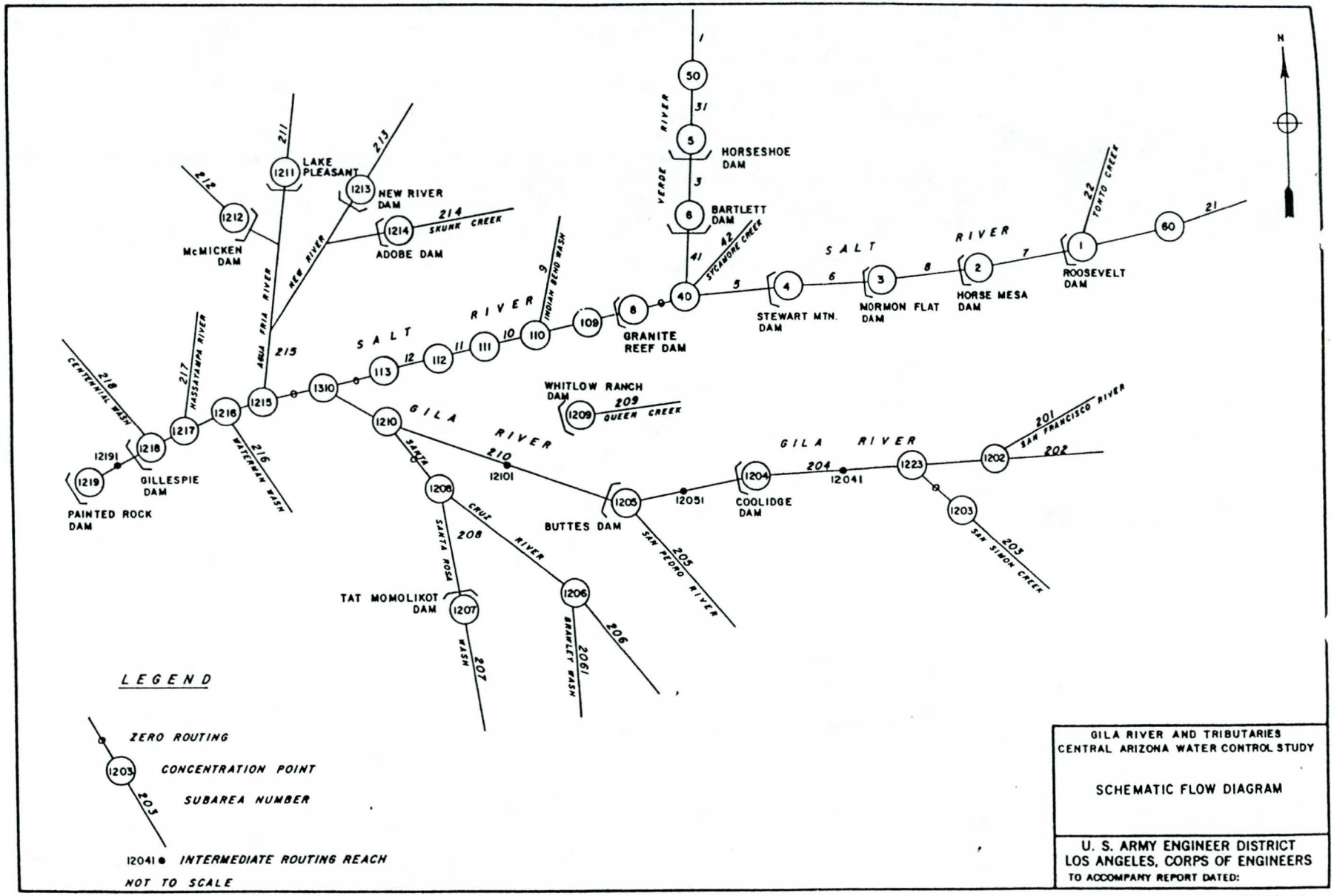
TABLE 23

DISCHARGE FREQUENCY VALUES

SALT RIVER AND GILA RIVER

EXISTING CONDITIONS

	Return period						
	500-yr	200-yr	100-yr	50-yr	20-yr	10-yr	5-yr
Salt River at:							
CP 40--Below confl w/Verde River	360,000	290,000	245,000	175,000	141,000	102,000	45,000
CP 109--Gilbert Road	345,000	285,000	230,000	170,000	139,000	100,000	44,000
CP 110--Tempe Bridge	330,000	275,000	215,000	160,000	135,000	93,000	40,000
CP 111--Central Avenue	325,000	265,000	200,000	155,000	130,000	91,000	39,000
CP 112--67th Avenue	315,000	255,000	190,000	150,000	126,000	90,000	38,000
CP 113--Above confl w/Gila River	310,000	250,000	185,000	145,000	125,000	85,000	36,000
Gila River at:							
CP 1310--Below confl w/Salt River	360,000	295,000	250,000	200,000	135,000	95,000	40,000
CP 1216--Below confl w/Waterman W.	350,000	290,000	245,000	195,000	133,000	88,000	39,000
CP 1217--Below confl w/Hassayampa River	340,000	280,000	240,000	190,000	129,000	82,000	38,000
CP 1218--Gillespie Dam	335,000	277,000	235,000	186,000	124,000	78,000	37,000
CP 12191--Midway from Gillespie to Painted Rock	330,000	272,000	230,000	180,000	120,000	75,000	36,000
CP 1219 --Painted Rock Dam	320,000	260,000	220,000	173,000	115,000	70,000	31,000



GILA RIVER AND TRIBUTARIES
CENTRAL ARIZONA WATER CONTROL STUDY

SCHEMATIC FLOW DIAGRAM

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

PLATE 11

JCC

5062 North 19th Avenue
Phoenix, Arizona 85015
(602) 242-2999

CELLA BARR
ASSOCIATES

October 3, 1989

Mr. Pedro Calza, Hydrologist
Flood Control District of Maricopa County
3335 West Durango Street
Phoenix, Arizona 85009

Re: Gila River Map Revision -
Gillespie Dam to Gila Bend Indian Reservation,
Maricopa County, Arizona
Proposed Starting Water Surface Elevation
CBA File No. 41389-01-30

Dear Mr. Calza:

As a follow-up to our letter of June 27, 1989 addressed to Mr. David Greenwood of Michael Baker Jr., Inc., we are furnishing you with additional information pertaining to the starting water surface elevation proposed to be utilized in our mapping of the 100-year floodplain for the Gila River upstream of Painted Rock Dam. This information should support the use of a starting water surface elevation of 661.00 feet to represent the backwater ponding elevation upstream of the dam. This elevation is equivalent to the spillway crest elevation of the dam.

We have been in contact with the Los Angeles District of the U.S. Army Corps of Engineers to obtain additional information dealing with the operational capabilities and flood capacity associated with Painted Rock Dam. As a result of our discussions, we were provided with excerpts from a report entitled "Reservoir Regulation Manual for Painted Rock Reservoir" prepared by the U.S. Army Corps of Engineers in June, 1962 (see attached). According to the report, there would be no surcharge over the Painted Rock Dam spillway for inflow peak discharges of 300,000 cfs or less. The 100-year flow of 220,000 cfs is less than this value, and thus, would create a backwater ponding elevation upstream of the dam that is at or below the spillway crest elevation of 661.00 feet.

The actual elevation of backwater ponding upstream of Painted Rock Dam would also be governed by the operational procedures implemented during the 100-year flood for the primary outlet gates and conduits within the dam structure itself below the spillway crest elevation. Thus, the adoption of a starting water surface elevation of 661.00 feet appears to be reasonable and proper to utilize as a basis for step backwater calculations commencing at the downstream limit of the study reach (Gila Bend Indian Reservation Boundary) as this value will incorporate an acceptable factor of safety to account for operational uncertainties, as well as hydrologic uncertainties.

We understand that the District will forward this additional submitted information to the Federal Emergency Management Agency (FEMA) and Michael Baker Jr., Inc. in an effort to receive their official concurrence with regard to the proposed discharges and starting water surface elevation described for the current study of the Gila River in this letter and our previous letter of June 27, 1989. If you have any questions or comments regarding this submitted information, please do not hesitate to call.

Sincerely,

CELLA BARR ASSOCIATES

James H. Nelson, P.E.
Project Manager

cc: Mr. Joe Tram, FCDMC
Mr. Russ Cruff, FCDMC
Mr. John Conway, CBA

JHN00366.30L\fw

L. A. D. M. 1130 - 2 . 43

GILA RIVER BASIN , ARIZONA AND NEW MEXICO

RESERVOIR REGULATION MANUAL

FOR

PAINTED ROCK RESERVOIR

U. S. ARMY ENGINEER DISTRICT , LOS ANGELES

CORPS OF ENGINEERS

JUNE 1962

RESERVOIR REGULATION MANUAL

FOR

PAINTED ROCK RESERVOIR
GILA RIVER BASIN, ARIZ. AND N. MEX.

PERTINENT DATA

Drainage area (excluding Willcox and Animas closed drainages).....sq. miles..	50,800
Reservoir:	
Elevation	
Streambed.....ft., m.s.l..	524
Spillway design surcharge level.....ft., m.s.l..	696.3
Area (survey of March 1953)	
Spillway crest.....acres..	53,200
Spillway design surcharge level.....do...	81,500
Top of dam.....do...	90,100
Capacity, gross (survey of March 1953)	
Spillway crest.....acre-feet..	2,491,700
Spillway design surcharge level.....do.....	4,834,600
Top of dam.....do.....	5,575,000
Allowance for silting.....do.....	200,000
Dam-type.....	Earthfill
Top elevation.....ft., m.s.l..	705
Height above original streambed.....ft..	181
Top length (excluding saddle dikes and spillway).....ft..	4,780
Spillway - type.....Detached,	broadcrest
Crest elevation.....ft., m.s.l..	661
Crest length.....ft..	610
Design surcharge on spillway crest.....ft..	35.3
Discharge at design surcharge.....c.f.s..	401,700
Outlets:	
Gates - type.....	Tainter
Number.....	3
Size.....	10'Wx18'H
Gate sill elevation.....ft., m.s.l..	530
Conduits -	
Number and type.....circular..	1
Size - inside diameter.....ft..	25
Length.....ft..	925
Maximum capacity at spillway crest.....c.f.s..	30,480
Regulated capacity at spillway crest.....c.f.s..	22,500

PERTINENT DATA--Continued

Reservoir design flood:		
Length of design flood	days..	18
Inflow volume of design flood	acre-feet..	2,800,000
Inflow peak	c.f.s..	300,000
Outflow, maximum average	c.f.s..	22,500
Reduction in peak	c.f.s..	227,500
Time to drain reservoir from maximum water-surface elevation (net storage)	days..	70
Spillway design flood:		
Length of flood	days..	18
Inflow volume of design flood	acre-feet..	7,680,000
Inflow peak	c.f.s..	620,000
Outflow peak	c.f.s..	436,500
Reduction in peak	c.f.s..	183,500

PLAN OF OPERATION

46. Operational requirements.--Painted Rock Reservoir is operated for flood control to achieve the following objectives insofar as possible: (a) to provide protection from floods for agricultural lands along the Gila River downstream from the dam, along the lower Colorado River in Arizona and California, and in the Imperial Valley of California; and (b) to provide flood protection to residential, commercial and industrial properties in the city of Yuma and towns of Gadsden and Somerton, Ariz.; to extensive irrigation facilities; to transportation facilities; and to important defense installations.

47. Prior operation plans.--The project document (H. Doc. No. 331) for Painted Rock Reservoir presented a general method of operation based on increasing the outflow in steps to a maximum controlled value of 22,500 cubic feet per second.

48. The operation presented in the report titled "Design Memorandum No. 3, General Design for Painted Rock Reservoir," dated March 1955, required the selection of one of two fixed operation plans, A or B. Under plan A, a debris pool would be developed to elevation 550. Then as the reservoir level rose, the outflow would be increased in steps until a value of 22,500 cubic feet per second was reached at elevation 640. This outflow would be maintained as long as possible, using surcharge storage above spillway crest. Under plan B, a debris pool would be developed to elevation 550 as in plan A. Above this elevation, to protect the outlet conduits from debris, the outlet gates would be regulated so that the openings equalled one-fourth of the reservoir water depth. Under this operation plan, a controlled outflow of 22,500 cubic feet per second would be reached at elevation 600 and maintained as long as possible using surcharge storage above spillway crest. The choice of plan depended on available storage space in upstream reservoirs and predicted flow into Painted Rock Reservoir. Plan A would be used to control small floods to relatively nondamaging discharges. If upstream storage space were limited and a major flood was predicted at Painted Rock Reservoir, operation plan B would be used. This plan of operation would control the reservoir design flood below spillway crest.

49. In the report titled "Design Memorandum No. 6, Dam and Appurtenances for Painted Rock Reservoir," dated November 1956, Painted Rock Reservoir would be operated in accordance with plan B, described in the preceding paragraph. Minor floods would be regulated on a prediction basis so that damage to developments below the dam would be kept to a minimum.

50. Flood-control operation.--The flood-control operation presented in this manual is similar to the operation described in Design Memorandum No. 3. One of two fixed operation plans, A or B, is selected for use depending on available upstream storage and water-surface elevation in Painted Rock Reservoir. Plans A and B are essentially as described under "Prior Operation Plans." The stepped outlet gate operation schedules for these plans are tabulated in tables 15 and 16, respectively.

51. With due regard for any release already in effect, the selection of operation plan A or B is made at the beginning of a flood. Whenever it is not in conflict with conditions resulting from operations for an immediately prior flood, an appropriate operation plan is determined by entering plate 26 with the water-surface elevation in Painted Rock Reservoir and the available storage space in upstream reservoirs. Refer to the note on plate 26 for instructions on the selection of the operation plan. The curves for plans A and B on plate 26 are based on a series of routings through Painted Rock Reservoir. Gross storage was used in these routings and the initial water-surface elevation necessary to control a given flood to spillway crest was calculated. The flood in each case was equal to the reservoir design flood depleted by the storage in upstream reservoirs available to control that flood. A safety factor was integrated into the curves for plans A and B, by assuming 10 percent more storage space would be required in upstream reservoirs than the results of the routings indicated. A form for tabulating the available storage space in upstream reservoirs that can be used to control a reservoir design flood is shown on plate 27. Actual storage and storage capacity of the upstream reservoir system for the period August 1910 through December 1960 are shown on plates 28 and 29.

52. If a flood of reservoir design magnitude should occur, it could be controlled to spillway crest by plan A if the available storage in upstream reservoirs and the water-surface elevation in Painted Rock Reservoir at the beginning of the flood define a point on plate 26 lying to the right of plan A curve. If the point lies between plan A and B curves, plan B can control the flood. If the point lies to the left of plan B curve, the flood cannot be controlled below spillway crest by plan B.

53. If the water surface in Painted Rock Reservoir is at elevation 640.0 feet or lower at the beginning of the spillway design flood, operation plan A or B will control the flood to maximum water-surface elevation 696.3 or lower. However, at a higher initial elevation, the outlets must be fully opened at the time the water surface reaches the elevation shown on plate 30, to control a spillway flood to elevation 696.3. All floods

occurring with initial water-surface elevation at 640.0 or higher will be treated as possible spillway design floods. (This deviation from the fixed operation plan above the spillway crest is required because at the beginning of the spillway design flood routing, it had been assumed that the water surface was at spillway crest, elevation 661.0 and the outlets fully open. The outlet discharge was not transferred above spillway crest as in operation plans A and B.)

54. Operation to reduce flows during downstream floods.--The travel time for releases from Painted Rock Reservoir to the Colorado River is roughly 2 days, which is about equal to the travel time from Parker Dam to the Gila River confluence. Therefore, if floodflows are reported, or are imminent on the Colorado River below Parker Dam, releases from Painted Rock Reservoir can be modified in time to be effective in reducing floods on the Colorado River below the confluence. The criteria for determing whether releases can be reduced, regardless of the time of year, will be determined from plate 26, i.e., it will be permissible to reduce releases if the point on plate 26 defined by available storage in upstream reservoirs and the water-surface elevation in Painted Rock Reservoir lies below the plan B curve. If a flood of reservoir design magnitude should occur above Painted Rock Dam, it would then be controlled to or below spillway crest. In summer, storm conditions may permit reducing the outflow to zero, as indicated in paragraph 68.

55. Conservation operation.--There is no written authority for conservation operation of Painted Rock Reservoir. However, considerable incidental water-conservation benefits result from the flood-control operation of the reservoir. Flood flows are reduced by the stepped operation to releases not exceeding an average discharge of 22,500 cubic feet per second. This operation promotes recharge of the underground basin downstream of the dam.

56. Limitations on storage.--Water cannot legally be stored above the taking line (approx. elevation 661) shown on plate 25. The government has acquired fee title to lands below approximately 585 feet and flowage easements to lands between approximately 585 and 661 feet.

57. Limitation on releases.--Except in floods larger than the reservoir design flood, releases are limited to a maximum average discharge of 22,500 cubic feet per second as shown in the gate operation schedules A and B (tables 15 and 16), which is the rate above which excessive damage occurs.

58. Division of responsibility for operation.--The hydraulic operation of Painted Rock Dam has been delegated through channels

Table 13

Area and Gross Capacity
Painted Rock Reservoir, Gila River Basin, Ariz. and N. Mex.*

Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)	Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)	Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)	Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)
530	83	27	553	17,400	1,960	576	119,800	7,590	599	399,000	16,700
531	160	68	554	19,500	2,130	577	127,800	7,980	600	416,800	17,100
532	250	108	555	21,700	2,300	578	136,200	8,370	601	435,000	17,700
533	390	149	556	24,000	2,470	579	144,500	8,760	602	453,000	18,300
534	560	189	557	26,500	2,640	580	154,300	9,160	603	471,000	18,800
535	760	230	558	29,100	2,810	581	164,000	9,520	604	490,000	19,400
536	990	270	559	31,800	2,980	582	174,000	9,890	605	510,000	19,900
537	1,280	311	560	34,700	3,150	583	184,000	10,300	606	530,000	20,400
538	1,580	351	561	37,900	3,400	584	194,000	10,600	607	550,000	20,800
539	1,920	392	562	41,400	3,650	585	205,000	11,000	608	571,000	21,200
540	2,320	432	563	45,200	3,900	586	216,000	11,400	609	592,000	21,700
541	2,800	504	564	49,200	4,150	587	227,000	11,800	610	613,300	22,100
542	3,360	575	565	53,500	4,450	588	239,000	12,300	611	635,000	22,700
543	4,000	647	566	58,100	4,680	589	252,000	12,700	612	657,000	23,200
544	4,700	718	567	63,000	4,970	590	265,600	13,100	613	680,000	23,800
545	5,500	790	568	68,200	5,250	591	279,000	13,500	614	703,000	24,300
546	6,400	922	569	73,700	5,530	592	292,000	13,900	615	727,000	24,800
547	7,400	1,050	570	79,500	5,800	593	305,000	14,300	616	751,000	25,300
548	8,600	1,190	571	85,500	6,090	594	318,000	14,700	617	776,000	25,800
549	10,000	1,320	572	91,700	6,370	595	332,000	15,100	618	802,000	26,400
550	11,700	1,450	573	98,200	6,650	596	348,000	15,500	619	831,000	26,900
551	13,500	1,620	574	105,000	6,920	597	364,000	15,900	620	861,200	27,400
552	15,400	1,790	575	112,200	7,200	598	381,000	16,300	621	891,000	28,000

*See footnote at end of table.

Table 13--Continued

Area and Gross Capacity
Painted Rock Reservoir, Gila River Basin, Ariz. and N. Mex.*

Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)	Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)	Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)	Elevation (Feet above mean sea level)	Capacity (Acre-feet)	Area (Acres)
622	920,000	28,500	643	1,643,000	41,000	664	2,650,000	55,300	685	3,970,000	70,800
623	949,000	29,000	644	1,683,000	41,600	665	2,706,000	55,800	686	4,042,000	71,700
624	978,000	29,600	645	1,723,000	42,100	666	2,763,000	56,700	687	4,115,000	72,600
625	1,007,000	30,200	646	1,764,000	42,800	667	2,821,000	57,400	688	4,189,000	73,500
626	1,036,000	30,700	647	1,808,000	43,600	668	2,880,000	58,100	689	4,264,000	74,400
627	1,066,000	31,200	648	1,854,000	44,300	669	2,940,000	58,800	690	4,339,000	75,300
628	1,098,000	31,800	649	1,901,000	45,000	670	3,006,000	59,600	691	4,415,000	76,300
629	1,130,000	32,300	650	1,948,800	45,700	671	3,061,000	60,200	692	4,492,000	77,300
630	1,162,500	32,800	651	1,997,000	46,400	672	3,122,000	60,900	693	4,570,000	78,200
631	1,195,000	33,400	652	2,045,000	47,000	673	3,184,000	61,600	694	4,649,000	79,200
632	1,228,000	34,100	653	2,093,000	47,600	674	3,246,000	62,200	695	4,729,000	80,200
633	1,261,000	34,700	654	2,142,000	48,300	675	3,309,000	62,900	696	4,810,000	81,200
634	1,295,000	35,300	655	2,191,000	48,900	676	3,372,000	63,600	697	4,892,000	82,200
635	1,330,000	35,900	656	2,240,000	49,600	677	3,436,000	64,300	698	4,974,000	83,100
636	1,366,000	36,600	657	2,290,000	50,400	678	3,500,000	65,000	699	5,057,000	84,100
637	1,405,000	37,300	658	2,340,000	51,100	679	3,565,000	65,700	700	5,141,000	85,100
638	1,444,000	38,000	659	2,390,000	51,800	680	3,630,500	66,400	701	5,226,000	86,100
639	1,483,000	38,700	660	2,440,200	52,500	681	3,696,000	67,300	702	5,312,000	87,100
640	1,523,400	39,400	661	2,491,700	53,200	682	3,763,000	68,200	703	5,399,000	88,100
641	1,563,000	39,900	662	2,543,000	53,900	683	3,831,000	69,000	704	5,487,000	89,100
642	1,603,000	40,500	663	2,596,000	54,600	684	3,900,000	69,900	705	5,575,000	90,100

* Table based on survey of March 1953.

Table 15

Plan A

Outlet gate operation schedule, Painted Rock Reservoir, Gila River basin, Ariz. and N. Mex.*

Step No.	When reservoir water surface is between elevation	Gate setting for gates indicated			Computed discharge	Downstream gage height
		No. 1	No. 2	No. 3		
	Feet above mean sea level	Feet of opening	Feet of opening	Feet of opening	Cubic feet per second	Feet
1	**530 - 550	0	0	0	0	0
2	550 - 554	3.2	3.2	3.2	2,400 - 2,600	7.50 - 7.60
3	554 - 558	2.8	2.8	2.8	2,400 - 2,600	7.50 - 7.60
4	558 - 563	2.6	2.6	2.6	2,400 - 2,600	7.50 - 7.60
5	563 - 568	2.4	2.4	2.4	2,400 - 2,600	7.50 - 7.60
6	568 - 577	2.2	2.2	2.2	2,400 - 2,600	7.50 - 7.60
7	577 - 583	2.0	2.0	2.0	2,400 - 2,600	7.50 - 7.60
8	583 - 589	1.8	1.8	1.8	2,400 - 2,600	7.50 - 7.60
9	589 - 591	1.7	1.7	1.7	2,400 - 2,450	7.50 - 7.55
10	591 - 602	3.5	3.5	3.5	4,800 - 5,200	8.50 - 8.63
11	602 - 603	3.3	3.3	3.3	4,950 - 5,050	8.55 - 8.58
12	603 - 614	6.8	6.8	6.8	9,600 - 10,400	9.92 - 10.13
13	614 - 618	6.4	6.4	6.4	9,850 - 10,150	10.00 - 10.08
14	618 - 626	13.8	13.8	13.8	19,500 - 20,500	12.30 - 12.50
15	626 - 635	13.0	13.0	13.0	19,500 - 20,500	12.30 - 12.50
16	635 - 640	12.5	12.5	12.5	19,750 - 20,250	12.35 - 12.47
17	640 - 648	13.8	13.8	13.8	22,000 - 23,000	12.80 - 13.00
18	648 - 657	13.2	13.2	13.2	22,000 - 23,000	12.80 - 13.00
19	***657 - 661.6	12.5	12.5	12.5	22,000 - 23,000	12.80 - 13.00
20	661.6 - 662.4	11.3	11.3	11.3	21,000 - 23,000	12.60 - 13.00
21	662.4 - 663.0	10.1	10.1	10.1	21,000 - 23,000	12.60 - 13.00
22	663.0 - 663.5	8.9	8.9	8.9	21,000 - 23,000	12.60 - 13.00
23	663.5 - 664.1	7.7	7.7	7.7	21,000 - 23,000	12.60 - 13.00
24	664.1 - 664.5	6.6	6.6	6.6	21,000 - 23,000	12.60 - 13.00
25	664.5 - 664.9	5.5	5.5	5.5	21,000 - 23,000	12.60 - 13.00
26	664.9 - 665.2	4.5	4.5	4.5	21,000 - 23,000	12.60 - 13.00
27	665.2 - 665.6	3.4	3.4	3.4	21,000 - 23,000	12.60 - 13.00
28	665.6 - 665.9	2.5	2.5	2.5	21,000 - 23,000	12.60 - 13.00
29	665.9 - 666.2	1.5	1.5	1.5	21,000 - 23,000	12.60 - 13.00
30	666.2 - 666.5	.6	.6	.6	21,000 - 23,000	12.60 - 13.00
31	666.5 - 666.8	0	0	0	21,600 - 23,000	12.72 - 13.00
32	666.8 & above				Spillway flow only See Instructions	

* Schedule applicable for rising or falling stages.
** Gates may be 1/2 ft. open between elevations 530 - 535 ft. to pass low flows.
*** Spillway crest elevation 661 ft.

INSTRUCTIONS

1. Communications with the District Office, existing.

a. Notify the Hydraulic Operations Center when a gate change will be required according to the schedule.

b. To report gate settings, while operating on schedule, give the applicable step number only.

c. Notify the Hydraulic Operations Center if unable to set gates as instructed.

2. Communications with the District Office, interrupted.

a. Follow the gate operation schedule.

b. If one or more of the gates cannot be operated, adjust the remaining gates gradually and uniformly until the downstream gage height agrees with the scheduled values. Keep a close check on gage height and change the gate opening as often as required. If the downstream gage height is not obtainable, adjust the gates that are functioning so that the sum of the gate openings will equal the sum of the openings in the schedule.

3. Flood occurring with initial reservoir water-surface elevation at 640 or higher.

a. Outlet gates will be fully opened at the elevation indicated on the "Curve for Determining Operation Above Spillway Crest" (plate 30).

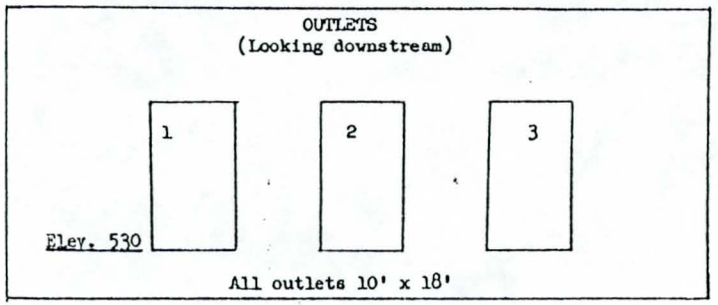


Table 16

Plan B

Outlet gate operation schedule, Painted Rock Reservoir, Gila River basin, Ariz. and N. Mex.*

Step No.	When reservoir water surface is between elevation	Gate setting for gates indicated			Computed discharge	Downstream gage height
		No. 1	No. 2	No. 3		
	Feet above mean sea level	Feet of opening	Feet of opening	Feet of opening	Cubic feet per second	Feet
1	**530 - 550	0	0	0	0	0
2	550 - 554	5.0	5.0	5.0	3,600 - 3,950	8.05 - 8.20
3	554 - 558	6.0	6.0	6.0	4,600 - 5,050	8.45 - 8.60
4	558 - 562	7.0	7.0	7.0	5,750 - 6,200	8.80 - 8.95
5	562 - 566	8.0	8.0	8.0	6,900 - 7,400	9.05 - 9.30
6	566 - 570	9.0	9.0	9.0	8,150 - 8,700	9.50 - 9.70
7	570 - 574	10.0	10.0	10.0	9,400 - 10,000	9.85 - 10.00
8	574 - 578	11.0	11.0	11.0	10,900 - 11,400	10.25 - 10.40
9	578 - 582	12.0	12.0	12.0	12,300 - 12,800	10.60 - 10.75
10	582 - 586	13.0	13.0	13.0	13,700 - 14,300	11.00 - 11.10
11	586 - 590	14.0	14.0	14.0	15,200 - 15,800	11.30 - 11.50
12	590 - 594	15.0	15.0	15.0	16,600 - 17,300	11.65 - 11.80
13	594 - 598	16.0	16.0	16.0	18,200 - 18,900	12.00 - 12.15
14	598 - 602	17.0	17.0	17.0	19,800 - 20,500	12.35 - 12.50
15	602 - 611	18.0	18.0	18.0	21,500 - 23,000	12.70 - 13.00
16	611 - 617	17.0	17.0	17.0	22,000 - 23,000	12.80 - 13.00
17	617 - 624	16.1	16.1	16.1	22,000 - 23,000	12.80 - 13.00
18	624 - 631.5	15.3	15.3	15.3	22,000 - 23,000	12.80 - 13.00
19	631.5 - 640	14.5	14.5	14.5	22,000 - 23,000	12.80 - 13.00
20	640 - 649.5	13.7	13.7	13.7	22,000 - 23,000	12.80 - 13.00
21	649.5 - 657	13.0	13.0	13.0	22,000 - 22,700	12.80 - 12.97
22	***657 - 661.6	12.5	12.5	12.5	22,000 - 23,000	12.80 - 12.97
23	661.6 - 662.4	11.3	11.3	11.3	21,000 - 23,000	12.60 - 13.00
24	662.4 - 663.0	10.1	10.1	10.1	21,000 - 23,000	12.60 - 13.00
25	663.0 - 663.5	8.9	8.9	8.9	21,000 - 23,000	12.60 - 13.00
26	663.5 - 664.1	7.7	7.7	7.7	21,000 - 23,000	12.60 - 13.00
27	664.1 - 664.5	6.6	6.6	6.6	21,000 - 23,000	12.60 - 13.00
28	664.5 - 664.9	5.5	5.5	5.5	21,000 - 23,000	12.60 - 13.00
29	664.9 - 665.2	4.5	4.5	4.5	21,000 - 23,000	12.60 - 13.00
30	665.2 - 665.6	3.4	3.4	3.4	21,000 - 23,000	12.60 - 13.00
31	665.6 - 665.9	2.5	2.5	2.5	21,000 - 23,000	12.60 - 13.00
32	665.9 - 666.2	1.5	1.5	1.5	21,000 - 23,000	12.60 - 13.00
33	666.2 - 666.5	.6	.6	.6	21,000 - 23,000	12.60 - 13.00
34	666.5 - 666.8	0	0	0	21,600 - 23,000	12.72 - 13.00
35	666.8 & above				Spillway flow only See Instructions	

* Schedule applicable for rising or falling stages.

** Gates may be 1/2 ft. open between elevations 530 - 535 ft. to pass low flows.

*** Spillway crest elevation 661 ft.

INSTRUCTIONS

1. Communications with the District Office, existing.

a. Notify the Hydraulic Operations Center when a gate change will be required according to the schedule.

b. To report gate settings, while operating on schedule, give the applicable step number only.

c. Notify the Hydraulic Operations Center if unable to set gates as instructed.

2. Communications with the District Office, interrupted.

a. Follow the gate operation schedule.

b. If one or more of the gates cannot be operated, adjust the remaining gates gradually and uniformly until the downstream gage height agrees with the scheduled values. Keep a close check on gage height and change the gate opening as often as required. If the downstream gage height is not obtainable, adjust the gates that are functioning so that the sum of the gate openings will equal the sum of the openings in the schedule.

3. Flood occurring with initial reservoir water-surface elevation at 640 or higher.

a. Outlet gates will be fully opened at the elevation indicated on the "Curve for Determining Operation Above Spillway Crest" (plate 30).

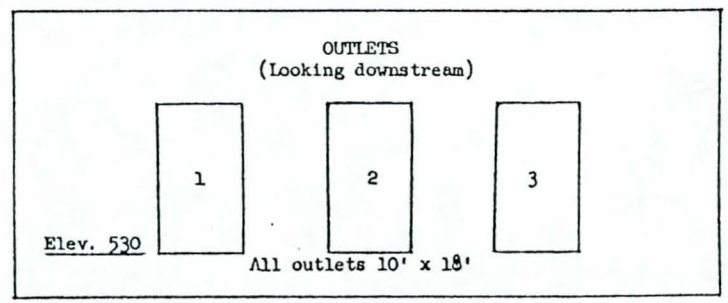


Table 17

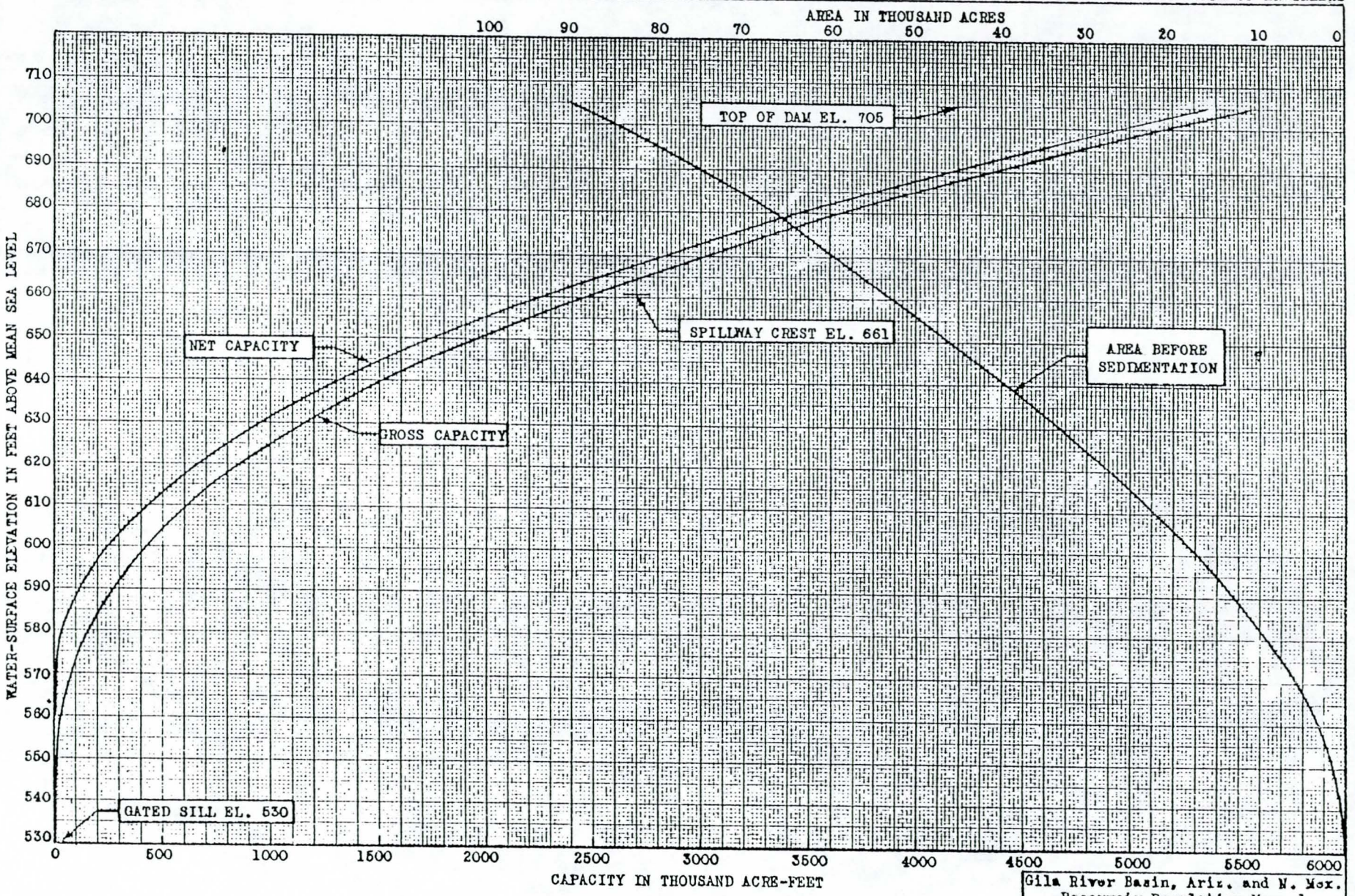
Summary of flood routings - Painted Rock Reservoir, Gila River basin, Ariz. and N. Mex.

Flood	Operation plan	Maximum inflow	Maximum outflow	Maximum water-surface elevation	Assumptions at start of routing	
					Reservoir	Storage
		Cubic feet per second	Cubic feet per second	Feet above mean sea level		
Modified 14-21 January 1916.*	A.....	195,000	22,500	657.4	Reservoir empty.	Net.
Reservoir design.	B.....	300,000	22,500	660.5	...do.....	Do.
Spillway design.	.....	620,000	436,500	696.3	Reservoir full to spillway crest. Outlet gates fully open.	Do.
Do.....	A or B (identical above elevation 640).	620,000	404,000	696.3	Reservoir full to elevation 640.	Do.

* Reflects present upstream conditions above Painted Rock Reservoir.

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



NOTE.--CURVES COMPUTED FROM DATA BASED ON AERIAL SURVEY OF MARCH 1953.

Gila River Basin, Ariz. and N. Mex.
Reservoir Regulation Manual
Painted Rock Reservoir

AREA AND CAPACITY CURVES
FOR PAINTED ROCK RESERVOIR

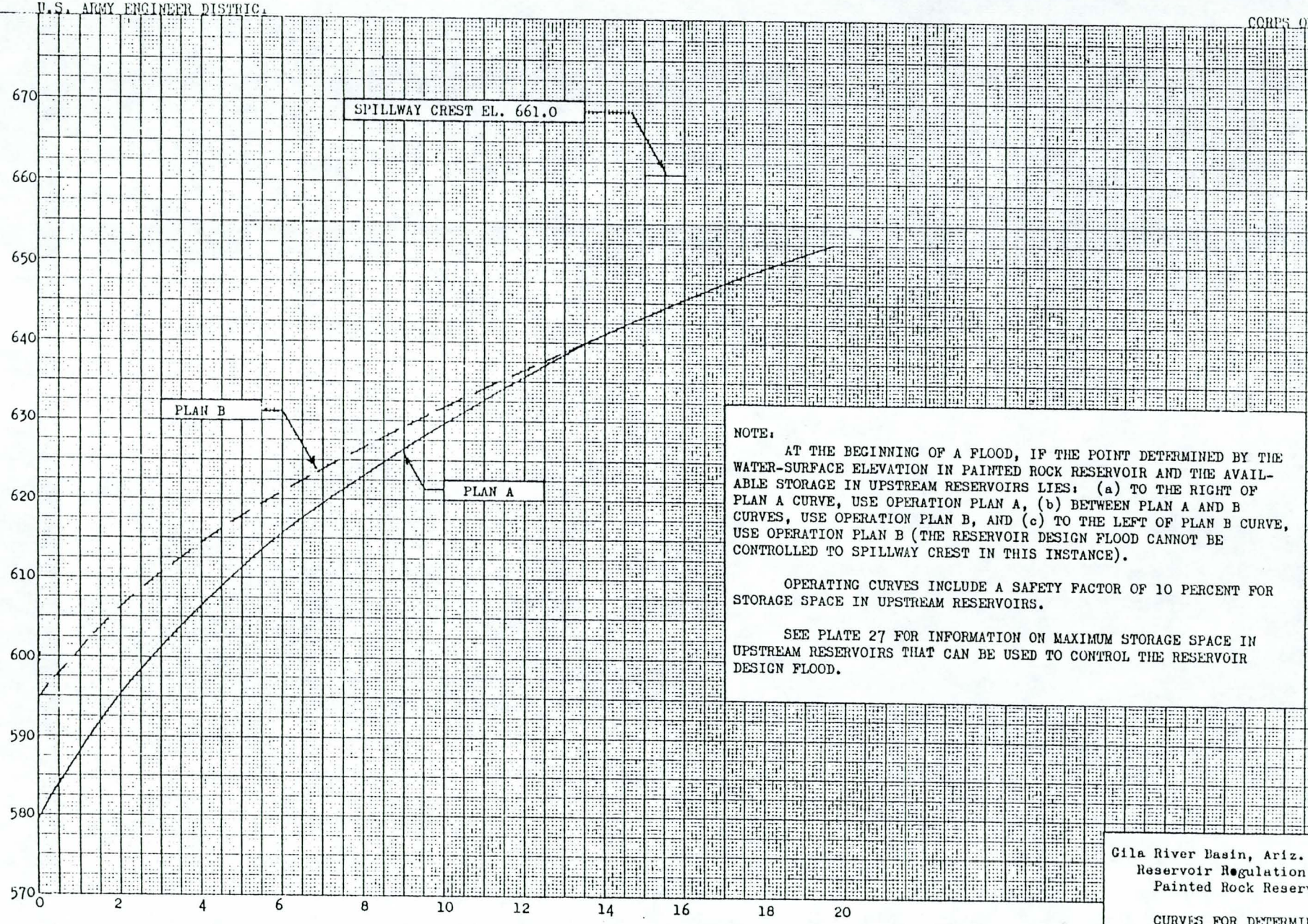
Survey of March 1953

U. S. Army Engineer District
Los Angeles, Corps of Engineers
To accompany report dtd: June 1962

PLATE 12

U.S. ARMY ENGINEER DISTRIC.

CORPS OF ENGINEERS



NOTE:

AT THE BEGINNING OF A FLOOD, IF THE POINT DETERMINED BY THE WATER-SURFACE ELEVATION IN PAINTED ROCK RESERVOIR AND THE AVAILABLE STORAGE IN UPSTREAM RESERVOIRS LIES: (a) TO THE RIGHT OF PLAN A CURVE, USE OPERATION PLAN A, (b) BETWEEN PLAN A AND B CURVES, USE OPERATION PLAN B, AND (c) TO THE LEFT OF PLAN B CURVE, USE OPERATION PLAN B (THE RESERVOIR DESIGN FLOOD CANNOT BE CONTROLLED TO SPILLWAY CREST IN THIS INSTANCE).

OPERATING CURVES INCLUDE A SAFETY FACTOR OF 10 PERCENT FOR STORAGE SPACE IN UPSTREAM RESERVOIRS.

SEE PLATE 27 FOR INFORMATION ON MAXIMUM STORAGE SPACE IN UPSTREAM RESERVOIRS THAT CAN BE USED TO CONTROL THE RESERVOIR DESIGN FLOOD.

Gila River Basin, Ariz. and N.Mex.
Reservoir Regulation Manual
Painted Rock Reservoir

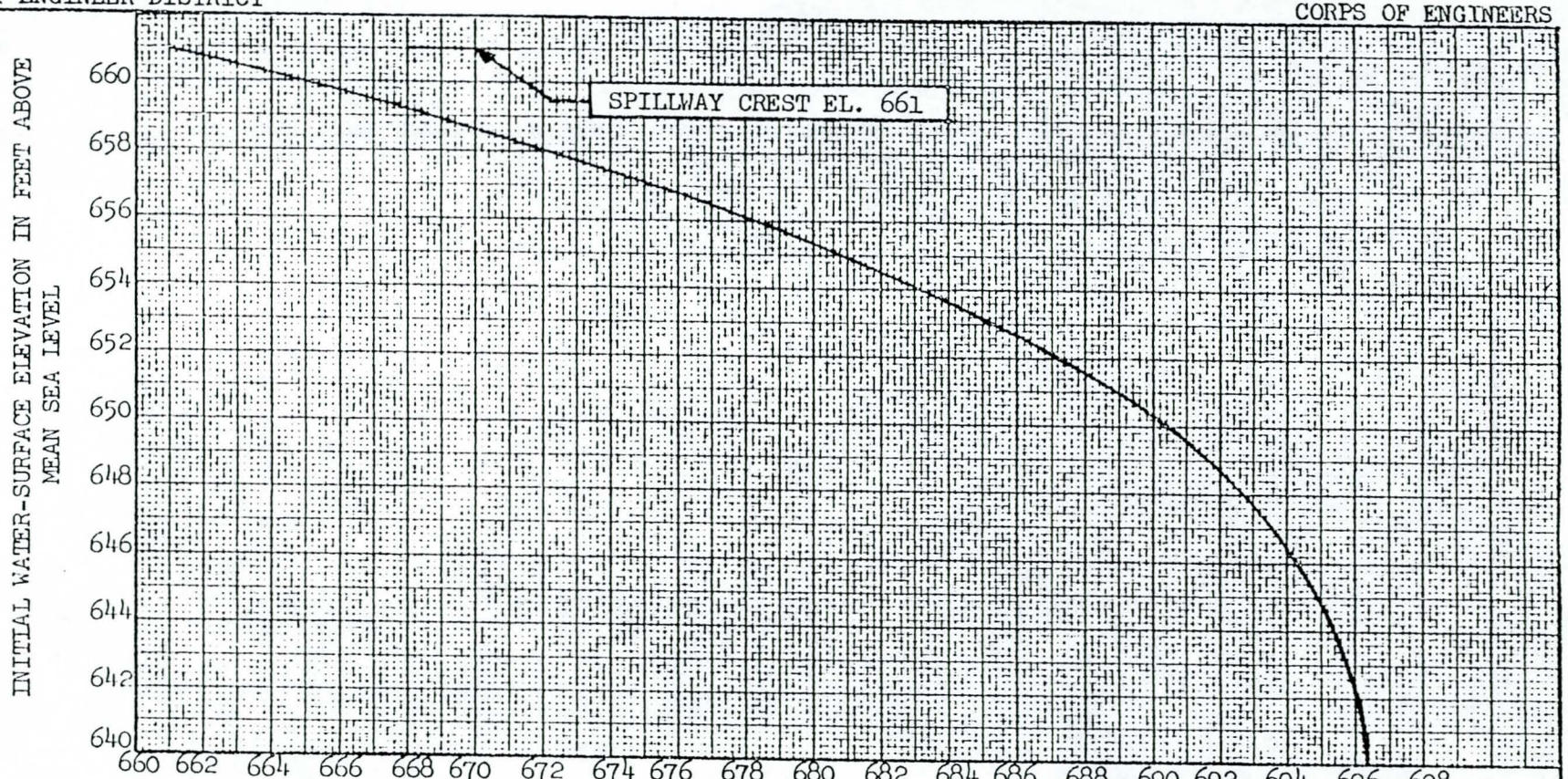
CURVES FOR DETERMINING
OPERATION PLAN

U.S. Army Engineer District
Los Angeles, Corps of Engineers
To accompany report dtd: June 1962

PLATE 26

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



NOTE.--IF A SPILLWAY FLOOD SHOULD OCCUR WHEN THE INITIAL RESERVOIR WATER-SURFACE ELEVATION IS 640 OR HIGHER, THE OUTLET GATES MUST BE FULLY OPENED AT THE ELEVATION SHOWN TO CONTROL THE FLOOD TO MAXIMUM WATER-SURFACE ELEVATION 696.3.

Gila River Basin, Ariz. and N. Mex.
Reservoir Regulation Manual
Painted Rock Reservoir

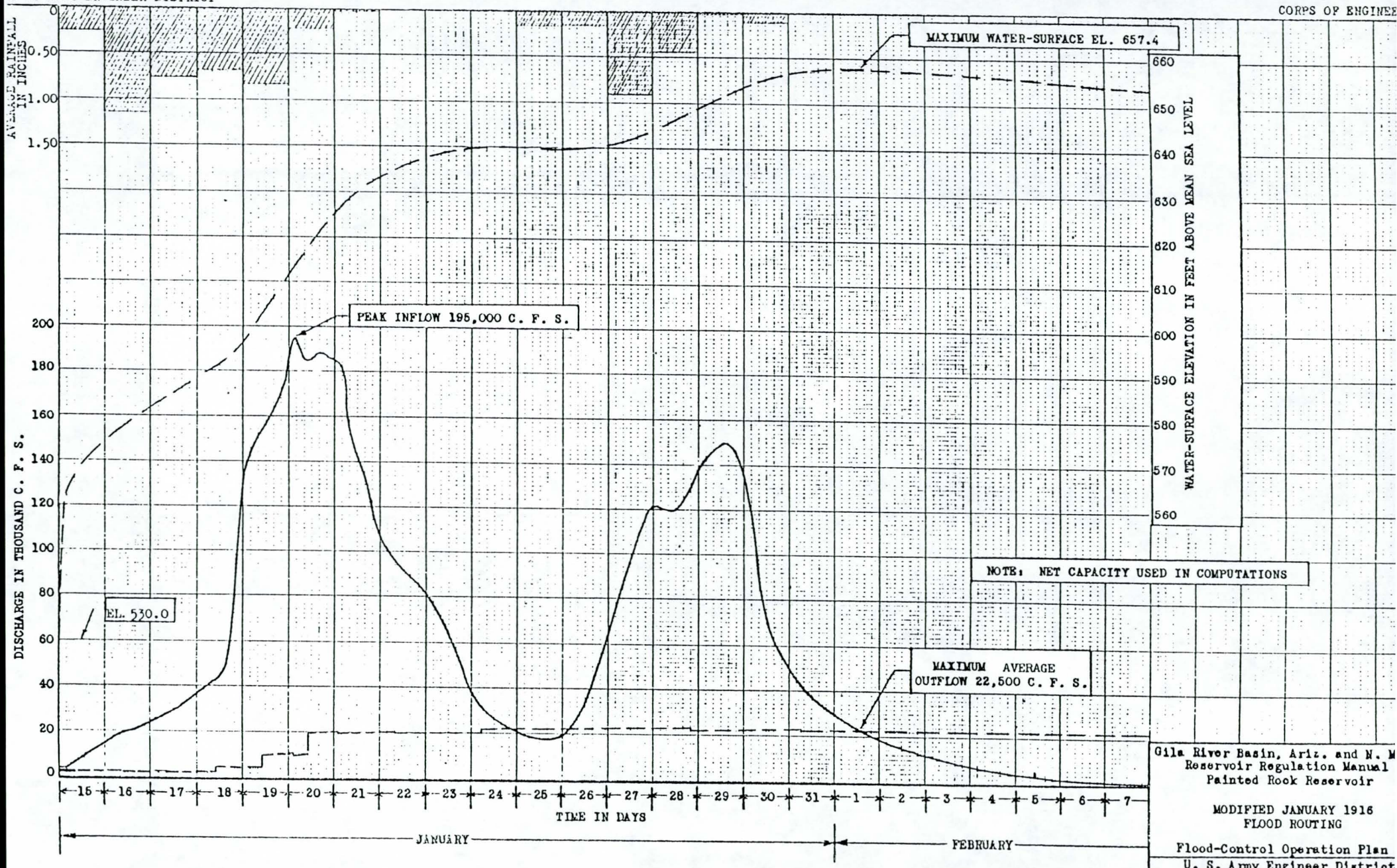
CURVE FOR DETERMINING OPERATION ABOVE SPILLWAY CREST

U. S. Army Engineer District
Los Angeles, Corps of Engineers
To accompany report dtd: June 1962

PLATE 30

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEE



Gila River Basin, Ariz. and N. M
Reservoir Regulation Manual
Painted Rock Reservoir

MODIFIED JANUARY 1916
FLOOD ROUTING

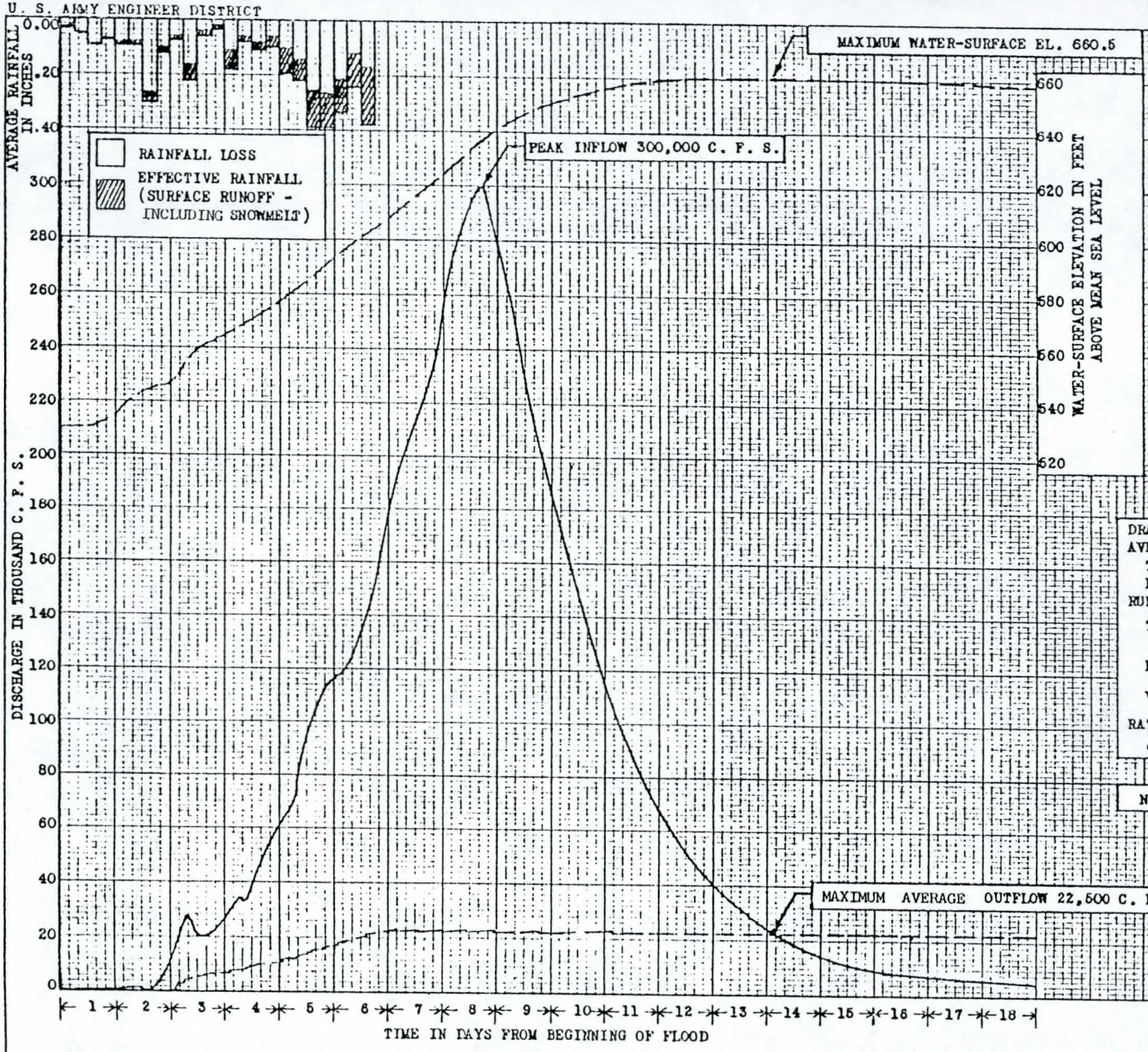
Flood-Control Operation Plan

U. S. Army Engineer District
Los Angeles, Corps of Engineer
To accompany report dtd: June 1

PLAT

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEER



DRAINAGE AREA	*50,800 SQ. MI.
AVERAGE RAINFALL DEPTH OVER AREA:	
TOTAL STORM	3.83 INCHES
EFFECTIVE, TOTAL STORM	1.27 INCHES
RUNOFF:	
TOTAL FLOOD VOLUME	2,800,000 AC.-FT. / 1.03 INCHES
MAXIMUM 8-DAY VOLUME	2,490,000 AC.-FT. / 0.92 INCH
VOLUME OVER 22,500 C. F. S.	2,200,000 AC.-FT. / 0.81 INCH
RATIO OF RUNOFF TO RAINFALL	27 PERCENT

* EXCLUDES WILLCOX AND ANIMAS CLOSED DRAINAGES.

NOTE: NET CAPACITY USED IN COMPUTATIONS

Gila River Basin, Ariz. and N. Mex.
Reservoir Regulation Manual
Painted Rock Reservoir

RESERVOIR DESIGN
FLOOD ROUTING

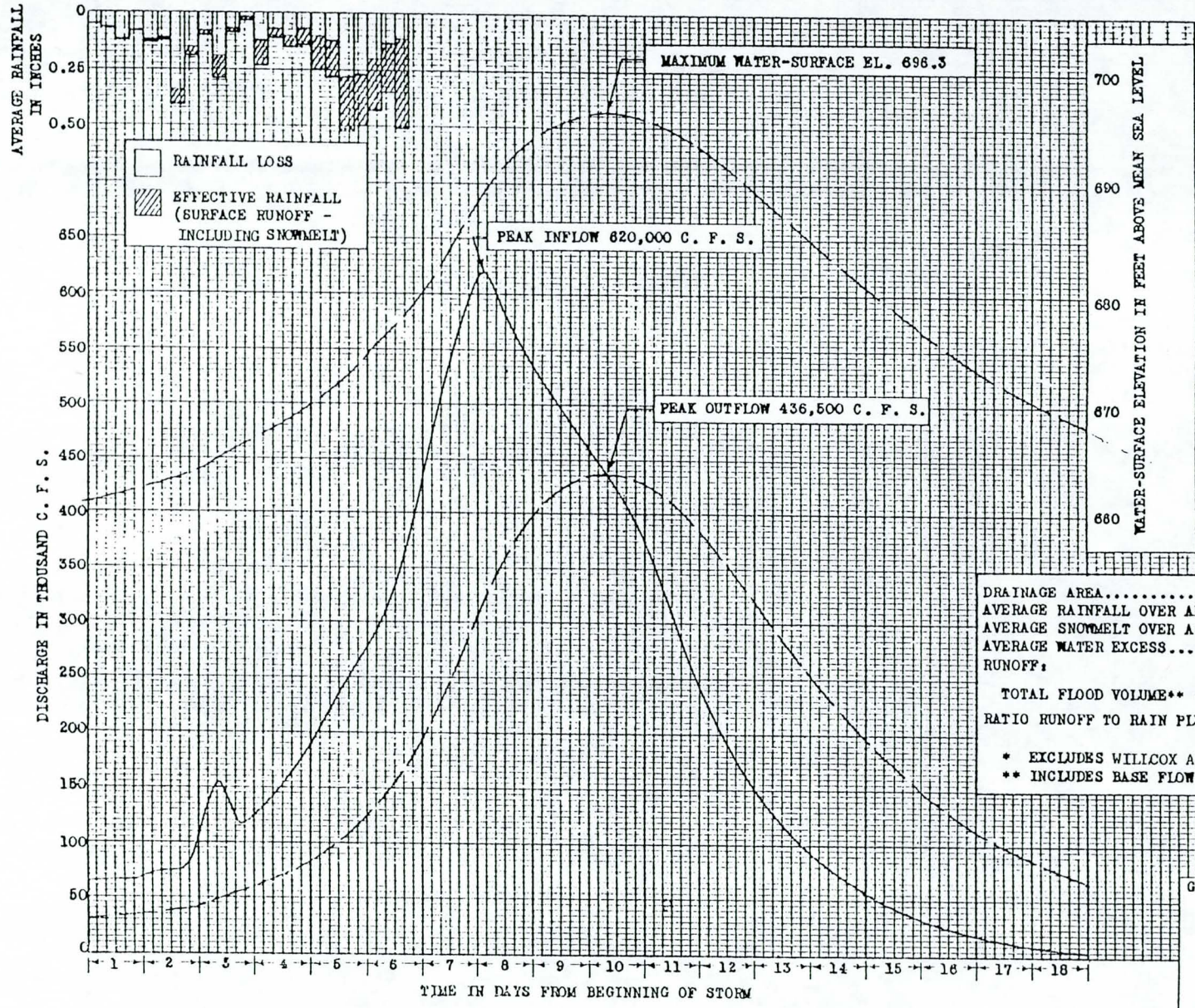
Flood-Control Operation Plan B

U. S. Army Engineer District
Los Angeles, Corps of Engineers
To accompany report dtd: June 1962

PLATE 3

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DRAINAGE AREA	*50,800 SQ. MI
AVERAGE RAINFALL OVER AREA	5.16 INCHES
AVERAGE SNOWMELT OVER AREA	2.58 INCHES
AVERAGE WATER EXCESS	2.19 INCHES
RUNOFF:	
TOTAL FLOOD VOLUME** (18 DAYS)	7,680,000 AC.-FT
	2.83 INCHES
RATIO RUNOFF TO RAIN PLUS SNOWMELT	37 PERCENT

* EXCLUDES WILLCOX AND ANIMAS CLOSED DRAINAGES.
** INCLUDES BASE FLOW.

NOTE: NET CAPACITY USED IN COMPUTATIONS.

Gila River Basin, Ariz. and N. Mex
Reservoir Regulation Manual
Painted Rock Reservoir

SPILLWAY DESIGN
FLOOD ROUTING

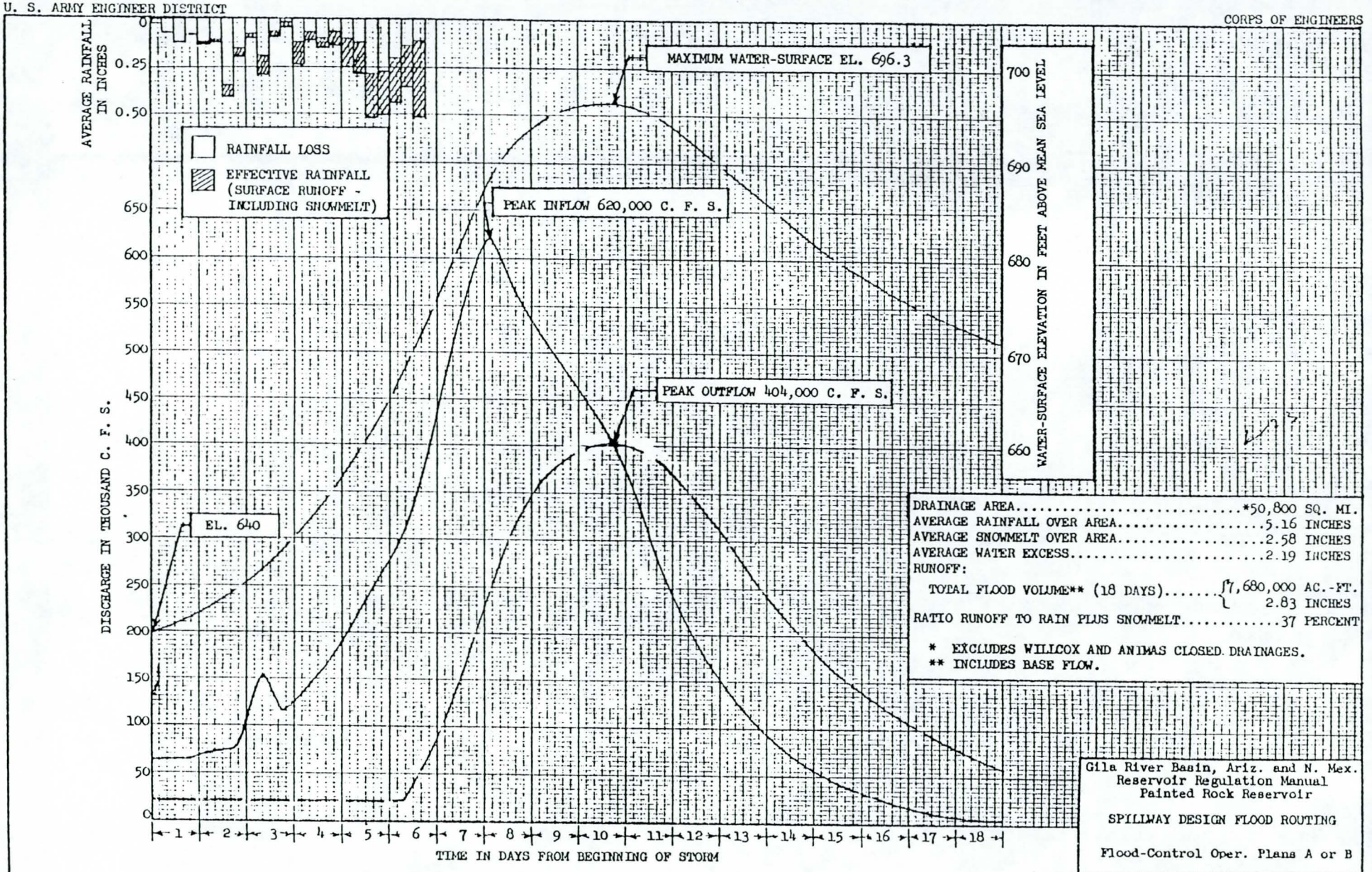
Outlets Fully Open

U. S. Army Engineer District
Los Angeles, Corps of Engineers
To accompany report dtd: June 1962

PLATE 37

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



DRAINAGE AREA	*50,800 SQ. MI.
AVERAGE RAINFALL OVER AREA	5.16 INCHES
AVERAGE SNOWMELT OVER AREA	2.58 INCHES
AVERAGE WATER EXCESS	2.19 INCHES
RUNOFF:	
TOTAL FLOOD VOLUME** (18 DAYS)	7,680,000 AC.-FT.
	2.83 INCHES
RATIO RUNOFF TO RAIN PLUS SNOWMELT	37 PERCENT

* EXCLUDES WILCOX AND ANIMAS CLOSED DRAINAGES.
** INCLUDES BASE FLOW.

NOTE: 1. NET CAPACITY USED IN COMPUTATIONS.
2. FLOOD-CONTROL OPERATION PLANS A AND B IDENTICAL ABOVE ELEVATION 640.

Gila River Basin, Ariz. and N. Mex.
Reservoir Regulation Manual
Painted Rock Reservoir

SPILLWAY DESIGN FLOOD ROUTING

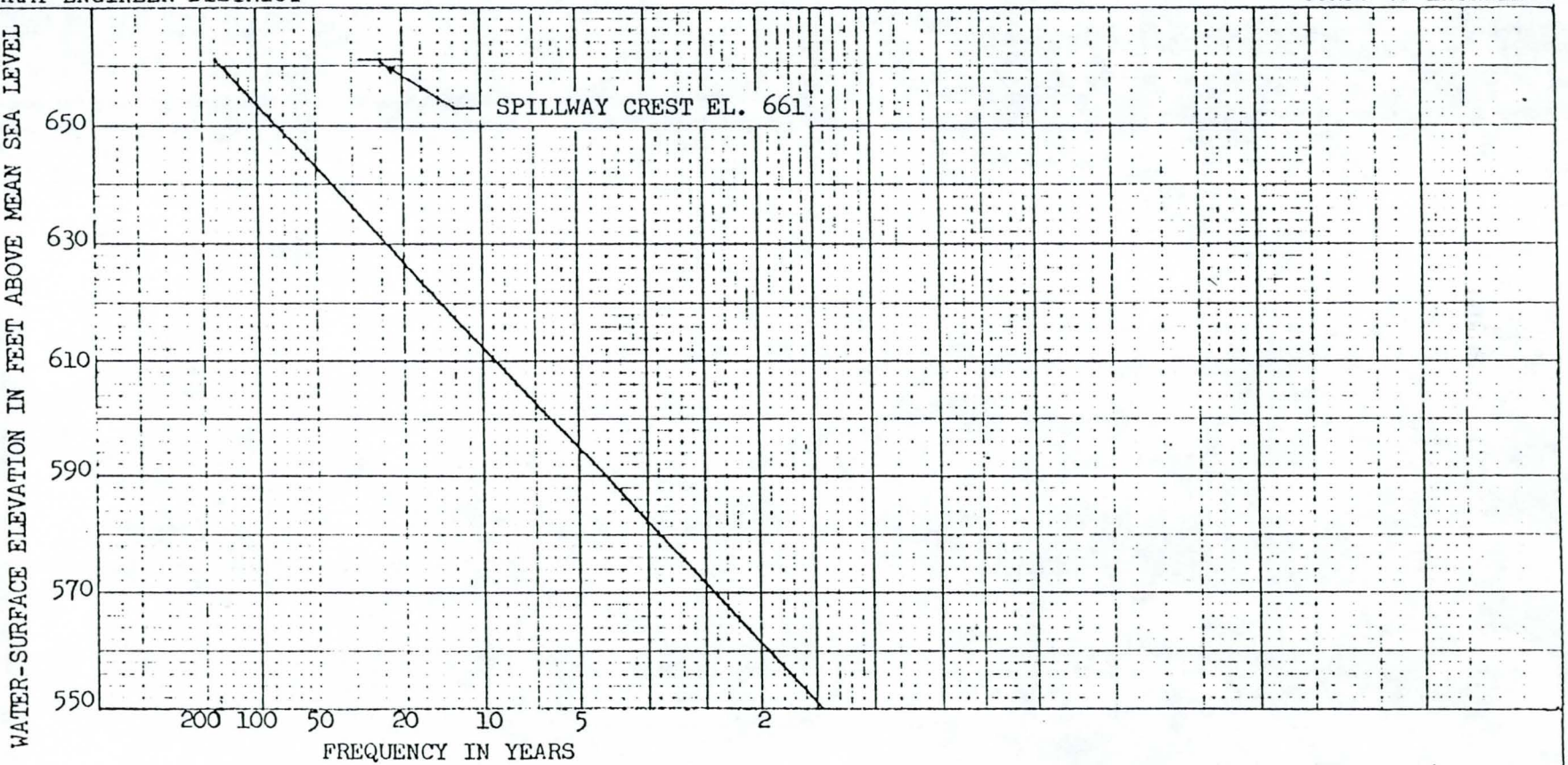
Flood-Control Oper. Plans A or B

U. S. Army Engineer District
Los Angeles, Corps of Engineers
To accompany report dtd: June 1962

PLATE 38

U. S. ARMY ENGINEER DISTRICT

CORPS OF ENGINEERS



NOTE:

NET CAPACITY USED IN COMPUTATIONS.

Gila River Basin, Ariz. and N. Mex.
Reservoir Regulation Manual
Painted Rock Reservoir

FILLING FREQUENCY CURVE

Flood-Control Operation Plan A

U. S. Army Engineer District
Los Angeles, Corps of Engineers
To accompany report dtd: June 1962

PLATE 39

ATTACHMENT NO. 6

Summary of 100-year discharges.

SUMMARY OF DISCHARGES

Flooding Source and Location	Drainage Area (square miles)	Peak 100-year Discharge (cfs)
Gila River		
Midway from Dam to Painted Rock Dam	50,300±	230,000
Roughly 13.7 miles downstream of Gillespie Dam		231,000
Roughly 9.7 miles downstream of Gillespie Dam		232,000
Roughly 5.6 miles downstream of Gillespie Dam		233,000
Roughly 1.7 miles downstream of Gillespie Dam		234,000
Gillespie Dam	49,650	235,000

ATTACHMENT NO. 8

Floodway data table.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
A	146.550	5350.	124147.	1.9		661.0	662.0	1.0
B	146.650	5355.	117479.	2.0		661.0	662.0	1.0
C	146.740	5310.	121300.	1.9		661.0	662.0	1.0
D	146.780	5310.	123199.	1.9		661.1	662.1	1.0
E	146.830	5245.	119481.	1.9		661.1	662.1	1.0
F	146.930	4985.	110504.	2.1		661.1	662.1	1.0
G	147.020	4825.	103891.	2.2		661.1	662.1	1.0
H	147.120	4810.	98725.	2.3		661.1	662.1	1.0
I	147.210	4845.	99638.	2.3		661.1	662.1	1.0
J	147.310	4860.	97221.	2.4		661.2	662.2	1.0
K	147.400	4840.	100779.	2.3		661.2	662.2	1.0
L	147.500	4835.	95903.	2.4		661.2	662.2	1.0
M	147.590	4810.	99584.	2.3		661.2	662.2	1.0
N	147.690	4770.	98894.	2.3		661.3	662.3	1.0
O	147.780	4615.	98975.	2.3		661.3	662.3	1.0
P	147.880	4310.	88703.	2.6		661.3	662.3	1.0
Q	147.970	3821.	80292.	2.9		661.3	662.3	1.0
R	148.070	3490.	73477.	3.1		661.3	662.3	1.0
S	148.160	3410.	72881.	3.2		661.4	662.4	1.0
T	148.260	3500.	76639.	3.0		661.4	662.4	1.0
U	148.350	3615.	77590.	3.0		661.5	662.5	1.0
V	148.440	3840.	79202.	2.9		661.5	662.5	1.0
W	148.540	4115.	83561.	2.8		661.5	662.5	1.0
X	148.630	4375.	87378.	2.6		661.6	662.6	1.0
Y	148.730	4575.	85525.	2.7		661.6	662.6	1.0
Z	148.820	4710.	81215.	2.8		661.6	662.6	1.0

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
AA	148.920	4820.	82671.	2.8		661.7	662.7	1.0
AB	149.010	5030.	81037.	2.9		661.7	662.7	1.0
AC	149.110	5280.	80086.	2.9		661.8	662.7	0.9
AD	149.200	5605.	83232.	2.8		661.8	662.7	0.9
AE	149.300	5885.	82292.	2.8		661.9	662.8	0.9
AF	149.390	6145.	83784.	2.8		661.9	662.8	0.9
AG	149.490	6375.	83945.	2.8		662.0	662.9	0.9
AH	149.580	6430.	79291.	2.9		662.0	662.9	0.9
AI	149.680	6360.	76165.	3.0		662.1	663.0	0.9
AJ	149.770	6250.	72532.	3.2		662.2	663.1	0.9
AK	149.870	6070.	69986.	3.3		662.2	663.1	0.9
AL	149.960	5825.	65026.	3.6		662.3	663.2	0.9
AM	150.050	5660.	62195.	3.7		1662.4	663.3	0.9
AN	150.150	5575.	56952.	4.1		662.5	663.4	0.9
AO	150.240	5560.	59292.	3.9		662.6	663.5	0.9
AP	150.340	5545.	60318.	3.8		662.8	663.7	0.9
AQ	150.430	5525.	60010.	3.8		662.9	663.8	0.9
AR	150.530	5490.	56003.	4.1		663.0	663.9	0.9
AS	150.620	5375.	54091.	4.3		663.2	664.0	0.8
AT	150.720	5080.	51860.	4.5		663.3	664.1	0.8
AU	150.810	4640.	49038.	4.7		663.5	664.3	0.8
AV	150.910	4320.	40705.	5.7		663.6	664.4	0.8
AW	151.000	3955.	35500.	6.5		663.9	664.7	0.8
AX	151.100	3835.	38155.	6.1		664.3	665.2	0.9
AY	151.190	3787.	39168.	5.9		664.8	665.6	0.8
AZ	151.290	3740.	38342.	6.0		665.2	665.9	0.7

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
BA	151.380	3645.	36404.	6.3		665.5	666.2	0.7
BB	151.480	3445.	34288.	6.7		665.8	666.6	0.8
BC	151.570	3245.	32105.	7.2		666.3	667.0	0.7
BD	151.660	3070.	30887.	7.5		666.8	667.5	0.7
BE	151.760	2950.	28000.	8.3		667.4	668.0	0.6
BF	151.850	2865.	27023.	8.5		668.0	668.5	0.5
BG	151.950	2735.	27678.	8.3		668.6	669.2	0.6
BH	152.040	2575.	25299.	9.1		669.5	669.8	0.3
BI	152.140	2400.	24424.	9.5		670.1	670.6	0.5
BJ	152.230	2280.	24639.	9.4		670.6	671.2	0.6
BK	152.330	2175.	18937.	12.2		670.9	671.5	0.6
BL	152.420	2630.	30531.	7.6		673.3	673.9	0.6
BM	152.520	3015.	36885.	6.3		673.8	674.6	0.8
BN	152.610	2920.	36547.	6.3		674.1	674.9	0.8
BO	152.710	2860.	34230.	6.7		674.4	675.2	0.8
BP	152.800	2981.	38419.	6.0		674.8	675.6	0.8
BQ	152.900	3425.	40831.	5.7		675.1	675.9	0.8
BR	152.990	3840.	41021.	5.7		675.5	676.2	0.7
BS	153.090	3930.	40415.	5.7		675.8	676.5	0.7
BT	153.180	3805.	40736.	5.7		676.1	676.8	0.7
BU	153.270	3770.	41160.	5.6		676.3	677.1	0.8
BV	153.370	3830.	46788.	5.0		676.5	677.3	0.8
BW	153.460	3910.	50606.	4.6		676.7	677.5	0.8
BX	153.550	4086.	52272.	4.4		676.9	677.8	0.9
BY	153.650	4060.	52330.	4.4		677.0	677.8	0.8
BZ	153.750	3925.	49708.	4.7		677.2	678.0	0.8

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
CA	153.840	3680.	45163.	5.1		677.3	678.1	0.8
CB	153.940	3455.	41362.	5.6		677.5	678.3	0.8
CC	154.030	3165.	34011.	6.8		677.6	678.4	0.8
CD	154.130	2645.	27282.	8.5		677.9	678.6	0.7
CE	154.220	2300.	24180.	9.6		678.4	679.1	0.7
CF	154.270	2270.	21061.	11.0		678.7	679.3	0.6
CG	154.320	1930.	20187.	11.5		679.6	679.8	0.2
CH	154.410	1975.	20820.	11.1		680.7	681.2	0.5
CI	154.510	2165.	25413.	9.1		682.2	682.7	0.5
CJ	154.600	2695.	34142.	6.8		683.3	683.8	0.5
CK	154.690	3435.	42762.	5.4		683.8	684.4	0.6
CL	154.790	3990.	41875.	5.5		684.1	684.7	0.6
CM	154.880	4040.	43402.	5.3		684.4	684.9	0.5
CN	154.980	3900.	34433.	6.7		684.7	685.2	0.5
CO	155.070	3745.	38990.	6.0		685.1	685.7	0.6
CP	155.170	3635.	39336.	5.9		685.4	686.1	0.7
CQ	155.260	3540.	35807.	6.5		685.7	686.4	0.7
CR	155.360	3490.	33901.	6.8		686.0	686.7	0.7
CS	155.450	3665.	32738.	7.1		686.6	687.3	0.7
CT	155.550	3981.	42442.	5.5		687.2	688.1	0.9
CU	155.640	4045.	35913.	6.5		687.5	688.3	0.8
CV	155.740	3950.	37670.	6.2		688.1	688.7	0.6
CW	155.830	3880.	34140.	6.8		688.6	689.2	0.6
CX	155.930	3810.	33200.	7.0		689.2	689.7	0.5
CY	156.020	3695.	34231.	6.8		689.8	690.3	0.5
CZ	156.120	3570.	34883.	6.7		690.3	690.8	0.5

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
DA	156.210	3380.	35026.	6.6		690.7	691.2	0.5
DB	156.300	3215.	32187.	7.2		691.1	691.6	0.5
DC	156.400	3040.	28619.	8.1		691.6	692.0	0.4
DD	156.490	2965.	29084.	8.0		692.4	692.7	0.3
DE	156.590	3015.	32334.	7.2		693.1	693.4	0.3
DF	156.680	3230.	36562.	6.3		693.8	694.1	0.3
DG	156.780	3500.	39546.	5.9		694.2	694.5	0.3
DH	156.870	3555.	42926.	5.4		694.5	694.9	0.4
DI	156.970	3524.	35455.	6.6		694.6	694.9	0.3
DJ	157.060	3337.	32609.	7.1		695.0	695.3	0.3
DK	157.160	2998.	27439.	8.5		695.5	695.8	0.3
DL	157.250	2893.	25420.	9.2		696.2	696.4	0.2
DM	157.350	2738.	28906.	8.1		697.3	697.4	0.1
DN	157.440	2643.	28595.	8.1		697.9	698.0	0.1
DO	157.540	2705.	27816.	8.4		698.4	698.4	0.0
DP	157.630	2665.	28045.	8.3		699.0	699.1	0.1
DQ	157.720	2575.	25270.	9.2		699.5	699.6	0.1
DR	157.820	2465.	22417.	10.4		700.1	700.2	0.1
DS	157.910	2395.	27039.	8.6		701.5	701.5	0.0
DT	158.010	2305.	26018.	9.0		702.0	702.1	0.1
DU	158.100	2225.	25544.	9.1		702.6	702.6	0.0
DV	158.200	2185.	28031.	8.3		703.2	703.4	0.2
DW	158.290	2105.	27123.	8.6		703.7	703.9	0.2
DX	158.390	2040.	25544.	9.1		703.9	704.2	0.3
DY	158.480	1995.	22974.	10.1		704.4	704.7	0.3
DZ	158.580	1945.	23737.	9.8		705.3	705.5	0.2

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
EA	158.670	1975.	25224.	9.2		706.1	706.4	0.3
EB	158.770	2040.	26792.	8.7		706.8	707.2	0.4
EC	158.860	2155.	29249.	8.0		707.6	707.9	0.3
ED	158.960	2360.	32433.	7.2		708.1	708.5	0.4
EE	159.050	2565.	34115.	6.8		708.6	708.9	0.3
EF	159.150	2733.	35187.	6.6		708.9	709.3	0.4
EG	159.240	2777.	38882.	6.0		709.4	709.8	0.4
EH	159.340	2860.	40948.	5.7		709.6	710.0	0.4
EI	159.430	2945.	39084.	6.0		709.8	710.2	0.4
EJ	159.520	3065.	39162.	5.9		710.1	710.5	0.4
EK	159.620	3181.	39245.	5.9		710.4	710.7	0.3
EL	159.710	3282.	38174.	6.1		710.7	711.1	0.4
EM	159.810	3362.	38200.	6.1		711.0	711.4	0.4
EN	159.900	3363.	37923.	6.1		711.2	711.6	0.4
EO	160.000	3410.	37027.	6.3		711.5	711.9	0.4
EP	160.090	3420.	35904.	6.5		711.9	712.3	0.4
EQ	160.190	3410.	35722.	6.5		712.2	712.6	0.4
ER	160.280	3325.	32178.	7.2		712.6	713.0	0.4
ES	160.380	3225.	31643.	7.4		713.0	713.5	0.5
ET	160.470	3135.	32711.	7.1		713.5	714.0	0.5
EU	160.570	3100.	32110.	7.3		713.9	714.4	0.5
EV	160.660	3145.	34366.	6.8		714.4	715.0	0.6
EW	160.760	3245.	35562.	6.6		714.7	715.4	0.7
EX	160.850	3455.	36617.	6.4		715.0	715.7	0.7
EY	160.950	3785.	42079.	5.5		715.5	716.2	0.7
EZ	161.040	4210.	41813.	5.6		715.7	716.4	0.7

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
FA	161.130	4765.	43537.	5.4		716.1	716.8	0.7
FB	161.230	5170.	44983.	5.2		716.5	717.1	0.6
FC	161.320	5625.	46809.	5.0		717.0	717.5	0.5
FD	161.420	5880.	44143.	5.3		717.3	717.8	0.5
FE	161.510	6216.	40281.	5.8		717.6	718.0	0.4
FF	161.610	6445.	45336.	5.2		718.2	718.7	0.5
FG	161.700	6482.	40457.	5.8		718.4	718.9	0.5
FH	161.800	6492.	45962.	5.1		718.8	719.4	0.6
FI	161.890	6570.	41179.	5.7		719.1	719.7	0.6
FJ	161.990	6730.	47928.	4.9		719.5	720.1	0.6
FK	162.080	6700.	42547.	5.5		719.8	720.5	0.7
FL	162.170	6507.	39880.	5.9		720.2	720.8	0.6
FM	162.270	6403.	43572.	5.4		720.7	721.4	0.7
FN	162.360	6237.	38263.	6.1		721.0	721.6	0.6
FO	162.460	6099.	37420.	6.3		721.5	722.1	0.6
FP	162.550	5974.	37217.	6.3		722.0	722.5	0.5
FQ	162.650	5891.	42332.	5.5		722.6	723.1	0.5
FR	162.740	5763.	33158.	7.1		723.0	723.4	0.4
FS	162.840	5611.	42801.	5.5		723.9	724.3	0.4
FT	162.930	5734.	37736.	6.2		724.3	724.6	0.3
FU	163.030	5741.	39861.	5.9		725.0	725.4	0.4
FV	163.120	5538.	40148.	5.8		725.6	725.9	0.3
FW	163.220	5205.	40020.	5.8		726.1	726.4	0.3
FX	163.310	4910.	38737.	6.0		726.6	726.8	0.2
FY	163.410	4645.	37576.	6.2		727.1	727.3	0.2
FZ	163.500	4395.	35346.	6.6		727.7	727.8	0.1

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
GA	163.600	3990.	34740.	6.7		728.4	728.5	0.1
GB	163.690	3580.	31883.	7.3		728.9	729.0	0.1
GC	163.790	3360.	33452.	7.0		729.6	729.7	0.1
GD	163.880	3297.	31667.	7.4		730.0	730.2	0.2
GE	163.970	3285.	30401.	7.7		730.5	730.8	0.3
GF	164.070	3345.	31125.	7.5		731.2	731.5	0.3
GG	164.160	3296.	29344.	8.0		731.8	732.0	0.2
GH	164.260	3249.	28096.	8.3		732.5	732.7	0.2
GI	164.350	3322.	32671.	7.2		733.4	733.7	0.3
GJ	164.450	3395.	35954.	6.5		734.0	734.3	0.3
GK	164.540	3395.	37208.	6.3		734.4	734.7	0.3
GL	164.640	3430.	36493.	6.4		734.8	735.1	0.3
GM	164.730	3410.	40159.	5.8		735.5	735.8	0.3
GN	164.830	3420.	37433.	6.3		736.0	736.3	0.3
GO	164.920	3480.	40478.	5.8		736.6	737.0	0.4
GP	165.020	3530.	44376.	5.3		737.2	737.6	0.4
GQ	165.110	3510.	40744.	5.8		737.5	737.9	0.4
GR	165.210	3550.	41113.	5.7		738.0	738.4	0.4
GS	165.300	3640.	39602.	5.9		738.4	738.8	0.4
GT	165.400	3835.	46011.	5.1		739.0	739.5	0.5
GU	165.490	3870.	42854.	5.5		739.3	739.8	0.5
GV	165.580	3790.	41876.	5.6		739.8	740.3	0.5
GW	165.680	3552.	39189.	6.0		740.3	740.7	0.4
GX	165.770	3087.	37908.	6.2		740.8	741.1	0.3
GY	165.870	2763.	33845.	6.9		741.1	741.4	0.3
GZ	165.960	2618.	32203.	7.3		741.7	742.0	0.3

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE*	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
HA	166.060	2427.	26878.	8.7		742.3	742.6	0.3
HB	166.150	2225.	28122.	8.4		744.0	744.2	0.2
HC	166.250	2060.	28049.	8.4		745.9	746.2	0.3
HD	166.340	1880.	28022.	8.4		747.6	747.9	0.3
HE	166.410	1753.	28405.	8.3		749.0	749.4	0.4
HF	166.420	1608.	29262.	8.0		750.1	750.5	0.4
HG	166.490	1749.	26961.	8.7		751.1	751.5	0.4
HH	166.560	1784.	34455.	6.8		752.7	753.0	0.3
HI	166.580	1765.	15857.	14.8		762.6	762.6	0.0
HJ	46.000	1800.	25827.	9.1		765.3	765.3	0.0

* Stream distance in miles upstream of Painted Rock Dam (stream mile 126.0).

TABLE

FEDERAL EMERGENCY MANAGEMENT AGENCY

MARICOPA COUNTY, ARIZONA

FLOODWAY DATA

Gila River

JHN00412.30T/fw

ATTACHMENT NO. 9

Table of Elevation Reference Marks (ERMs).

GILA RIVER MAP REVISION REQUEST
Gillespie Dam to Gila Bend Indian Reservation
Elevation Reference Markers NGVD 1929
CBA File No. 41389-01-02

ERM 1 USC & GS brass cap on the north end of the most easterly pier of bridge on Old U.S. Highway 80 over Gila River near Gillespie Dam. Located in Section 28, Township 2 South, Range 5 West. Cap is stamped P-13 1927.
Elevation = 749.45

ERM 2 USC & GS brass cap 1.3' south of a witness post. 1.5± miles southeast of bridge over Gila River along Old U.S. Highway 80. Cap is 50'± southwest of center line of highway. Cap is stamped S-361 1967 located in Section 27, Township 2 South, Range 5 West.
Elevation = 749.46

ERM 3 USC & GS brass cap 2'± south of witness post. 2.5± miles southeast of bridge over Gila River along Old U.S. Highway 80. Cap is 50'± southwest of center line of highway. Cap is stamped R-361 1967 located in Section 35, Township 2 North, Range 5 West.
Elevation = 747.75

ERM 4 USC & GS brass cap 1.5' south of a witness post. 3.5± miles southeast of bridge over Gila River along Old U.S. Highway 80. Cap is 50'± southwest of center line of highway. Cap is stamped R-13 1927 located in Section 36, Township 2 South, Range 5 West
Elevation = 748.31

ERM 5 USC & GS brass cap 1.5'± south of witness post. 4.5± miles southeast of bridge over Gila River and 1.0± miles northwest of Intersection of Old U.S. Highway 80 and Patterson Road along Old U.S. Highway 80 50'± southwest of center line of Highway. Cap is stamped Q-361 1967 located in Section 6, Township 3 South, Range 5 West.
Elevation = 747.68

ERM 6 N.G. S brass cap on top of concrete pad attached to well casing. Cap is at northeast corner of pad located 85' south of intersection of Patterson Road and Old U.S. Highway 80 and 71' southwest of the center line of Old U.S. Highway 80. Cap is stamped A-476 1981 located in Section 7, Township 3 South, Range 5 West.
Elevation = 749.22

ERM 7 USC & GS brass cap 1.5' south of a witness post. 1.0 miles southeast of intersection of Old U.S. Highway 80 and Patterson Road along Old U.S. Highway 80. Cap is stamped N-361 1967 located in Section 17, Township 3 South, Range 5 West. 50'± southwest of center line of highway.
Elevation = 744.94

ERM 8 USC & GS brass cap 2' west of a witness post. 2± miles southeast of the intersection of Old U.S. Highway 80 and Patterson Road along Old U.S. Highway 80. 80'± southwest of Center line of highway. Cap is stamped M-361 1967 located in Section 16, Township 3 South, Range 5 West.

Elevation = 745.35

ERM 9 USC & GS brass cap 2' north of a witness post. 3± miles southeast of the intersection of Old U.S. Highway 80 and Patterson Road and 1± mile northwest of Intersection of Old U.S. Highway 80 and Woods Road along Old U.S. Highway 80. 50'± northeast of the center line of highway. Cap is stamped L-361 1967 located in Section 21, Township 3 South, Range 5 West.

Elevation = 741.86

ERM 10 USC & GS brass cap 1.5' south of a witness post on southeast corner of the intersection of the intersection of Old U.S. Highway 80 and Woods Road. Cap is 185'± northeast of the center line of Old U.S. Highway 80 and 70'± southeast of center line of Woods Road. Cap is stamped T-13 1927 located in Section 33, Township 3 South, Range 4 West.

Elevation = 742.47

ERM 11 USC & GS brass cap 1" south of a witness post. 0.7± miles southeast of the intersection of Old U.S. Highway 80 and Woods Road along Old U.S. Highway 80. 53'± northeast of center line of highway. Cap is stamped K-361 1967 located in Section 33, Township 3 South, Range 4 West.

Elevation = 736.26

ERM 12 N.G.S. brass cap on top of concrete pad attached to well casing. Cap is at the west corner of the pad. Located near section corner 3, 4, 9, 10, Township 3 South, Range 4 West, and is 95' west of the center line of Old U.S. Highway 80 69' southwest of power pole number 41. Cap is stamped B-476 1981

Elevation = 730.32

ERM 13 USC & GS brass cap 2' east of a witness pole. Cap is at southwest corner of the intersection of Old U.S. Highway 80 and Pierpoint Road 80' west of the center line of the highway and 17' south of the center line of Pierpoint Road. Cap is stamped J-361 1967 located near the northeast corner of Section 16, Township 3 South, Range 4 West.

Elevation = 712.495

ERM 14 N.G.S. brass cap on top of northwest corner of a concrete pad attached to a well casing. Located near section corner 15, 16, 21, 22, Township 4 South, Range 4 West, and is 76' west of the center line of Old U.S. Highway 80. 46' southwest of power pole number 5-R. Cap is stamped C-476 1981

Elevation = 699.61

ERM 15 USC & GS brass cap 1' west of a witness post. 1 mile north of Fornes Road along Old U.S. Highway 80. 50'± west of the center line of the highway. Cap is stamped G-361 1967 located near the northeast corner of Section 28, Township 3 South, Range 4 West.

Elevation = 687.94

ERM 16 N.G.S. brass cap on top of the northeast corner of a concrete pad attached to a well casing. Located at the northwest corner of the intersection on Fornes Road and Old U.S. Highway 80 and 90' north of the center line of Fornes Road near Section corner 27, 28, 33, 34, Township 4 South, Range 4 West. Cap is stamped D-476 1981.

Elevation = 686.50

ERM 17 N.G.S. brass cap on top of the northwest corner of a concrete pad attached to a well casing. Located near Section corner 33, 34, 4, 3, Township 4 South, Range 4 West, and is 101' west of center line of Old U.S. Highway 80 73' northwest of power pole number 93. Cap is stamped E-476 1981.

Elevation = 704.98

ERM 18 USC & GS brass cap stamped B-361 1967 near the northeast corner of the Gila Bend landfill on west side of Old U.S. Highway 80 in Section 4, Township 5 South, Range 4 West.

Elevation = 733.75

ERM 19 USC & GS brass cap stamped X-13 1927. 734.10 at southwest corner of the intersection of Old U.S. Highway 80 and Dirt Road entrance to Loma Linda Ranch. 14' south of Loma Linda Ranch sign in Section 16, Township 5 South, Range 4 West.

Elevation = 733.91

ERM 20 Void

ERM 21 3¼" aluminum cap stamped MCFCD bench mark Cella Barr Associates RLS 19324 1989 located at the northwest corner of a "T" intersection of Stout Road and a Dirt Road to the west. 1 mile north of Watermelon Road near Section corner 17, 18, 19, 20, Township 5 South, Range 4 West, 2.5' south of a 4 strand barbed wire fence.

Elevation = 676.14

ERM 22 GLO brass cap at Section corner 7, 8, 17, 18, Township 5 South, Range 4 West. Located at the north end of Stout Road at the Gila River 10'± northwest of the southeast corner of a barbed wire fence.

Elevation = 646.94

ERM 23 GLO brass cap at section corner 5, 6, 7, 8, Township 5 South, Range 4 West 2 miles west of Old U.S. Highway 80 and 2 miles south of Fornes Road 0.5' north of a 4' metal tee post.

Elevation = 650.91

ERM 24 3¼" aluminum brass cap stamped MCFCD bench mark Cella Barr Associates RLS 19324 1989 2.3 miles west of Old U.S. Highway 80 and 1 mile south of Fornes Road on west side of a north-south dirt road 3' east of a barbed wire fence near North line of Section 6, Township 5 South, Range 4 West.

Elevation = 668.89

ERM 25 BLM brass cap stamped 1/16 corner of section 30 1978, Township 4 South, Range 4 West, 2.3 miles west of Old U.S. Highway 80 on Fornes Road 1.3' below ground. Reference monument 93' northwest of cap.

Elevation = 668.08

ERM 26 BLM brass cap ¼ corner sections 20, 29, Township 4 South, Range 4 West, 1.5 miles west of Old U.S. Highway 80 and 1 mile north of Fornes Road.

Elevation = 671.32

ERM 27 GLO brass cap section corner 17, 18, 19, 20, Township 4 South, Range 4 West, 2 miles west of Old U.S. Highway 80 and 1 mile south of Pierpoint Road on the side of the mountain 300'± south of dirt road.

Elevation = 719.31

ERM 28 GLO brass cap section corner 7, 8, 17, 18, Township 4 South, Range 4 West, 2 miles west of Old U.S. Highway 80 on south side of Pierpoint Road.

Elevation = 683.09

ERM 29 BLM brass cap ¼ corner sections 6 and 7, Township 4 South, Range 4 West, 2.5 miles west of Old U.S. Highway 80, and 1 mile north of Pierpoint Road 200'± west of Enterprise Ranch Road.

Elevation = 699.95

ERM 30 3¼" aluminum cap stamped MCFCD bench mark Cella Barr Associates RLS 19324 1989 on east side of Enterprise Road, 2 miles north of Pierpoint Road near north line of Section 6, Township 4 South, Range 4 West.

Elevation = 703.27

ERM 31 3¼" aluminum cap stamped MCFCD bench mark Cella Barr Associates RLS 19324 1989 near north line of Section 36, Township 3 South, Range 5 West, 1.2 miles south of the main entrance to the Enterprise Ranch, 100'± east of Enterprise Ranch Road 1.5' west of a barbed wire fence.

Elevation = 705.15

ERM 32 Brass cap on 2" pipe in concrete stamped ¼ corner 24 and 25, LS 6177, Township 35, Range 5 West, 0.2 miles south of main entrance to the Enterprise Ranch, 50' west of Enterprise Ranch Road.

Elevation = 721.96

ERM 33 3¼" aluminum cap stamped MCFCD bench mark Cella Barr Associates RLS 19324 1989 0.8 miles north of main entrance to Enterprise Ranch 70' east of Enterprise Ranch Road 1.0' west of barbed wire fence.

Elevation = 724.79

ERM 34 — 3¼" aluminum cap stamped MCFCD bench mark Cella Barr Associates RLS 19324 1989, 500'± west of section corner 11, 12, 13, 14, Township 3 South, Range 5 West, 1' west of a barbed wire fence on the east side of Enterprise Ranch Road.

Elevation = 723.31

ERM 35 — 3¼" aluminum cap stamped MCFCD bench mark Cella Barr Associates RLS 19324 1989 at the southwest corner of the intersection of Enterprise Ranch Road and a drainage channel near Section corner 2, 3, 10, 11, Township 3 South, Range 5 West, 30' west of road.

Elevation = 732.68

ERM 36 — Top of 3/4" O.P. at Section corner 33, 34, and 3, Township 2 South, Range 5 West, 400' west of Enterprise Ranch Road, 1' north of railroad tie 2 miles south of Old U.S. Highway 80 bridge.

Elevation = 736.10

ERM 37 — 2" capped pipe stamped 1979 GD-34 USCE 1.5' east of a metal tee post on west side of Enterprise Ranch Road 1 mile south of Old U.S. Highway 80 bridge. Pipe has a piece of PVC conduit over top and is near the north ¼ corner of Section 33, Township 2 North, Range 5 West.

Elevation = 744.75

ERM 38 — USC & GS brass cap stamped Q-13 1927 on the north end of the most westerly pier of the Old U.S. Highway 80 bridge over the Gila River near Gillespie Dam in Section 28, Township 2 South, Range 5 West.

Elevation = 746.45